COUNTY OF SAN MATEO

STATE OF CALIFORNIA

PROJECT MANUAL

and

CONTRACT DOCUMENTS

for

EAST PALO ALTO GOVERNMENT CENTER MECHANICAL REPLACEMENT PROJECT 2415 UNIVERSITY AVE. EAST PALO ALTO, CA 94303

Project No. P25J1

ISSUED FOR BID
SEPTEMBER 6, 2022

* *

Department of Public Works
San Mateo County
555 County Center, 5TH Floor
Redwood City, CA 94063-1665

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BIDDING CALENDAR

NOTICE - THIS SUMMARY OF DATES IS FOR INFORMATIONAL PURPOSES ONLY.

The dates and times listed may not be relied upon or enforced. This summary does not form a part of the Contract Documents and does not establish contractual obligations.

NOTICE – THIS IS A SUMMARY ONLY AND DOES NOT LIST ALL DATES, TIMES OR TIME PERIODS CONTAINED IN THE BIDDING AND CONTRACT DOCUMENTS.

All bidders and contractors must refer to the actual documents for all applicable dates, times, and time periods.

East Palo Alto Government Center - Project No. P30F1		
Event	**Date/Time**	**Location**
Contract Documents Issued for Bid (Released &Available):	Sept. 6, 2022	https://publicworks.smcgov.org/projects-out-bid
Mandatory Pre-Bid Conference and Project Site Visit/Job Walk	Sept. 20, 2022 at 2:00PM	East Palo Alto Government Center 2415 University Ave., East Palo Alto, CA 94303 See Notice to Contractors Document 00 11 16 for instructions to attend.
Deadline for Questions –Last Day for prospective Bidders to submit questions, in writing, by email to Authorized Contact Person: kleong1@smcgov.org	Oct. 7, 2022 by 5:00PM	N/A
Response to Questions – Issue Addenda	Oct. 17, 2022	https://publicworks.smcgov.org/projects-out-bid
Bids Due:	Before Oct. 31, 2022 2:30PM	See Notice to Contractors Document 00 11 16
Bid Opening Date:	Oct. 31, 2022 at 2:30PM	See Notice to Contractors Document 00 11 16
Bid Evaluation Period:	Nov.1 to 7, 2022	N/A
Issue Notice of Intent to Award:	Nov. 7, 2022	N/A
Protest Period:	Nov. 8 to 14, 2022	See Instructions to Bidders Document 00 21 13
Submission to County Board for Approval:	Dec. 13, 2022	N/A
Anticipated Contract Award Date:	Jan 6, 2023	N/A

END OF DOCUMENT

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DOCUMENT 00 11 16

NOTICE TO CONTRACTORS

NOTICE IS HEREBY GIVEN that the Board of Supervisors of the County of San Mateo, State of California, will receive sealed bids for the following construction contract:

EAST PALO ALTO GOVERNMENT CENTER
MECHANICAL REPLACEMENT PROJECT
EAST PALO ALTO, CA 94303
PROJECT NO. P25J1

Bids shall be received in accordance with the Contract Documents. The Contract Documents may be examined and/or downloaded at the Department of Public Works website at https://publicworks.smcgov.org/projects-out-bid (includes complete bid package).

A **Mandatory** Pre-Bid Conference followed by a Project Site Visit/Job Walk is scheduled for **Tuesday, September 20, 2022, at 2:00 PM (Pacific Time)**. The mandatory pre-bid conference will meet at East Palo Alto Government Center, outside the main entrance, 2415 University Ave., East Palo Alto, CA 94303. Due to the nature of this project, it is mandatory for interested contractors to attend the pre-bid conference and visit the project site to become familiar with project. **Bids will not be accepted from any prime contractor not present at the mandatory pre-bid conference as evidenced on the attendance roster.**

Please review the Project Plans & Specifications in advance of the Mandatory Pre-Bid Conference and Project Site Visit.

Due to COVID-19 requirements in San Mateo County and at the East Palo Alto Government Center, interested Contractors are required to RSVP to the Authorized County Representative no later than **2:00 PM (Pacific Time), Monday, September 19, 2022,** of their planned attendance (with number of persons) to the Mandatory Pre-Bid Conference and Project Site Visit.

Contractors are expected to provide Personal Protective Equipment (PPE) for their personnel, as published by *Order No. c19-5c (Revised) of the Health Officer of the County of San Mateo*. The entire Order shall be followed by all who live and visit San Mateo County. Contractors shall comply with ALL applicable federal, state, and local health orders and ordinances and are required to continue to check for updates to such orders and ordinances.

Questions regarding this project should be directed to the Authorized Contact Person:
King Leong, Project Manager II – Capital Projects
Department of Public Works
555 County Center, 5th Floor, Redwood City, California 94063-1665
Office Phone: (650)599-7268
Cell Phone: (650)208-9855

Bids shall be submitted using forms furnished and bound in the Project Manual of the Construction Documents and in accordance with the Instructions to Bidders Document 11 21 13 and shall be accompanied by a Bid Bond.

Bids shall be sealed and filed with the Clerk of the Board of Supervisors of the County of San Mateo at the Hall of Justice and Records, 400 County Center, 1st Floor, Redwood City, California, 94063 and filed Bids shall receive the Clerk's timestamp before **Monday, October 31, 2022, 2:30PM (Pacific Time).** All sealed bids officially received and filed with the Clerk of the Board of Supervisors will be opened in public shortly thereafter outside in front of the 400 County Center Building or at another location as designated by County.

The Board of Supervisors of the County of San Mateo, State of California, reserves the right to reject any and all bids, alternate bids, or unit prices and waive any irregularities in any bid received.

No bidder may withdraw his bid for a period of ninety (90) days after the date set for the opening thereof.

Prospective bidders must be fully qualified, licensed, certified, and insured to perform the Work requested for the Project. All work performed must meet all current applicable laws and regulations.

Pursuant to Labor Code Sections 1770, et seq., the Director of the Department of Industrial Relations has determined the general prevailing rate of wages in the County of San Mateo for each craft, classification, or type of workman needed to execute the contract. The prevailing rates so determined are based on an 8-hour day, 40-hour week, except as otherwise noted. Existing agreements between the Building Trades and the Construction Industry groups relative to overtime, holidays and other special provisions shall be recognized. It shall be mandatory upon the Contractor and upon any sub-contractors under him, to pay not less than the said specific rates to all laborers, workmen or mechanics employed by them in the execution of this contract.

Pursuant to State Senate Bill SB 854 (Stat. 2014, Ch. 28), effective January 1, 2015:
(1) No Contractor or Subcontractor may be listed on a bid proposal for a public works project (submitted on or after March 1, 2015) unless registered with the

Department of Industrial Relations pursuant to Labor Code section 1725.5 (with limited exceptions from this requirement for bid purposes only under Labor Code section 1771.1(a)).

(2) No Contractor or Subcontractor may be awarded a contract for public work on a public works project (awarded on or after April 1, 2015) unless registered with the Department of Industrial Relations pursuant to Labor Code section 1725.5.

(3) This project is subject to compliance monitoring and enforcement by the Department of Industrial Relations. All Contractors and Subcontractors must furnish electronic certified payroll records directly to the Labor Commissioner (aka Division of Labor Standards Enforcement).

Contractor and its subcontractor(s) agree to pay not less than prevailing rates of wages and be responsible for compliance with all the provisions of the California Labor Code, Article 2-Wages, Chapter 1, Part 7, Division 2, section 1770 et seq and section 1810 et seq. A copy of the prevailing wage scale established by the Department of Industrial Relations is on file in the office of the Director of Public Works, and available at www.dir.ca.gov/DLSR or by phone at 415-703-4774. California Labor Code section 1776(a) requires each contractor and subcontractor keep accurate payroll records of trades' workers on all public works projects and to submit copies of certified payroll records upon request.

A bid security bond will be required for the faithful performance of the contract in amount of not less than ten percent (10%) of the amount of the bid. See Document 00 61 16 Bid Bond.

A payment bond and performance bond will be required pursuant to California Public Contract Code Section 7103 and Section 10221 if a contractor is awarded a contract.

The Work to be performed, per approved plans dated April 30, 2022, consists, in general, of providing all labor, materials, tools, appurtenances, and equipment required, as well as any other items and details not mentioned above but required by the Contract Documents and as directed by the Director of Public Works.

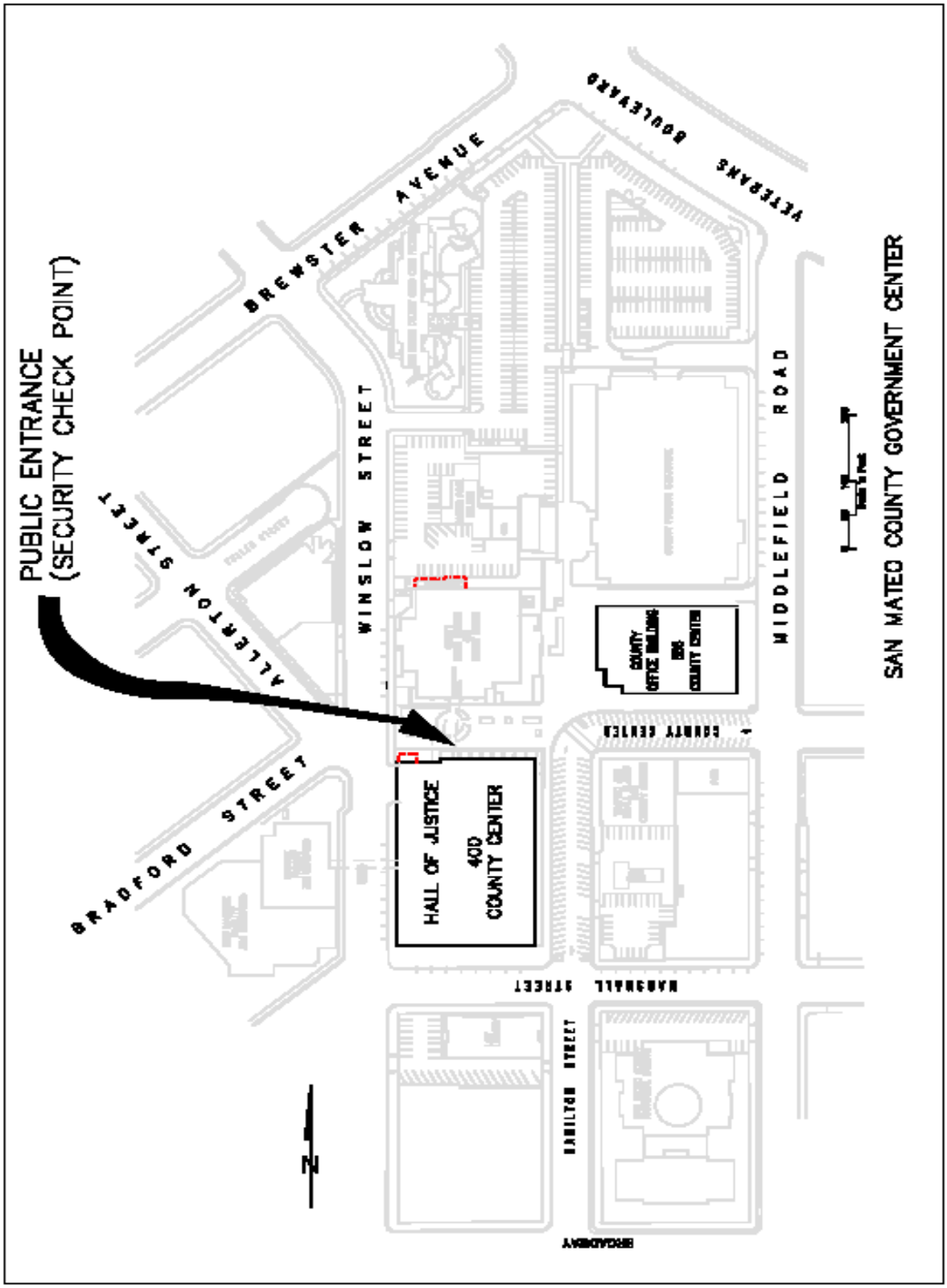
The East Palo Alto Government Center Mechanical Replacement Project consists of: Replacement of existing mechanical system; Ceiling Replacement including upgrade to all LED Lighting; New fire alarm system; Elevator cab replacement; Phasing, per approved plans dated April 30, 2022, Sheet A1.10. See Document 00 21 13 Instructions to Bidders.

The Contract Time for completion of all the Work of the Project is Two hundred Seventy-four (274) calendar days, as defined as sufficiently complete in accordance with the Contract Documents.

Liquidated Damages are $1000.00 per calendar day and shall be based on the Contract Time. Pursuant to California Government Code Section 53069.85, Owner may withhold

Liquidated Damages from payments to the Contractor as such damages accrue, or, at Owner's discretion, withhold Liquidated Damages from any payments due or that become due pursuant to the Contract, including Retention and final payment.

END OF DOCUMENT 00 11 16


PUBLIC ENTRANCE
(SECURITY CHECK POINT)
BREWSTER AVENUE
VETERANS BOULEVARD
ALLERTON STREET
WINSLOW STREET
MIDDLEFIELD ROAD
SAN MATEO COUNTY GOVERNMENT CENTER
BRADFORD STREET
HALL OF JUSTICE
400
COUNTY CENTER
COUNTY CENTER
MARSHALL STREET
BROADWAY
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DOCUMENT 00 21 13

INSTRUCTIONS TO BIDDERS

1. General

1.1 Bids shall be received in accordance with the Contract Documents. Each Bidder shall carefully read the complete Contract Documents including these instructions.

1.2 Before submitting a bid, each Bidder shall attend the mandatory pre-bid conference and visit the project site and evaluate all conditions and limitations involved thereon as no allowance will be made because of the lack of such examination and knowledge.

1.3 Only licensed Contractors authorized to do business under the laws of the State of California and able to qualify as follows will be eligible to submit a bid.

1.4 Contractors shall meet the following qualifications for this project:

A. Contractors bidding to the County shall have a minimum five (5) years continuous experience as a prime contractor on mechanical replacement projects in California of comparable quality, size, complexity, and type.
B. Contractors bidding to the County shall have completed as the prime three (3) mechanical replacement projects of comparable quality, size, complexity and type, preferably in an operating government facility, and the projects have been closed with County of San Mateo building department compliance.
C. Contractors bidding to the County shall submit Superintendent's qualifications with a minimum of three (3) years supervising mechanical replacement projects of comparable quality, size, complexity, and type.
D. Subcontractors shall meet the above two requirements in A. and B. as it pertains to their Work.
E. Contractor is legally authorized to do business in the State of California.
F. Within two (2) business days of request by County, Contractor shall submit evidence of compliance to the above qualifications (in A. B., and C.) and a list of all project work performed, both complete and incomplete, within the previous five (5) years including the names and phone numbers of the Owners and Architects.

1.5 Contractors shall meet the following construction requirements:

A. Permits: All work is subject to inspection and acceptance of the San Mateo County Building Department.
B. Differing Site Conditions: Contractor is advised the work will be performed in an existing structure.
C. Work shall be performed between the construction hours of 7:00AM to 5:00PM, unless otherwise agreed upon between the County, Contractor and City of East Palo Alto due to extenuating factors.
D. Contractor is advised the County intends to maintain active utility operations specific to facility systems during construction. Existing systems and utility outages, and shutdowns shall be approved in advance by the County. Refer to Document 01 35 13.19 Special Project Procedures.
E. Contractor to coordinate with the County regarding providing temporary construction barriers and public wayfinding signage for duration of project.
F. Not used.
G. Schedule: Contractor's attention is directed to the Contract Time and the requirement of the Contractor to achieve substantial completion of the work within said time period. Construction shall be completed within Contract Time defined as sufficiently complete in accordance with the Contract Documents to allow the Owner to occupy or utilize for its intended use.
H. Sequence of Construction. Bidder is advised there will be phasing of work, per approved plans dated April 30, 2022, per Sheet A1.10. Refer to Section 01 11 00 Summary of Work.
I. Contractor shall be required to attend weekly construction project meetings with County and County's Representatives for the duration of the project. Contractor shall track meeting action items and provide updates per Contract Documents.
J. Contractor's Personnel: Contractor shall submit within ten (10) working days from the execution of the Contract a list of names, addresses, and telephone numbers of key personnel who are to be contacted in case of emergencies on the job during non-working hour, including Saturdays, Sundays, and Holidays. Contractor shall update the list during the project and ensure the latest revision is posted in project office and provided to County Representatives.

All personnel who will have access to the work site may be required to wear photo identification issued by the County at all times. Photo identification will only be issued to each worker after successful completion of a background check clearance from the Sheriff's

Office. The County will notify the Contractor within five (5) working days if any workers are deemed acceptable or unacceptable as a result of a background check clearance. The County reserves the right to reject personnel with current parole or probationary status and/or criminal records. County staff reserves the right to request a worker be excused from the job site for not wearing the appropriate photo identification issued by the County. No claims for delays will be allowed for failure on the part of the Contractor to enforce this requirement.

1.6 Contract Documents:

Questions regarding the Contract Documents, such as discrepancies, conflicts, omissions, doubt as to meanings, or regarding scope of work shall be referred to the County Authorized Contact Person. Inquiries must be received by the Authorized Contact Person not later than 96 hours before bid time. Inquiries will be answered in writing to all bidders of record if a response or written clarification is warranted in the opinion of the Owner. The Owner will not be responsible for oral clarifications. Regarding questions on the Contract Documents in the absence of written clarifications, Contractor is instructed to bid the more expensive method or materials.

2. Bid Proposals

2.1 Bids shall be submitted in accordance with the Contract Documents. Bid documents shall be submitted on County forms provided in these Contract Documents, and are to be properly and fully completed, including the designation of all subcontractors who will perform work or labor or render service on behalf of Contractor, in an amount in excess of one-half of one percent of the Contractor's total bid. Bidders must complete and submit all of the following documents with their Bid:

1. Document 00 41 13 – Bid Form and Designated Subcontractor List
2. Document 00 45 19 - Non-Collusion Declaration
3. Document 00 45 36.01 – EEO Certification of Compliance & Intent
4. Document 00 45 36.02 – EEO Program Contractor Report Form
5. Document 00 45.36.03 - EEO Program Questionnaire
6. Document 00 45 46 - Anti-Trust Laws Questionnaire
7. Document 00 61 16 - Bid Bond (Bid Security) Form
8. Document 00 45 26 – Workers Compensation Certification

2.2 No bid will be considered which makes exceptions, changes, or in any manner makes reservations to the terms of the Contract Documents.

2.3 Unit Prices on all classes of work as specified or required shall be submitted. Additions to or deductions from the contract sum shall be based on these unit prices. However, none will be acceptable that are above and beyond a fair and just amount and may be subject to third party estimator verification and reasonable adjustment before the signing of the Contract or bid disqualification.

2.4 Each bid must give the full business address of the bidder and be signed by the bidder with his usual signature. Bids by partnerships must furnish the full name of all partners and must be signed in the partnership name by one of the members of the partnership or by any authorized representative, followed by the signature and designation of the person signing. Bids by corporations must be signed with the legal name of the corporation, followed by the name of the State of incorporation and by the signature and designation of the president, secretary, or other person authorized to bind it in the matter. Corporations must furnish a Certificate attesting to the existence of the corporation. The name of each person signing shall also be typed or printed below the signature. When requested by the Owner, satisfactory evidence of the authority of the officer signing on behalf of the corporation shall be furnished.

2.5 Bids are to be submitted in separate sealed envelopes. Envelopes shall be marked in lower left corner "Bid for" (provide contract title) and "Bid Opening" (provide bid opening date and time).

Deliver all bids to Clerk of the Board of Supervisors of the County of San Mateo at the Hall of Justice and Records, 400 County Center, 1st Floor, Redwood City, California, 94063 for the Clerk's timestamp of receipt before the day of **Oct. 31, 2022, 2:30 PM.**

2.6 All sealed bids officially received and filed with the Clerk of the Board of Supervisors of the County of San Mateo on or before the day of **Oct. 31, 2022, 2:30 PM** will be opened in public shortly thereafter outside of the 400 County Center building or at another location as designated at that time by County Clerk of the Board.

2.7 No bid will be considered which is received after the date and time set for the deadline to receive bids as stated herein, as determined by County.

3. Bonds and Insurance

3.1 Bids shall be accompanied by a cashier's check or a certified check payable to County, or a Bid Bond of not less than ten percent (10%) of the

amount of the base Bid, plus all additive alternates as required. Required form of corporate surety, a Bid Bond Form, is provided by County and must be used and fully completed by Bidders choosing to provide a Bid Bond as security. The Surety on Bidder's Bid Bond must be an insurer admitted in the State of California and authorized to issue surety bonds in the State of California. Bids submitted without necessary bid security will be deemed non-responsive and will not be considered.

3.2 Two bonds, as itemized below and in the forms presented in these Contract Documents, shall be furnished by the successful Bidder within ten (10) calendar days after notification of award, and by which documents shall be filed with the Department of Public Works, Capital Projects Division, 555 County Center, 5th Floor, Redwood City, California. The bonds shall be in the form of surety bonds issued by corporations duly and legally licensed to transact business in the State of California, satisfactory to the County. Premiums for said bonds shall be paid by the Contractor and maintained at Contractor's expense during the period prescribed herein for the completion of the work to be performed under the contract.

3.3 Performance Bond in amount of 100 percent (100%) of the Contract Amount to insure County during construction and for the guarantee period after completion against faulty or improper materials or workmanship and to assure County of full and prompt performance of Contract.

3.4 Payment Bond in amount of 100 percent (100%) of the Contract Amount in accordance with the laws of the State of California to secure payment of any and all claims for labor and material used or consumed in performance of this Contract.

3.5 Workers' Compensation Insurance, Comprehensive General Liability Insurance, and Motor Vehicle Liability Insurance and evidence thereof shall be furnished to County and shall be maintained by the Contractor as detailed in the General Conditions.

4. Wage Rates

4.1 The Director of Industrial Relations has determined the general prevailing rate of wages in the County of San Mateo.

4.2 In accordance with the General Conditions, it shall be mandatory upon the Contractor and Subcontractors to pay not less than the said prevailing wage rates to all laborers, workmen, or mechanics employed by them in the execution of this Contract. When applicable, both Contractor and Subcontractor hereby agree to pay not less than prevailing rates of wages

and be responsible for compliance with all the provisions of the California Labor Code, Article 2-Wages, Chapter 1, Part 7, Division 2, Section 1770 et seq and Section 1810 et seq. A copy of the prevailing wage scale established by the Department of Industrial Relations is on file in the office of the Director of Public Works, and available at www.dir.ca.gov/DLSR or by phone at 415-703-4774. California Labor Code Section 1776(a) requires each Contractor and Subcontractor keep accurate payroll records of trades workers on all public works projects and to submit copies of certified payroll records upon County's request.

4.3 The Contractor's attention is further directed to the following requirements of State Senate Bill SB 854 (Stat. 2014, Chapter 28), effective January 1, 2015:

(1) No Contractor or Subcontractor may be listed on a bid proposal for a public works project (submitted on or after March 1, 2015) unless registered with the Department of Industrial Relations pursuant to Labor Code section 1725.5 (with limited exceptions from this requirement for bid purposes only under Labor Code section 1771.1(a)).

(2) No Contractor or Subcontractor may be awarded a contract for public work on a public works project (awarded on or after April 1, 2015) unless registered with the Department of Industrial Relations pursuant to Labor Code section 1725.5.

(3) This project is subject to compliance monitoring and enforcement by the Department of Industrial Relations.

4.4 The Contractor is further advised that, pursuant to State Senate Bill SB 854 (Stat. 2014, Chapter 28), effective January 1, 2015, all contractors and subcontractors working on a contract for public work on a public works project (awarded on or after April 1, 2015) must furnish electronic certified payroll records to the Labor Commissioner.

5. Non-Discrimination

5.1 All Contractors with contracts over $5,000 must comply with the County Ordinance No. 4026, Chapter 2.93 of the County of San Mateo Ordinance Code with respect to the provision on employee benefits. The ordinance mandates that Contractors provide to employees with domestic partners benefits equal to those provided to employees with spouses.

6. Contractor Employee Jury Service Ordinance

6.1 For contracts over $100,000, Contractor shall comply with the County Ordinance No. 4324, Chapter 2.85 of the County of San Mateo Ordinance

Code with respect to provision of jury duty pay to employees. Refer to Document 00 45 29 Jury Service and Wage Compensation.

7. Recycling and Diversion of Debris from Construction and Demolition Ordinance

7.1 All Contractors with demolition contracts exceeding $5,000 in value; or construction contracts exceeding $250,000 in value; or construction contracts consisting of at least 2,000 square feet shall comply with the County Ordinance No. 4099, Chapter 4.105 of the County of San Mateo Ordinance Code for with respect to construction and demolition debris. Refer to Document 00 62 63 Recycling and Diversion of Debris from Construction and Demolition.

8. Sole Source Products and/or County Vendors

8.1 The County has found and determined that the following item(s) shall be used on this Project based on the purpose(s) indicated. Public Contract Code Section 3400(b): A particular material, product, thing, or service is designated by specific brand or trade name for the following purpose(s):

(1) In order to match other products in use at the San Mateo Medical Center.

(2) In order to obtain a necessary item that is only available from one source.

See Drawings and Specifications for specific project requirements.

8.2 Fire Alarm System and Product Manufacturer:
Siemens Industry, Inc.
25821 Industrial Boulevard
Hayward, CA 94545
Contact: Jon Meurer, jon.meurer@siemens.com
Phone: (510) 305-8510

8.3 Access Control Vendor:
Johnson Controls, Inc.
Contact: Andrew Aguero
Phone: (510) 600-5175

9. Contractor Selection and Contract Award

9.1 Before a contract is awarded, the Director of Public Works may, at his sole discretion, require from the proposed contractor evidence of his ability to faithfully, capably, and reasonably perform such proposed contract within the Contract Time and for the Contract Amount and may consider such evidence before making a decision on the award of such proposed contract.

9.2 The County reserves the right to reject any and all bid proposals, to contract work with whomever and in whatever manner, to abandon work entirely, or waiver of any irregularities in receiving bids.

9.3 The contract shall be awarded to the lowest and most responsible bidder as interpreted by the County in accordance with the Contract Documents. The Base Bid shall be used to determine the lowest bidder. Alternates may be accepted and awarded to the lowest and most responsible bidder, as determined above, in any combination or order.

9.4 Once a decision has be made to award a contract to a bidder, the County will issue a Notice of Intent to Award to notify all bidders of the selected bidder

10: Protests

Protests that do not comply with the protest procedures outlined below will be rejected.

10.1 Protest Eligibility, Format, and Address

(1) Protests or objections may be filed regarding the procurement process, the content of the solicitation, Construction Documents, or any addenda, or contract award.

(2) The County will only review protests submitted by an interested party, defined as an actual or prospective bidder whose direct economic interest could be affected by the County's conduct of the solicitation. Subcontractors do not qualify as interested parties.

(3) Submit written protests to the Department of Public Works by registered mail to:

Kevin Sporer, Deputy Director
Department of Public Works
County of San Mateo
555 County Center, 5th Floor

Redwood City, Ca 94063.

10.2 Protest Deadlines

Submit Protests with any supplemental materials by 2:00PM, Pacific Standard Time, (PST), as appropriate, on the deadlines set forth below. The date of filing is the date the County receives the protest, unless received after 2:00PM PST, or on other than a Business Day, in which case the date of filing will be the next Business Day. Failure to file by the relevant deadline constitutes a waiver of any protest on those grounds. Supplemental materials filed after the relevant deadline may be rejected by the County.

(1) If relating to the content of the solicitation or to an addendum, file within five (5) Business days after the date the County releases the solicitation or addendum.

(2) If relating to any notice of non-responsiveness or non-responsibility, file within five (5) Business Days after the County issues such notice.

(3) If relating to intent to award, file within five Business Days after the County issues notice of Intent to Award. No protests will be accepted once actual award has been made.

10.3 Protest Contents

(1) The letter of protest must include all of the following elements:
a) Detailed grounds for the protest, fully supported with technical data, test results, documentary evidence, names of witnesses, and other pertinent information related to the subject being protested; and
b) The law, rule, regulation, ordinance, provision or policy upon which the protest is based, with an explanation of the violation.

(2) Protests that simply disagree with decisions of the Department of Public Works will be rejected.

10.4 Reply to Protest

The County will send a written response to the protestor and to any other party named in the protest.

10.5 No Stay of Procurement Action during Protest

Nothing in these protest requirements will prevent the County from proceeding with negotiations or awarding a purchase order or contract while a protest is pending.

11. Public Records

11.1 General

(1) All bids, protests, and information submitted in response to this solicitation will become the property of the County and will be considered public records. As such, they may be subject to public review.

(2) Any contract arising from this solicitation for bids will be public record.

(3) Submission of any materials in response to this solicitation for bids constitutes:

a) Consent to the County's release of such materials under the Public Records Act without notice to the person or entity submitting the materials; and
b) Waiver of all claims against the County and/or its officers, agents, or employees that the County has violated a proposer's right to privacy, disclosed trade secrets, or caused any damage by allowing the bid or materials to be inspected; and
c) Agreement to indemnify and hold harmless the County for release of such information under the Public Records Act; and
d) Acknowledgement that the County will not assert any privileges that may exist on behalf of the person or entity submitting the materials.

11.2 Confidential Information

(1) The County is not seeking proprietary information and will not assert any privileges that may exist on behalf of the proposer: Proposers are responsible for asserting any applicable privileges or reasons why a document should not be produced in response to a public record request.

(2) If submitting information protected from disclosure as a trade secret or any other basis, identify each page of such material subject to protection as "CONFIDENTIAL". If requested material has been designated as confidential, the County will attempt to inform the proposer of the public records request in a timely manner to permit assertion of any applicable privileges.

(3) Failure to seek a court order protecting information from disclosure within ten (10) days of the County's notice of the request to the proposer will be deemed agreement to disclosure of the information and the proposer agrees to indemnify and hold the County harmless for release of such information.

(4) Requests to treat and entire proposal as confidential will be rejected and deemed agreement to County disclosure of the entire proposal and the proposer agrees to indemnify and hold the County harmless for release of any information requested.

(5) Trade secrets will only be considered confidential if claimed to be a trade secret when submitted to the County, marked as confidential, and compliant with Government Code Section 6254.7.

END OF DOCUMENT 00 21 13

DOCUMENT 00 41 13

BID FORM

STIPULATED SUM SINGLE-PRIME CONTRACT

To: The County of San Mateo
State of California

From: _____
(Proper Name of Bidder)

For: **East Palo Alto Government Center**
Mechanical Replacement Project
2415 University Ave., East Palo Alto, CA 94303
SMC Project Number: P25J1

Bid Opening Date: October 31, 2022, at 2:30PM

1. SCOPE OF BIDS – The undersigned, doing business under the name of

_____,
declares that the only persons or parties interested in this Bid proposal as Principals are those named herein; that this Bid is made without collusion with any other person, firm or corporation; that Principals have carefully examined the location of the proposed Work, the form of Agreement, and the Contract Documents therein referred to; that they propose, and agrees if this Bid is accepted, that Principals will contract with the County of San Mateo, in the form of the Agreement in the Contract Documents, and shall perform all the Work and furnish all the materials specified in the Contract Documents for the following amount(s). The base bid, unit prices, alternates, allowances, as applicable, shall include all labor, materials, equipment, supervision, overhead, profit, and incidentals necessary to complete the Work in accordance with the Contract Documents. The Base Bid will be used to determine the lowest responsible bidder.

2. BASE BID – Base bids shall include all Work specified in the Contract Documents. Write base bid in words and numbers. The base bid is the Contract Amount.

_____Dollars

($_____)

3. UNIT PRICES: Not used.

A unit price shall be quoted for each of the following items of Work in accordance with the Contract Documents. Unit Prices shall apply to Work added to or deducted from the contract by Change Order. Unit Prices will not apply to Work in the Contract Documents unless specifically called out to be paid by a unit price.

4. ALLOWANCES: Not Used.

5. ALTERNATES: Not Used.

6. CONTRACT – If written notice (by electronic mail and U.S. Mail) of the acceptance of this Bid to the undersigned occurs within ninety (90) calendar days after the date of opening the bids, or any time thereafter before the bid is withdrawn, the undersigned will, within ten (10) calendar days after the date of such notice, execute and deliver a contract in the Form of Agreement provided in these Contract Documents and submit with Agreement required Payment and Performance Bonds in the form provided in these Contract Documents. The undersigned designates the address provided in Section 14 of this form to be the place of business to which such notice of acceptance may be mailed or delivered.

7. TIME OF COMPLETION – The undersigned agrees, if awarded the Contract, to complete this entire work within Contract Time specified in Document 00 11 16 Notice to Contractors.

8. BONDS – The undersigned agrees, if awarded the Contract to execute within ten (10) calendar days, two corporate surety bonds as called for in Document 11 21 13 Instruction to Bidders.

9. INSURANCE – Bidder's Insurance as required for this Contract is placed with:

_____

Bidder's Workers Compensation Insurance is placed with:

_____

Bidder's All Other Risk Insurance is placed with:

_____

10. ADDENDA – All Addenda during Bidding are bound with Contract Documents and issued during the time of bidding.

11. ADDENDA RECEIPT – The receipt and acceptance of the following addenda is hereby acknowledged:

ADDENDUM NO. _____ DATED_____
ADDENDUM NO. _____ DATED_____
ADDENDUM NO. _____ DATED_____

12. This Bid may be withdrawn at any time prior to the scheduled time for the opening of bids or any authorized postponement thereof.

13. CONTRACTOR'S LICENSE – The undersigned agrees, if awarded the contract, to maintain and keep current through the completion of the contract the valid licenses for the work to be performed as required by the California Contractors License Law and all other applicable licensing requirements.

License No.	License Class	Expiration Date

14. By the signature below, the Bidder certifies, under penalty of perjury, the accuracy of the representations made in this Bid proposal.

Dated _____, 20_____.

Company
Business Type _____Corporation _____Partnership _____Sole Proprietorship

State of Incorporation of Location of Business Registration:_____

Name of Bidder: _____

Type of Organization: _____

Signed by: _____

Print Name of Signer: _____

Title of Signer:_____

Address of Bidder: _____

Phone:_____ Fax:_____

Email: _____

Taxpayer Identification Number of Bidder:_____

Department of Industrial Relations Registration Number:_____

If Bidder is a partnership, give full names of all partners:

_____

If Bidder is a corporation, affix corporate seal.

Name of Corporation:

_____

President/Secretary/Treasurer/Other:

_____

15. DESIGNATION OF SUBCONTRACTORS – In compliance with the provisions of Sections 4100-4108 of the Public Contract Code of the State of California, and any amendments thereof, each Bidder shall set forth and list below the name and the location of each subcontractor who will be employed, and the kind of form that each will perform work or labor or render service to the Bidder in or about the construction of the Work in an amount in excess of one-half of one percent (1/2 of 1%) of the Bidder's total Bid to County, if the Contract is awarded to the Bidder. Any work that the Bidder fails to list, Bidder agrees to perform that portion itself or be subject to penalty under applicable law.

In case more than one subcontractor is named for the same kind of work, state the portion that each will perform. Vendors or suppliers of materials only do not need to be listed.

Reference: Notice to Contractor regarding State Senate Bill SB 854

DESIGNATION OF SUBCONTRACTORS - Please List All Subcontractor's

DESIGNATED SUBCONTRACTOR LIST				
Project Number: P30F1	**Project Name: Prevent Self Harm and Ligature Project**			
Name and City of Subcontractor **(1) (4)**	Description of Work: Reference to Contract Items **(1)**	Price Under Contract **(2) (3)**	State of California Contractor's License **(2)**	Department of Industrial Relations Registration No. (DIR) **(2)**

(1) Submit this information with sealed bid.
(2) This information shall be required of the two (2) apparent low bidders, no later than two days following the bid opening. **DO NOT INCLUDE THIS INFORMATION WITH BID**.
(3) Dollar amounts will be treated as proprietary and will solely be for the use of County staff. **DO NOT INCLUDE THIS INFORMATION WITH BID**.
(4) Submit full address of Subcontractors two days following bid opening.

Attach additional page as necessary. Indicate "none" or number or pages attached here: _____ pages attached.

END OF DOCUMENT 00 41 13

DOCUMENT 00 45 19

NON-COLLUSION DECLARATION

TO BE EXECUTED BY BIDDER AND SUBMITTED WITH BID

Project: **East Palo Alto Government Center**
Mechanical Replacement Project
2415 University Ave., East Palo Alto, CA 94303

Project No.: P25J1

The undersigned declares:

I am the _____ of _____, the party making the foregoing bid. The bid is not made in the interest of, or on behalf of, any undisclosed person, partnership, company, association, organization, or corporation. The bid is genuine and not collusive or sham. The bidder has not directly or indirectly induced or solicited any other bidder to put in a false or sham bid. The bidder has not directly or indirectly colluded, conspired, connived, or agreed with any bidder or anyone else to put in a sham bid, or to refrain from bidding. The bidder has not in any manner, directly or indirectly, sought by agreement, communication, or conference with anyone to fix the bid price of the bidder or any other bidder, or to fix any overhead, profit, or cost element of the bid price, or of that of any other bidder. All statements contained in the bid are true. The bidder has not, directly or indirectly, submitted his or her bid price or any breakdown thereof, or the contents thereof, or divulged information or data relative thereto, to any corporation, partnership, company, association, organization, bid depository, or to any member or agent thereof, to effectuate a collusive or sham bid, and has not paid, and will not pay, any person or entity for such purpose.

Any person executing this declaration on behalf of a bidder that is a corporation, partnership, joint venture, limited liability company, limited liability partnership, or any other entity, hereby represents that he or she has full power to execute, and does execute, this declaration on behalf of the bidder.

I declare under penalty of perjury under the laws of the State of California that the foregoing is true and correct and that this declaration is executed on _____date], at _____city], _____state]."

_____ _____
Signature Title

(ATTACH NOTARIAL ACKNOWLEDGMENT FOR THE ABOVE SIGNATURE)

END OF DOCUMENT 00 45 19

DOCUMENT 00 45 26

WORKERS' COMPENSATION CERTIFICATION

Contract Between County Of San Mateo (The "County" Or The "Owner") and _____ (The "Contractor" Or The "Bidder") for the construction of:

EAST PALO ALTO GOVERNMENT CENTER MECHANICAL REPLACEMENT PROJECT - PROJECT NO. P25J1 (The "Contract" Or The "Project")

Labor Code §3700 provides:

"Every employer, except the State, and all political subdivisions or institutions thereof, shall secure the payment of compensation in one or more of the following ways:

(a) By being insured against liability to pay compensation by one or more insurers, duly authorized to write compensation insurance in this State.

(b) By securing from the Director of Industrial Relations a certificate of consent to self-insure, which may be given upon furnishing proof satisfactory to the Director of Industrial Relations of ability to self-insure and to pay any compensation that may become due to employees."

I am aware of the provisions of §3700 of the Labor Code that require every employer to be insured against liability for Worker's Compensation or to undertake self-insurance in accordance with the provisions of that code, and I will comply with such provisions before commencing the performance of the Work of this Contract.

Date: _____ 20_____

By_____ Print Name:_____
(Signature of Contractor) (Name of Contractor)

_____ (Official Title)

(Labor Code §1861 requires that this Contractor certification must be signed and filed by the Contractor with the public agency prior to performing any Work.)

END OF DOCUMENT 00 45 26

DOCUMENT 00 45 29

JURY SERVICE AND WAGE COMPENSATION

COUNTY OF SAN MATEO
CONTRACTOR EMPLOYEE JURY SERVICE
ORDINANCE NO. 4324, CHAPTER 2.85

2.85.010 Definitions

For the purposes of this chapter:
(a) "Contract" means a legal agreement between the county and a contractor for public works, consulting, or other services, or for purchase of supplies, material or equipment.

(b) "Contractor" means a party who enters into a contract with the county for which the contractor receives consideration of $100,000 or more.

(c) "Contract Authority" means the Board of Supervisors or the head of the department or agency presenting the proposed contract to the Board of Supervisors.

(d) "Employee" means any California resident who is a full-time employee of a contractor under the laws of California.

(e) "Full time" means 40 hours or more worked per week, or a lesser number of hours if
(1) the lesser number is a recognized industry standard as determined by the County Manager, or
(2) the contractor has a long standing practice that defines the lesser number of hours as full time. (Ord. 4324, 08/15/06)

2.85.020 Contractor Jury Service Policy

(a) A contractor shall have and adhere to a written policy that provides that its employees shall receive from the contractor, on an annual basis, no less than five days of regular pay for actual jury service in San Mateo County. The policy may provide that employees deposit any fees received for such jury service with the contractor or that the contractor deduct from the employees' regular pay the fees received for jury service.

(b) At the time of seeking a contract, a contractor shall certify to the County that it has and adheres to a policy consistent with this chapter or will have and adhere to such a policy prior to award of the contract.

(c) The Board of Supervisors may waive the requirements of this chapter when it determines that it is in the best interests of the County for such reasons as follows:

1. Award of a contract or amendment is necessary to respond to an emergency;
2. The Contractor is a sole source;
3. No compliant contractors are capable of providing goods or services that respond to the County's requirements;
4. The requirements are inconsistent with a grant, subvention or agreement with a public agency;
5. The County is purchasing through a cooperative or joint purchasing agreement.

(d) Contractors should submit requests for waivers of the terms of this chapter to the Contract Authority or the County Manager.

(e) The County Manager may reject a contractor’s bid or proposal, or terminate a contract, if he determines that the contractor is in violation of the requirements of this chapter or was established, or is being used, for the purpose of evading the intent of this chapter.

(f) No contract shall be executed with a contractor unless such contractor is in compliance with this chapter. (Ord. 4324, 08/15/06)

2.85.030 Powers and duties of the County Manager

The County Manager's office shall have the authority to:
(a) Adopt rules and regulations, in accordance with this chapter and the Ordinance Code of the County of San Mateo, establishing standards and procedures for effectively carrying out this chapter;

(b) Receive notification from employees of contractors regarding violations of this chapter;

(c) Determine and recommend to the Board of Supervisors for final decision the imposition of appropriate sanctions for violation of this chapter by contractors including, but not limited to:

1. Disqualification of the contractor from bidding on or being awarded a County contract for a period of up to 5 years, and
2. Contractual remedies, including, but not limited to termination of contract.

(d) Impose other appropriate contractual sanctions for violations of this chapter;

(e) Allow for remedial action after a finding of noncompliance.

(g) Perform such other duties as may be required or which are necessary to implement the purposes of this chapter. (Ord. 4324, 08/15/06)

2.85.040 Date of Application

The provisions of this chapter shall apply to any contract awarded or amended on or after September 01, 2005, provided that if the contractor is then signatory to a collective bargaining agreement, this chapter shall only apply to any contract with that contractor which is awarded or amended after the effective date of the next collective bargaining agreement. (Ord. 4324, 08/15/06)

END OF DOCUMENT 00 45 29

DOCUMENT 00 45 36.01

EQUAL EMPLOYMENT OPPORTUNITY REQUIREMENTS

CERTIFICATION OF COMPLIANCE

WITH LAWS PROHIBITING DISCRIMINATION

THIS FORM MUST BE COMPLETED IN FULL AND SUBMITTED WITH THE BID

We are in compliance with the Equal Employment Opportunity Requirement of Executive Order 11246, Title VII of the Civil Rights Act of 1964, the California Fair Employment Practices Act, Section 503 of the Rehabilitation Act of 1973, and any other federal or state laws relating to equal employment opportunity and the provisions of Title 2, Chapter 2.50 of the San Mateo County Ordinance Code and the Board established guidelines implementing them.

We will not discriminate against any employee or applicant for employment based on race, religion, color, national origin, age, ancestry, physical or mental disability, sexual orientation, or sex. This pertains to the areas of recruitment, hiring, training, upgrading, transfer, compensation, and termination.

CERTIFICATION OF INTENT

We will develop and implement, during the course of the work concerned, an Equal Employment Opportunity Program of hiring and employment conducted without regard to race, religion, color, national origin, age, ancestry, physical or mental disability, sexual orientation, or sex of the applicants. With this certification we shall submit any and all information which may be required by the County in connection with this program.

Date: _____

Bidder/Company Name: _____

Signature: _____

Print Name: _____

Title: _____

END OF DOCUMENT 00 45 36.01

DOCUMENT 00 45 36.02

EQUAL EMPLOYMENT OPPORTUNITY PROGRAM
CONTRACTOR REPORT FORM

THIS FORM MUST BE COMPLETED IN FULL AND SUBMITTED WITH THE BID

Project: **East Palo Alto Government Center**
Mechanical Replacement Project
2415 University Ave., East Palo Alto, CA 94303

Project No.: P25J1

Company Name: _____ Date: _____

RACIAL/ETHNIC MAKEUP OF THE COMPANY

Be sure to include the total of all employees in each classification in the first column, not just minorities. Report the number of employees enrolled in formal on-the-job (apprenticeship) training programs in parenthesis () for each classification.

Minority Employees										
Job Classification	Total All Employees	Ethnicity								
		American-Indian or Native Alaskan	Asian	Native Hawaiian or Pacific Islander	Black American or African American	Caucasian	Filipino	Hispanic or Latino (1)	Other (2)	Unidentified (3)
Total(s)										

Ethnicity Notes:

(1) "Hispanic" includes all persons of Mexican, South and Central American, Puerto Rican, Cuban or Spanish ancestry.

(2) "Other" includes all others whose origin consists of two or more races other than Hispanic or Latino.

(3) Use this category for employees who have chosen not to identify any race or ethnicity, including "Other".

END OF DOCUMENT 00 45 36.02

DOCUMENT 00 45.36.03

EQUAL EMPLOYMENT OPPORTUNITY PROGRAM QUESTIONNAIRE

THIS QUESTIONNAIRE MUST BE COMPLETED IN FULL BY AN OFFICIAL OF THE COMPANY AND SUBMITTED WITH THE BID

Project: **East Palo Alto Government Center**
Mechanical Replacement Project
2415 University Ave., East Palo Alto, CA 94303

Project No.: P25J1

Company Name: _____

Name of Company Official: _____

Phone: _____ Date: _____

1. _____Yes _____No Have you read and are you acquainted with the Equal Employment Opportunity Requirement of Executive Order 11246, Title VII of the Civil Rights Act of 1964, Section 503 of the Rehabilitation Act of 1973, the California Fair Employment Practices Act and Title 2, Chapter 2.50 of the San Mateo County Ordinance Code?

2. _____Yes _____No Is it the policy of your company to recruit, hire, train, upgrade, transfer, compensate, and discharge without regard to race, religion, color, national origin, age, ancestry, physical or mental disability, sexual orientation, or sex?

3. _____Yes _____No Have you appointed an Equal Employment Opportunity Officer? Give his name, position in the company, office address, and phone number.

_____

_____

_____

4. _____Yes _____No Does your employment advertising state that you are

an Equal Opportunity Employer?

5. _____Yes _____No Have all recruitment sources been advised that all qualified applicants will be considered for employment without regard to race, religion, color, national origin, age, ancestry, physical or mental disability, sexual orientation, or sex?

6. _____Yes _____No Were any employees hired by means other than the union hiring hall in the past year?

   How many? _____

   What positions? _____

   _____

7. If non-union personnel are employed by the company, or if a position cannot be filled by the union hall, specify the advertisement and recruitment sources that are used. (For example, State HRD, newspapers, high schools, vocational schools, referral agencies/organizations, community groups).

   _____

   _____

8. How many apprentices do you employ? _____

   How many of these are minorities? _____

9. _____Yes _____No Do you have a program for upgrading and counseling present employees?

   Describe: _____

   _____

   _____

10. _____Yes _____No Do you have a collective bargaining agreement with a labor union or other organization?

    Please list these groups: _____

11. What percentage of your work force is covered by union agreement?_____

12. _____Yes _____No Have you advised the labor union and/or worker organization of your company's responsibility under the Equal Employment Opportunity Program?

13. _____Yes _____No Does your company's collective bargaining agreement include a provision for non-discrimination in employment?

14. _____Yes _____No Have you notified all subcontractors submitting bids to you that they will be subject to the same minority employment requirements should you be the successful bidder?

15. Describe any previous experience with Equal Employment Opportunity Programs:

16. State what Equal Employment Opportunity Program you plan to take in connection with this project:

_____

_____

_____

_____

If your company has a written Equal Employment Opportunity Program now in effect, please attach a copy of it.

END OF DOCUMENT 00 45.36.03

DOCUMENT 00 45 36.04

County of San Mateo
Contractor's Declaration Form

I. CONTRACTOR INFORMATION

Contractor Name:		Phone:	
Contact Person:		Fax:	
Address:		Number of employees:	

II. EQUAL BENEFITS (check one or more boxes)

Contractors with contracts in excess of $5,000 must treat spouses and domestic partners equally as to employee benefits.

- ☐ Contractor complies with the County's Equal Benefits Ordinance by:
  - ☐ offering equal benefits to employees with spouses and employees with domestic partners.
  - ☐ offering a cash equivalent payment to eligible employees in lieu of equal benefits.
- ☐ Contractor does not comply with the County's Equal Benefits Ordinance.
- ☐ Contractor is exempt from this requirement because:
  - ☐ Contractor has no employees, does not provide benefits to employees' spouses, or the contract is for $5,000 or less.
  - ☐ Contractor is a party to a collective bargaining agreement that began on _____ (date) and expires on _____ (date), and intends to offer equal benefits when said agreement expires.

III. NON-DISCRIMINATION (check appropriate box)

- ☐ Finding(s) of discrimination have been issued against Contractor within the past year by the Equal Employment Opportunity Commission, Fair Employment and Housing Commission, or other investigative entity. Please see attached sheet of paper explaining the outcome(s) or remedy for the discrimination.
- ☐ No finding of discrimination has been issued in the past year against the Contractor by the Equal Employment Opportunity Commission, Fair Employment and Housing Commission, or any other entity.

IV. EMPLOYEE JURY SERVICE (check one or more boxes)

Contractors with original or amended contracts in excess of $100,000 must have and adhere to a written policy that provides its employees living in San Mateo County up to five days regular pay for actual jury service in the County.

- ☐ Contractor complies with the County's Employee Jury Service Ordinance.
- ☐ Contractor does not comply with the County's Employee Jury Service Ordinance.
- ☐ Contractor is exempt from this requirement because:
  - ☐ the contract is for $100,000 or less.
  - ☐ Contractor is a party to a collective bargaining agreement that began on _____ (date) and expires on _____ (date), and intends to comply when the collective bargaining agreement expires.
  - ☐ Contractor has no employees.
  - ☐ Contractor has no employees who live in San Mateo County.

I declare under penalty of perjury under the laws of the State of California that the foregoing is true and correct, and that I am authorized to bind this entity contractually.

_____ _____
Signature Name

_____ _____
Date Title

DOCUMENT 00 45 46

ANTI-TRUST LAWS QUESTIONNAIRE

THIS QUESTIONNAIRE MUST BE COMPLETED IN FULL AND SUBMITTED WITH THE BID

Project: **East Palo Alto Government Center**
Mechanical Replacement Project
2415 University Ave., East Palo Alto, CA 94303

Project No.: P25J1

Company Name: _____

In accordance with instructions from the State of California Attorney General's Office, with regard to California and Federal Anti-Trust Laws, answers to the following must be included with the bid.

1. _____Yes _____No Were bid depository of registry services used in obtaining subcontractor bid figures in order to compute your bid?

2. If the answer to No. 1 is "Yes" please list the subcontractors using a bid depository or registry service.

   _____

   _____

3. _____Yes _____No Did you have any source of subcontractor's bids other than bid depositories?

4. _____Yes _____No Has any person or group threatened you with subcontractor boycotts, union boycotts, or other sanctions to attempt to convince you to use the services or abide by the rules of one or more bid depositories?

Date: _____ Name: _____

Nature of the threats: _____

Additional comments: _____

END OF DOCUMENT 00 45 46

DOCUMENT 00 52 13

AGREEMENT FORM – STIPULATED SUM

THIS AGREEMENT, entered into this _____ day of _____, 20__, by and between the COUNTY OF SAN MATEO, a Political Subdivision of the State of California, hereinafter called the "County", and _____, hereinafter called the "Contractor".

WITNESSETH that the Contractor and the County, in consideration of the mutual covenants, considerations and agreements herein contained, agree as follows:

STATEMENT OF WORK – The Contractor shall furnish all labor and materials and perform all work for:

East Palo Alto Government Center
Mechanical Replacement Project
East Palo Alto, CA 94303
Project No. P25J1

in strict accordance with the Contract Documents.

TIME FOR COMPLETION – The work shall be commenced on a date to be specified in the Notice to Proceed issued by the County. Construction shall be completed within **Two Hundred Seventy-four (274) calendar days** defined as sufficiently complete in accordance with the Contract Documents so the Owner can occupy or utilize for its intended use.

COMPENSATION TO BE PAID TO CONTRACTOR – The County will pay and the Contractor will accept in full consideration for the performance of the contract, subject to additions and deductions and procedures for payment as provided therein, the sum of _____ ($_____) which is the Contractor's Bid. The Contract as defined in paragraph 1.1 of the General Conditions constitutes the sole agreement of the parties hereto relating to said work and correctly states the rights, duties, and obligations of each party as of the document's date. Any prior agreement, promises, negotiations, or representations between the parties not expressly stated in this document are not binding. All subsequent modifications shall be in writing.

PREVAILING WAGE RATES - In accordance with the provisions of Section 1770 of the Labor Code, the Board of Supervisors of the County of San Mateo has ascertained the prevailing rate of wages applicable to the work to be done, which

prevailing wage rates have been established as indicated in the Notice to Bidders and are incorporated herein by reference.

The Contractor's attention is further directed to the following requirements of State Senate Bill SB 854 (Stat. 2014, chapter 28), effective January 1, 2015:

(1) No contractor or subcontractor may be listed on a bid proposal for a public works project (submitted on or after March 1, 2015) unless registered with the Department of Industrial Relations pursuant to Labor Code section 1725.5 [with limited exceptions from this requirement for bid purposes only under Labor Code section 1771.1(a)].

(2) No contractor or subcontractor may be awarded a contract for public work on a public works project (awarded on or after April 1, 2015) unless registered with the Department of Industrial Relations pursuant to Labor Code section 1725.5.

(3) This project is subject to compliance monitoring and enforcement by the Department of Industrial Relations.

IN WITNESS WHEREOF, the parties hereto on the day and year first above written have executed this agreement in three counterparts, each of which shall, without proof or accounting for the other counterparts, be deemed an original thereof.

COUNTY OF SAN MATEO

A Political Sub-Division of the State of California

By _____
President, Board of Supervisors

Attest:

_____
Michael Callagy, County Manager

_____
Clerk of the Board of Supervisors

By _____
Contractor

END OF DOCUMENT 00 52 13

DOCUMENT 00 61 13.13

PERFORMANCE BOND FORM
(100% of Contract Price)

(Note: Bidders must use this form, NOT a surety company form.)

KNOW ALL PERSONS BY THESE PRESENTS:

That WHEREAS, the County of San Mateo, hereinafter designated as the "County," has awarded to _____(CONTRACTOR'S NAME), hereinafter designated as "Principal," a contract dated _____ (CONTRACT AWARD DATE), hereinafter designated as the "Contract," which Contract is by this reference made a part hereof, for the work described as the **East Palo Alto Government Center Mechanical Replacement Project, located at 2415 University Ave., East Palo Alto, CA 94303, Project No.P25J1.**

And WHEREAS, Principal is required to furnish a bond in connection with the Contract, guaranteeing the faithful performance thereof;

NOW THEREFORE, THESE PRESENTS WITNESSETH:

That the said Principal and the undersigned, (SURETY'S NAME), as corporate Surety, are held and firmly bound unto the County in the sum of

_____ Dollars ($_____)
lawful money of the United States, for the payment of which sum well and truly to be made, we bind ourselves, our heirs, executors, administrators, and successors, jointly and severally, firmly by these presents.

The condition of this obligation is such, that if the Principal shall well and truly perform and fulfill all the undertakings, covenants, terms, conditions, and agreements of said Contract during the original term of said Contract and any extensions thereof that may be granted by the County, with or without notice to the Surety, and during the life of any guarantee required under the Contract, and shall also well and truly perform and fulfill all the undertakings, covenants, terms, conditions and agreements of any and all duly authorized modifications of said Contract that may hereafter be made, notice of which modifications to Surety being hereby waived, on Principal's part to be kept and performed at the time and in the manner therein specified, and in all respects according to their true intent and meaning, and shall indemnify, defend, protect, and hold harmless the County as stipulated in the Contract, then this obligation shall become and be null and void; otherwise it shall be and remain in full force and effect.

No extension of time, change, alteration, modification, or addition to the Contract, or of the work required thereunder, shall release or exonerate Surety on this bond or in any way affect the obligation of this bond; and Surety does hereby waive

notice of any such extension of time, change, alteration, modification, or addition.

IN WITNESS WHEREOF, this instrument has been duly executed by the Principal and Surety this _____ day of _____, 20_____.

Principal	Surety
Signature	Signature
Printed Name	Printed Name of California Agent Surety
	Address of California Agent Surety
	Telephone Number of California Agent Surety

(Affix Corporate Seal)

NOTE: Notary acknowledgement for Surety signatures and Surety's Power of Attorney and Certificate of Authority for Surety must be attached. The California Department of Insurance must authorize the Surety to be an admitted surety insurer.

END OF DOCUMENT 00 61 13.13

DOCUMENT 00 61 13.16

PAYMENT BOND FORM

Contractor's Labor & Material Payment Bond
(100% of Contract Price)

(Note: Bidders must use this form, NOT a surety company form.)

KNOW ALL PERSONS BY THESE PRESENTS:

That WHEREAS, the County of San Mateo hereinafter designated as the "County," has awarded to _____ (CONTRACTOR NAME) hereinafter designated as the "Principal," a contract dated _____ (CONTRACTOR AWARD DATE) hereinafter designated as the "Contract," which Contract is by this reference made a part hereof, for the work described as the **East Palo Alto Government Center Mechanical Replacement Project, located at 2415 University Ave., East Palo Alto, CA 94303, Project No.P25J1.**

And WHEREAS**,** pursuant to law, the Principal is required, before entering upon the performance of the work, to file a good and sufficient bond with the body by whom the Contract is awarded to secure the claims to which reference is made in Sections 9550 to 9566 and 9100 to 9364 both inclusive, of the Civil Code of California.

NOW THEREFORE, THESE PRESENTS WITNESSETH:

That the said Principal and the undersigned _____,
(Surety's Name)

as corporate Surety, are held and firmly bound unto all laborers, material men and other persons referred to in said statutes in the sum of

_____ Dollars ($_____)

lawful money of the United States, for the payment of which sum well and truly to be made, we bind ourselves, our heirs, executors, administrators, successors, or assigns, jointly and severally, by these presents.

The condition of this obligation is that if the above bonded Principal, contractor, person, company or corporation, or his or its sub-contractor, fails to pay any claimant name in Section 9100 of the Civil Code of the State of California, or amounts due under the Unemployment Insurance Code, with respect to work or labor performed by any such claimant, that the Surety on this bond will pay the same, in an amount not exceeding the aggregate sum specified in this bond, and also, in case suit is brought upon this bond, a reasonable attorney's fee, which shall be awarded by the court to the prevailing party in said suit, and attorney's fees to be taxed as costs in said suit.

It is hereby expressly stipulated and agreed that this bond shall inure to the benefit of any and all persons, companies and corporations entitled to file claims under Section 9100 to 9364 of the Civil Code, so as to give a right of action to them or their assigns in any suit brought upon this bond.

This bond is executed and filed to comply with the provisions of the act of Legislature of the State of California as designated in the Civil Code, Sections 9550-9566 inclusive, and all amendments thereto.

Should the condition of this bond be fully performed, then this obligation shall become null and void, otherwise it shall be and remain in full force and effect.

And the said Surety, for value received, hereby stipulates and agrees that no change will be made which increases the total Contract price more than twenty percent (20%) in excess of the original Contract price without notice to the Surety, then, this obligation to be void, otherwise to remain in full force and virtue.

Correspondence relating to this bond shall be sent to the Surety at the address set forth below.

IN WITNESS WHEREOF, this instrument has been duly executed by the Principal and Surety this _____ day of _____, 20___.

_____	_____
Principal	Surety
_____	_____
Signature	Signature
_____	_____
Printed Name	Printed Name of California Agent Surety
	_____
	Address of California Agent Surety
	_____
	Telephone Number of California Agent Surety

(Affix Corporate Seal)

NOTE: Notary acknowledgement for Surety signatures and Surety's Power of Attorney and Certificate of Authority for Surety must be attached. The California Department of Insurance must authorize the Surety to be an admitted surety insurer.

END OF DOCUMENT 00 61 13.16

DOCUMENT 00 61 16

BID BOND

(Bid Security Form)

KNOW ALL PERSONS BY THESE PRESENTS, that we, the undersigned,

_____, as Principal ("Principal"),

and _____, as Surety ("Surety"), are hereby held and firmly bound unto the County of San Mateo in the State of California, as represented by the County Board of Supervisors, hereinafter called the "Owner" in the sum of

_____ Dollars ($_____) lawful money of the United States of America, for payment of which sum, well and truly to be made, we hereby jointly and severally bind ourselves, our heirs, executors, administrators, successors, and assigns.

The condition of the above obligation is such that, whereas the Principal has submitted to the County a certain Bid, attached hereto and hereby made a part hereof, to enter into a contract in writing for the **East Palo Alto Government Center Mechanical Replacement Project, located at 2415 University Ave., East Palo Alto, CA 94303, Project No.P25J1** in strict accordance with the Contract Documents.

NOW, THEREFORE,

a. If said Bid shall be rejected, or, in alternate

b. If said Bid shall be accepted and the Principal shall execute and deliver a contract in the Form of Agreement attached hereto and shall execute and deliver Performance and Payment Bonds in the Forms attached hereto (all properly completed in accordance with said Bid), and shall in all other respects perform the agreement created by the Acceptance of said Bid.

Then, this obligation shall be void; otherwise, the same shall remain in force and effect, it being expressly understood and agreed that the liability of the Surety for any and all default of the Principal hereunder shall be the amount of this obligation as herein stated.

The Surety, for value received, hereby stipulates and agrees that the obligation of said Surety and its bond shall be in no way affected or impaired by any extension of the time within which the County may accept such Bid and said Surety does hereby waive notice of such extension.

IN WITNESS WHEREOF, the above-bounden parties have executed this instrument under their several seals this _____ day of _____, 20__, the name and corporate seal of each corporate party being hereto affixed and these presents duly signed by its undersigned representative, pursuant to authority of its governing body.

In presence of:

_____

(Individual Principal) (Affix Corporate Seal)

(Business Address)

By_____

Attest:

_____
(Corporate Principal)

_____

(Business Address)

(Affix Corporate Seal)

By_____

Attest:

_____
(Corporate Surety)

_____
(Business Address)

(Affix Corporate Seal)

By

_____

The rate or premium on this bond is _____ per thousand.

Total amount of premium charge, $_____
(The above must be filled in by Corporate Surety.)

(Note: If Bidder is providing a bid bond as its bid security, Bidder must use this form, NOT a surety company form.)

Bidder must attach Power of Attorney and Certificate of Authority for Surety and a Notarial Acknowledgement for all Surety's signatures. The California Department of Insurance must authorize the Surety to be an admitted Surety Insurer.

END OF DOCUMENT 00 61 16

County of San Mateo

WASTE MANAGEMENT PLAN

Case/group number(s):
BLD _____ - _____

Project address:

Street: _____

City: _____

Zip Code: _____

Green Halo number(s):

_____

Submit to:
County of San Mateo
Office of Sustainability
455 County Center, 4th Floor
Redwood City, CA 94063
Mon-Fri, 8:30 am-12:00 pm, 1:00 pm-4:30 pm

Information and support: 888-442-2666
www.smcsustainability.org/waste-reduction/construction-demolition

WMP required because project is a:

❑ Residential ❑ Demolition

❑ Nonresidential ❑ New Construction

❑ Addition

Section One: Permit Application

This Waste Management Plan (WMP) must be completed, submitted for review with a **$95 administration fee**, and approved to obtain a building permit. Separate WMPs are required for demolition and construction at the same site unless the Building Department requires only one permit. Need for a WMP is at the discretion of the Building Official or designee.

Applicant's Name: _____ Owner's Name:_____

Phone Number: _____ Email: _____

Applicant is (please check one): ❑ Owner ❑ Architect ❑ Builder ❑ Owner/Builder ❑ Other _____

Contractor (if applicable): _____ Contact Phone Number: _____

Project Description: _____

Project Square Footage: _____ Estimated Completion Date: _____

Waste Management Requirements:
You are required to recycle or re-use all inert solids (asphalt, brick, concrete, dirt, fines, rock, sand, and stone) and 65% of all construction and demolition debris.

I understand that I am required by San Mateo County Building Regulations Section 9210 - Adoption Of 2016 California Green Building Standards Code (Building Regulations) to salvage, reuse, or recycle **all inert solids** (asphalt, brick, concrete, dirt, fines, rock, sand, and stone) and **a minimum of 65%** of all construction and demolition debris (C&D). _____(Initial)

I understand that failure to meet the requirements of the Building Regulations shall constitute a misdemeanor, and shall be punishable by imprisonment in the county jail for up to 6 months and/or a fine of up to $1,000, calculated as a percentage of the required 65% diversion of C&D debris, and that the fine must be paid as a condition of final approval. _____ (Initial)

At the completion of this project, or more frequently if required, all weight tags or other equivalent documentation from salvage, recycling and waste facilities will be provided and I understand that I may not be issued my final inspection unless all original receipts and documentation are submitted to the County of San Mateo Office of Sustainability. _____ (Initial)

Recycling and waste facilities ask for the correct origin of the materials generated as they come through the scale house. These tons are reported to the State of California. I understand that I need to advise my debris box company, waste haulers, and my drivers that the materials generated on this project originated in Unincorporated County of San Mateo. _____ (Initial)

1) Deconstruction/salvage/reuse:

What materials will be salvaged/reused? _____

Deconstruction or salvage company (if applicable): _____

What materials will be reused on site? _____

How will this be documented? _____

2) Material transportation:

Will you be using a hauling company, debris box company or hauling the material yourself?

❑ Hauler ❑ Debris Box ❑ Self-haul

If using a hauling or debris box company, which company? _____

Have they been notified that the diversion of 65% mixed debris and all insert solids is required? ❑ Yes ❑ No

3) Waste management plan:

Check the materials you anticipate generating and fill in the facilities that you plan to use.

Category	Material	√	Reuse, Recycling or Disposal Facility
Mixed C&D	Mixed Debris		
Inerts	Asphalt		
	Bricks		
	Concrete		
	Dirt		
	Other inert solids		
Source Separated	Cardboard		
	Metals		
	Wood		
	Roofing		
	Carpet		
	Drywall		
	Yard trimmings		
	Other		
Disposal	Waste		

The undersigned hereby agrees to comply with the Waste Management Plan as submitted and is the owner or authorized agent to sign for the owner of this project.

Applicant Signature _____ **Date** _____

County Approval: ❑ Approved ❑ Approved with comments ❑ Denied

All receipts, weight tags and documentation for salvage, recycling, and disposal must be submitted:

❑ On completion of project ❑ Other _____

Office of Sustainability Approval: _____ Date: _____

OFFICE OF SUSTAINABILITY
COUNTY OF SAN MATEO

County of San Mateo
WASTE MANAGEMENT PLAN

Case/Group Number(s):
BLD _____ - _____

Project Address:

Street: _____

City: _____

Section Two: Final Report Approval

Please complete, submit, and get this section approved by the Office of Sustainability, prior to obtaining final approval by the Building Department no later than 30 days after completion of the demolition or construction project. Please provide weight of materials in **tons**. If needed, please use the conversion table on the next page to convert cubic yards to tons.

This section must be completed and signed, and all receipts or other supporting documentation must be attached in order to receive final project approval.

Category	Date	Material/items	Name of facility debris was hauled to	Weight (Tons)	Volume (CU. YD.)
Mixed C&D					
Salvage/Reuse					
Inerts Asphalt, bricks, concrete, dirt, rock, sand, soil, stone					
Source Separated Cardboard, wood, metal, sheetrock, wire, carpet, yard trimmings					
Disposal (Waste)					

❑ All receipts or equivalent documentation for salvage, recycling, and disposal are hereby attached.

❑ This project has recycled all of the inert solids and at least 65% of all debris generated.

Applicant Signature _____ **Date** _____

County Approval: ☐ Approved ☐ Approved with Comments ☐ Fine Payment Required

Comments:

_____

Fine Calculation: 1 – (C&D Diversion % Achieved ____ / 65%) x $1000 = $_____

Office of Sustainability Approval: _____ Date: _____

OFFICE OF SUSTAINABILITY
COUNTY OF SAN MATEO

County of San Mateo

WASTE MANAGEMENT PLAN

Cubic Yards to Tons Conversion Table

Category	Material	Cubic Yards	Pounds	Tons
Mixed C&D	Mixed load C&D	1	500	0.25
Inerts	Asphalt	1	1380	0.69
	Bricks	1	3000	1.5
	Concrete	1	1860	0.93
	Dirt	1	2000	1
	Other inert solids	1	1240	0.62
Source Separated	Cardboard	1	100	0.05
	Metals	1	900	0.45
	Wood	1	300	0.15
	Asphalt roofing	1	1188	0.59
	Carpet	1	600	0.3
	Drywall	1	400	0.2
	Green waste	1	300	0.15
	Gravel	1	2600	1.3
Disposal	Waste	1	300	0.15

DOCUMENT 00 65 36

WARRANTY FORM

(Contractor's or Subcontractor's own letterhead)

WARRANTY GUARANTEE FOR THE:

Project Name: **East Palo Alto Government Center Mechanical Replacement Project**
Project/Facility Address: 2415 University Ave., East Palo Alto, CA 94303
Project No.: P25J1

We, _____(Contractor's name) hereby guarantees

(Scope of Contractor's Work) _____

_____which Contractor has installed for the County of San Mateo for the above project

beginning _____ for _____ year(s) in accordance with the Contract Documents.

We agree to repair or replace to the satisfaction of the Owner any and all such work that may prove defective in workmanship or materials within that period, ordinary wear and tear and unusual abuse or neglect excepted, together with all other Work which may be damaged or displaced in connection with such Work. This Warranty includes labor and materials.

In the event of our failure to comply with the above-mentioned conditions within seven (7) calendar days after being notified in writing, we collectively and separately do hereby authorize the Owner to proceed to have the defects repaired and made good at our expense, and will pay the costs and charges therefore immediately upon demand.

I hereby certify that I am authorized to sign this document.

Date_____ _____
(Signature of Contractor)

_____
Print Name and Title

Date_____ _____
(Signature of Subcontractor)

Print Name and Title
(Subcontractor must co-sign with Contractor)

Representative(s) to be contacted for service subject to terms of Contract:

NAME: _____

ADDRESS: _____

PHONE NO.: _____

END OF DOCUMENT 00 65 36

DOCUMENT 00 72 13

GENERAL CONDITIONS

DOCUMENT 00 72 13

GENERAL CONDITIONS

1 THE CONTRACT

1.1 CONTRACT DESCRIPTION

The Contract Documents form the entire Contract between the Contractor and the Owner. The Contract supersedes prior negotiation and representations, either written or oral.

1.2 CONTRACT DOCUMENTS

A. The Contract Documents consist of the Notice to Contractors, Instructions to Bidders, Agreement, General Conditions, Special Provisions, Supplementary Conditions, Specifications, Drawings, Addenda, Revisions , Construction Change Directives, Change Orders (including Unilateral Change Orders), RFI Responses, Shop Drawings and other documents listed in the Agreement or included in the Project Manual, and written interpretations and instruction when issued in accordance with the provisions herein.

B. The Contract Documents are complementary and what is required by anyone shall be as binding as if required by all. The Contract Documents are not necessarily complete in every detail. The Contract is to include all labor, materials, equipment and other items as necessary for the proper execution and completion of the work as specified or reasonably inferable as being necessary to produce the intended results in accordance with high quality industry standards.

C. An item designated by reference to the number, symbol, or title of a specific standard such as a commercial standard, a Federal Specification, a Trade Association Standard or other similar standard, shall comply with the requirements in the latest revision thereof and any amendments or supplement thereto in effect on the date of the bid. The standards referred to shall have full force and effect as though printed in the Specifications.

D. The County will arrange for the Contractor to have access to one set of reproducible Drawings. The Contractor may at his expense, reproduce the Drawings and Specifications as needed. All Drawings and Specifications and copies thereof are the property of the Owner. They are not to be used on other projects.

E. For convenience, the Specifications may be arranged in sections and the Drawings may be arranged by system or otherwise. Such separation shall not be

considered as the limit of Work required of any separate trade. The terms and conditions of such limitations are wholly between the Contractor and his Subcontractors.

F. In general, the Drawings will indicate dimensions, position, quantity and type of construction; and the Specifications will indicate quality and method. Work indicated in one but not the other shall be furnished as though fully set forth in both. Work not specifically marked, specified, or detailed shall be the same as similar work that is marked, specified, or detailed.

G. The Project Manual is a collection of documents assembled for the convenience of the parties and usually includes, but is not limited to, the Notice to Contractors, Instructions to Bidders, General Conditions, Supplementary General Conditions, Special Provisions, Bid Documents, Agreement, and Specifications.

1.3 ERROR IN THE DOCUMENTS

A. Should an error or conflict appear in the Contract Documents, or a conflict with the documents and actual conditions, the Contractor shall notify the Owner, Owner's Representative, and Architect at once, and the Architect will provide a response and/or issue instructions. If the Contractor proceeds with the work without a written response/instructions, he shall make good any resulting unacceptable work or consequences.

B. Whenever the documents could be construed to be ambiguous or conflicting at the time of Bid, the Contractor is deemed to have included the cost of the more expensive material, method, or requirement in the Contract Amount.

C. Figured dimensions shall govern over scaling and large scale details shall govern over smaller scale details.

1.4 SEPARATE CONTRACTS

A. The Owner reserves the right to let other contracts in connection with this Project. Contractor shall afford other County contractor(s) reasonable opportunity for the introduction and storage of their materials and the execution of their work and shall properly connect and coordinate his work with theirs as required by the Owner.

B. If any part of Contractor's Work depends for proper execution or results upon the work of another contractor, the Contractor shall inspect and measure the work of other contractor and promptly report to the Owner all defects or discrepancies that render it unsuitable for such proper execution or results. Contractor's action of proceeding with his work shall constitute his acceptance of the prior work as fit and proper for the reception of his work.

C. The Contractor and its respective Subcontractors shall repair any damage he may do to another County contractor's work to the Owner's satisfaction.

1.5 CONTRACT TERMINATIONS

A. Owner's Right to Terminate Contract for Cause

If Contractor should be adjudged as bankrupt, or if he should make a general assignment for the benefit of his creditors, or if a receiver by the Surety should be appointed on account of his insolvency, or if he should fail to supply enough properly skilled workmen or materials to maintain the schedule, or if he should fail to diligently and expeditiously prosecute the Work, or if he should fail to commence the Work on the Project site per the Owner's Notice to Proceed, or if he should fail to make prompt payments to Subcontractors or for materials or labor, or persistently disregard laws, ordinances or the instructions of the Owner or Architect, or otherwise breach any provision of the Contract between the Contractor and Owner, the Owner may without prejudice to any right or remedy the Owner may have and after giving the Contractor seven (7) calendar days written notice, terminate the Contract or terminate the Contractor's right to proceed with the Work and take possession of the premises and of all materials, tools and equipment thereon and finish the Work by whatever method the Owner may deem expedient. In such case, Contractor shall not be entitled to receive any further payment until the Work is finished. If the unpaid balance of the Contract Amount shall not exceed the expense of finishing the Work, including compensation for additional managerial and administrative services, such excess amount of the Contract shall be paid to the Contractor. If such expense shall exceed such unpaid balance, the Contractor shall pay the difference to the Owner.

B. Owner's Right to Terminate Contract for Convenience

The Owner reserves the right to terminate this contract at any time. Contractor shall be compensated on the basis of the reasonable value of the portion of Work completed as prorated against the Contract Amount or shown as a separate price and the cost incurred for portions of the Work performed but not completed. The total payments to contractor shall not exceed the Contract Amount.

C. Contractor's Right to Terminate Contract

Except as provided by paragraph 1.5.D Emergency Termination, if the Work should be stopped by the Owner, or an order of the court, or other public authority for a period of six months, through no act or fault of the Contractor or of anyone employed by him, then the Contractor may, upon twenty-one (21) days written notice to the Owner, terminate this Contract and recover from the Owner the amount owed under the Contract for the portion of Work, if any, which was completed.

D. Emergency Termination

This Contract is subject to termination as provided by Section 4410 and 4411 of the Public Contracts Code of the State of California, being portions of the Emergency Termination of Public Contracts Act of 1949. Said Sections read as follows:

> "Sec. 4410. TERMINATION OF CONTRACT FOR PUBLIC WORK IN EVENT OF NATIONAL EMERGENCY. In the event a national emergency occurs, and public work, being performed by Contract, is stopped, directly or indirectly, because of the freezing or diversion of materials, equipment, or labor, as the result of an order or of a proclamation of the President of the United States, or of an order of any federal authority, and the circumstances or conditions are such that it is impracticable within a reasonable time to proceed with a substantial portion of the Work, then the public agency and the Contractor may, by written agreement, terminate said Contract."
>
> "Sec. 4411. INCLUSION OF TERMS AND CONDITIONS OF TERMINATION OF CONTRACT IN AGREEMENT: COMPENSATION TO CONTRACTOR. Such an agreement shall include the terms and conditions of the termination of the Contract and provision for the payment of compensation or money, if any, which either party shall pay to the other or any other person, under the facts and circumstances in the case."
>
> "Compensation to the Contractor shall be determined on the basis of the reasonable value of the Work done, including preparatory Work. As an exception to the foregoing, in the case of any fully completed separate item or portion of the work for which there is a separate Contract price, the Contract price shall control. The parties may in any other case adopt the Contract price as the reasonable value of the Work or any portions thereof."

1.6 ALLOWANCES

A. The Contractor shall include in the Contract Amount all allowances stated in the Contract Documents. Items or services covered by these allowances shall be supplied as the Owner may direct.

B. Allowances for material and equipment shall cover the cost to the Contractor, less any applicable trade discount, delivered at the site, and all applicable taxes. The Contractor's costs for unloading and handling on the site, labor, installation costs, overhead, profit and other expenses required to complete the Work shall be included in the Contract Amount and not in the allowance.

C. Whenever the cost of the material, equipment or service is more than or less than the allowance, the Contract Amount shall be adjusted by the procedure in Section 2, Contract Modifications.

1.7 DISPUTES

Should any dispute including breach, arise out of or relate to this Contract the Contractor shall continue to perform the Work in accordance with the Contract Documents and the Owner and Contractor agree to pursue resolution of the disagreement by whatever means available. Neither a dispute resolution process, the resolution, nor lack of resolution shall delay, hinder, or alter the completion of the Work in accordance with the undisputed portion of the Contract Documents and in accordance with the Owner's direction to Contractor regarding disputed portions of the Contract.

1.8 SEVERABILITY

In the event that any provision or any part of a provision of this Contract shall be finally determined to be superseded, invalid, illegal or otherwise unenforceable pursuant to applicable laws by an authority having jurisdiction, such determination shall not impair or otherwise affect the validity, legality, or enforceability of the remaining provisions or parts of provisions of this Contract, which shall remain in full force and effect as if the unenforceable provision or part were deleted.

1.9 HEADINGS

The headings of any section or provision of this Contract are for convenience only and shall not be deemed to limit, restrict or alter the content, meaning or effect thereof.

2 CONTRACT MODIFICATIONS

2.1 MODIFICATION DOCUMENTS

A. The Owner, without invalidating the Contract and without consent of surety, may accomplish changes in the Work within the general scope of the Contract consisting of additions, deletions, additional instructions, or other revisions, to the Contract Documents, and where applicable, the Contract Amount and/or the Contract Time being equitably adjusted accordingly. All such changes in the Work may be accomplished by Owner's Instructions, Architect's Supplemental Instructions, a Construction Change Directive, a Change Order (including a Unilateral Change Order), as may be applicable in accordance with the provisions of the Contract. The Contract Amount and/or the Contract Time may be changed only by a Change Order. Contractor agrees to promptly proceed with changes in the Work according to the respective form of documentation issued. All changes

to the Work and all Contractor requests for additional compensation shall be resolved in accordance with this Section 2, Contract Modifications.

B. A Change Order is a written order from the Owner ordering a change in the Work. Upon receipt of a Change Order, the Contractor shall promptly proceed with the Work as changed. The Contractor will not delay the Work for any reason. Within ten (10) working days after receiving a Change Order and prior to or simultaneously with proceeding with the change in the Work, Contractor shall advise the Owner and Architect of Contractor's inability to proceed with the Work, and shall state in writing. Proceeding with the Work as changed without submitting a notice to Owner or Owner's Representative indicates Contractor's full acceptance of the Change Order including the Contract Amount and/or Contract Time.

C. The signature of the Owner and Contractor on the Change Order indicates their final and conclusive acceptance of the stated terms and provisions as full compensation for the change to the Work. In the event the Owner and Contractor do not agree upon an adjustment to the Contract Amount and/or Contract Time resulting in a Change Order, the Owner may issue a Unilateral Change Order. A Unilateral Change Order is signed by the Owner and issued to the Contractor authorizing an adjustment in the Contract Amount and/or Contract Time as the Owner deems equitable. A Unilateral Change Order does not require the Contractor's signature, but may be signed by the Contractor and returned to the Owner.

D. If Contractor is in disagreement with the terms or provisions of a Unilateral Change Order, the Contractor shall give the Owner and Architect written notice of his disagreement, the basis thereof, and supporting documentation within ten (10) working days of receiving the Unilateral Change Order. Such notice of disagreement does not excuse performance by the Contractor of all obligations under the Contract Documents and the Contractor shall proceed with the Work including the Work involved with the disagreement. Failure to present such notice of disagreement constitutes a waiver by the Contractor of any entitlement to additional cost or time, or subsequent claim.

E. The Owner and Architect have the authority to issue Owner's instructions or Architect's Supplemental Instructions respectively to the Contractor which may require minor changes in the Work not involving an adjustment in the Contract Amount or an extension of Contract Time. If Contractor believes an adjustment of Contract Amount or Contract Time is justified, Contractor shall not incur additional cost or delay and notify the Owner or Architect in writing within 24 hours of upon receipt.

F. A Construction Change Directive is a written document signed by the Owner and issued to the Contractor to perform as specified. The Contractor shall immediately

comply with and perform to the Construction Change Directive. If the Contractor believes an adjustment of Contract Amount or Contract Time is justified, a request may be submitted in accordance with Section 2.4, Contractor Claims. If the Owner concurs with the Contractor a Change Order will be issued.

2.2 VERBAL INSTRUCTIONS

Contractors shall not act or rely upon verbal instructions. If a verbal instruction is provided on site to the Contractor, Contractor shall document such verbal instruction through a confirming RFI. No work will be accepted by the Owner that differs from the Contract Documents as modified in writing.

2.3 METHOD OF DETERMINING ADJUSTMENT

A. An adjustment to the Contract Amount or Contract Time pursuant to a Change Order resulting from a Construction Change Directive, Claim, or other provision herein shall be determined in one or more of the following ways at the Owners discretion.

1 By negotiation based upon Contractor's estimate. The estimate shall include quantities of materials and man hours, and a breakdown of cost showing labor, materials, profit, overhead, and all other items of cost. Labor rates for Change Orders shall be agreed upon between the Owner and the Contractor withing thirty (30) calendar days of Contract Award date General requirements, labor burden, project supervision, project management and facilities are not allowed. Overhead and profit shall not exceed the percentages specified in the Contract Documents.

2. By unit prices stated in the Contract or subsequently agreed upon.

3. By acceptance of a lump sum price proposal of Subcontractor to Contractor.

4. By determination of the Owner and issued unilaterally by a Unilateral Change Order.

B. If the adjustment is not determined by the above methods prior to the Contractor starting Work pursuant to the Change Order, , Contractor shall proceed with the Work and keep daily accurate records of the labor hours, materials, and other items of cost used in the performance of the changed Work. Copies of the records shall be given to the Owner or Owner's Representative daily. Contractor shall present at such time and in such form as Owner may prescribe, an itemized accounting together with appropriate supporting data as may be required by Owner to fully substantiate the cost of the changed Work. Owner shall consider such accounting in its determination of equitable adjustment. Overhead and profit

shall not exceed the percentages specified in the Contract Documents.

C. Extension of Contract Time will be granted only to the extent that the time required to complete the Work as changed or delayed extends the schedule critical path beyond the contract completion date. If changes or delays do not extend the critical path of the schedule beyond the contract completion date, there will be no contractor entitlement to extended or additional home office expenses. Float, as used in this agreement, is the sum of the amount of time available to a task before the task becomes critical and the amount of time between the scheduled completion date and the contract completion date. Float may be used in the order needed by either the Owner or the Contractor.

2.4 CONTRACTOR CLAIMS AND DISPUTES

A. If the Contractor wishes to request an adjustment in the Contract Amount or Contact Time, other than pursuant to a Change Order or Construction Change Directive, Contractor shall give the Owner and Architect a written Notice of Claim.

B. Contractor shall file with the Owner any written Claim, including the documents necessary to substantiate it, on or before Substantial Completion, but no later than the day of Contractor's submittal of final payment on the Contract.

C. The Notice of Claim shall be given by the Contractor to the Owner before conditions occur which are the basis for the Claim, except in an emergency endangering life or property in which case the Contractor should proceed in accordance with Section 6.7, Emergencies. Failure to present such Notice of Claim constitutes a waiver of such Claim.

D. Notices for claims or disputes are valid only if written and shall be a document issued for the sole purpose of notification and titled clearly "Notice of (specify category i.e., delay) Claim." A separate written notice is required for each subject and issue.

E. Written notice shall be deemed to have been duly served if delivered in person to the individual to whom it is addressed, or if sent by certified mail to the address specified in the Contract Documents as may be revised in writing.

F. The Contractor shall continue to perform its Work under the Contract and shall not cause a delay in the Work during any dispute, claims definition, negotiation, mediation, or arbitration proceeding, except by written agreement by the Owner.

G. The adjustment to the Contract Amount or Contract Time, if any, as the result of a settled claim, shall be determined and issued in accordance with this Section 2, Contract Modifications.

H. All procedures for Claims and Disputes resolution shall be duly processed pursuant to the California Public Contract Code, Division 2, Part 1, Chapter 9 Sections 9201 – 9204.

I. The attention of the Contractor is drawn to Government Code Section 12650, et seq. regarding penalties for false claims.

2.5 DELAYS BEYOND CONTRACTOR'S CONTROL

A. If the Contractor is delayed at any time in the progress of the Work by acts or neglect of the Owner or by any separate contractor employed by Owner, or by labor disputes, fire, unusual delays in transportation, unusually adverse weather conditions, unavoidable casualties or by any other unforeseeable cause of delay beyond the Contractor's control, which the Owner decides justifies the delay, then the Contract Time may be extended for such reasonable time as the Owner in his discretion may decide. Contractor's Claim for extension of Contract Time shall be made in writing to the Owner in accordance with Section 2.4, Contractor Claims. Only one Claim is necessary in the case of continuing delay.

B. Unusually adverse weather conditions for the purposes of this Project are agreed to be work days lost from weather or the effects of weather greater than the number of lost days specified in Section 7.5, Schedule.

2.6 HIDDEN CONDITIONS

Should concealed or unknown conditions be encountered in the performance of the Work below the surface of the ground or in an existing structure be at variance with the conditions indicated by the Contract Documents, or differ materially from those ordinarily encountered and generally recognized as inherent in work of the character provided for in this Contract, the Contract Amount and/or Contract Time shall be equitable adjusted as provided herein upon Claim by Owner or Contractor. Contractor Claims shall be in accordance with Section 2.4, Contractor Claims.

2.7 HAZARDOUS MATERIALS

Asbestos or other hazardous material may be present in County buildings or on County property. Asbestos is typically in the form of pipe lagging, fire proofing, floor tiles, mastic, and plaster. Soil may be contaminated by petroleum products or other substances. In the event any suspected asbestos or other hazardous material is encountered during construction that may be disturbed by the Work, the Contractor shall stop immediately and notify the County. The Contractor and all Subcontractors shall instruct their employees of the type and location of the most likely forms of hazardous material to be encountered and of the procedure to be taken if encountered. Contractor will be responsible for the mitigation and

abatement of the hazardous material upon authorization of Owner. All Claims for adjustment in time or money shall be processed in accordance with Section 2.6, Hidden Conditions.

2.8 OVERHEAD AND PROFIT

A. Adjustments to the Contract Amount due to changes in the Work or any other reason, shall include overhead and profit as follows:

1. Contractor's overhead and profit on the direct cost of Work (labor, material, and equipment) performed by his forces and all Subcontractors shall be a total sum not exceeding twenty percent (20%) in aggregate of such costs.

2. Contractor's overhead and profit on the direct cost of Work (labor, material, and equipment) performed by Subcontractors shall be a total sum not exceeding ten percent (10%).

3. Subcontractor's overhead and profit on the direct cost of the Work (labor, material, and equipment) performed by Subcontractor shall be a total amount not exceeding fifteen percent (15%). Subcontractor overhead and profit will be allowed for one tier only.

4. Bonds and Insurance shall not exceed one percent (1%) of the sum of the direct cost of the work, the Subcontractor's overhead and profit, and the Contractor's overhead and profit.

5. Changes to the Work ordered by the Architect or Owner which decrease the Contract Amount shall include overhead and profit in accordance with the above provisions. Value engineering revisions initiated by the Contractor and accepted by Owner which decrease the Contract Amount shall be at cost only.

6. The "direct cost of the Work" is considered to be the cost of labor, material, and equipment incorporated into the construction. Supervision and administration of the work, changes, or claims shall not be included in direct cost.

2.9 MAINTAIN RECORDS

Contractor and Subcontractor shall maintain records, in accordance with generally accepted accounting principles, relating to costs of changes to the Work or Claims for 4 years after the final completion. The Owner will have the right to audit these records at any time up to 4 years after completion of the Project and recover from the Contractor or Subcontractor any amount paid but not substantiated by audit.

2.10 PROPOSAL REQUESTS

Contractor is required to provide preliminary estimates using their best judgment of time and cost impact of potential changes to the Project as requested by the Architect and/or Owner. Estimates shall be provided to the Architect and Owner within 10 working days of receiving the Proposal Request. Contractor will be responsible for any cost increase or schedule impact resulting from Contractor's failure to respond within the allowed time.

3 CONTRACTOR

3.1 DEFINITIONS

A. The term Contractor, as used herein, is the person or organization identified as such in the Agreement, and is referred to as if singular and masculine and includes his authorized representatives.

B. The term Subcontractor, as used herein, includes only those persons or organizations having a direct Contract with the Contractor to perform a portion of Contractor's Work.

3.2 GENERAL

A. Contractor agrees to perform all Work required by the Contract Documents.

B. All Work shall be done in accordance with the best practices of the various trades and/or suppliers and highest industry standards.

C. The Contractor shall keep on the Project site during the progress of the Work a competent superintendent satisfactory to the Owner. The Superintendent shall not be changed except with the consent of the Owner. The Superintendent shall represent the Contractor and all directions given to him shall be as binding as if given to the Contractor.

D. It is the Contractor's responsibility to diligently prosecute the Work, using his best skills and attention, and the most appropriate techniques and equipment that are required to provide a finished product in compliance with the Contract requirements. Contractor shall insure that no Work is done that does not comply with the Contract Documents.

E. The Contractor shall attend a preconstruction meeting, weekly progress meetings and other meetings as necessary to accomplish the Work and administer the provisions of the Contract.

F. Contractor shall submit to Owner a daily record of Contractor's activity. Such

record shall be delivered to Owner's Representative daily for previous day's activity and shall include Project name, date, weather, names of Subcontractors, count of personnel by company, material deliveries, description and location of activity and events. The record of daily activity shall not be used as a Notice to Owner.

3.3 SUBCONTRACTS

A. The Contractor shall not be permitted to substitute any person or organization for any Subcontractor, person or organization listed by him in his bid without the prior, written consent of the Owner, as provided for in the California Public Contract Code, Division 2, Part 1, Chapter 4, Section 4017.

B. In addition to the information required in Division 00 Bidding Documents regarding Subcontractors, the Contractor, after execution of the Contract but prior to execution of a subcontract, shall submit the following information on each Subcontractor: name, address, and nature of Subcontractor's work, Subcontract Amount, and all other information the Owner deems relevant. The Contractor shall not Contract with any such proposed Subcontractor or entity to whom the Owner objects.

C. Contractor shall bind every Subcontractor and every Subcontractor agrees to be bound by the terms of the Contract Documents insofar as applicable to their portions of the Work. The Contractor shall be responsible for the acts and omissions of Subcontractors.

D. Contractor agrees to pay to each Subcontractor promptly upon receiving payment from Owner.

E. Neither the acceptance of the Subcontractor nor any other act of the Owner, nor anything contained in any contract document is to be construed as creating any contractual relation between the Owner and any Subcontractor.

3.4 PERSONNEL AND LABOR POLICY

A. Contractor shall at all times enforce strict discipline and good order among his employees and shall not employ any unfit person or anyone not skilled in the work assigned to them. The Contractor shall be responsible to the Owner for the acts and omissions of its employees and other persons performing work for the Contractor.

B. No person shall be excluded from participation in, denied benefits of, or be subject to discrimination under this Contract on the basis of their race, color, religion, national origin, age, sex, sexual orientation, pregnancy, childbirth or related conditions, medical condition, mental or physical ability, or veteran's status.

Contractor shall ensure full compliance with federal, state and local laws, directives and executive orders regarding non-discrimination for all employees and subcontractors under this Contract.

Violation of the non-discrimination provisions of this Contract shall be considered a breach of this Contract and subject the Contractor to penalties, to be determined by the County Manager, including but not limited to: i) termination of this Contract; ii) disqualification of the Contractor from bidding on or being awarded a County contract for a period of up to 5 years; iii) liquidated damages of $2,500 per violation; iv) imposition of other appropriate contractual and civil remedies and sanctions, as determined by the County Manager.

To effectuate the provisions of this paragraph, the County Manager shall have the authority to: i) examine Contractor's employment records with respect to compliance with this paragraph; ii) set off all or any portion of the amount described in this paragraph against amounts due to Contractor under the Contract or any other Contract between Contractor and County.

Contractor shall report to the County Manager the filing by any person in any court of any complaint of discrimination or the filing by any person of any and all charges with the Equal Employment Opportunity Commission, the Fair Employment Housing Commission or any other entity charged with the investigation of allegations within 30 calendar days of such filing, provided that within such 30 calendar days such entity has not notified Contractor that such charges are dismissed or otherwise unfounded. Such notification shall include the name of the complainant, a copy of such complaint and a description of the circumstance. Contractor shall provide County with a copy of its response to the complaint when filed.

For contracts over $5,000, with respect to the provision of employee benefits, Contractor shall comply with the County Ordinance which prohibits contractors from discriminating in the provision of employee benefits between an employee with a domestic partner and an employee with a spouse. See Document 00 7373 Supplemental Conditions, Equal Benefits Compliance Ordinance No. 4324, Chapter 2.84.

C. Contractor shall ensure equal employment opportunity based on objective standards of recruitment, selection, promotion, classification, compensation, performance evaluations, and management relations, for all employees working on the Project. Contractor’s affirmative action policies shall be made available to Owner upon request. See Document 00 45 36.01 Equal Opportunity Requirements, Certification of Compliance with Laws Prohibiting Discrimination.

D. It is the policy of the Owner that Contractors on public Projects employ their workers from the local labor market whenever possible. Consistent with that

policy, the Contractor is requested to employ his workers from the local labor market. Local labor market within the meaning of this section is defined as the labor market within the geographical confines of the County of San Mateo, State of California.

E. The Contractor shall forfeit, , as per the San Mateo County Office of Labor Standards and Enforcement (OLSE) and/or the State of California Department of Industrial Relations (DIR) penalties for each laborer, workman, or mechanic employed in the execution of the Contract by Contractor, or by any Subcontractor under Contractor, upon any of the Work performed for the Contract, for each calendar day during which said laborer, workman, or mechanic is required or permitted to labor more than eight (8) hours in violation of the provisions of the California Labor Code, Division 2, Part 7, Chapter 1, Article 3, Section 1810.

F. Apprenticeship Program: Contractor shall comply with the provision of California Labor Code, Division 2, Part 7, Chapter 1, Article 2, Section 1777.5.

G. The Contractor shall comply with the provisions of the California Labor Code, Division 2, Part 7, Chapter 1, Article 2, Section 1776, and the regulations implementing it in Title 8of the California Administrative Code. The Contractor shall be responsible for compliance by his Subcontractors. A certified copy of all weekly payroll records shall be furnished upon request of the Owner, the Division of Labor Standards Enforcement, or the Division of Apprenticeship Standards of the Department of Industrial Relations.

H. Payrolls shall contain the full name, address, and social security number of each employee, his correct classification, rate of pay, daily and weekly number of hours worked, itemized deductions made and actual wages paid. They shall also indicate apprentices and ratio of apprentices to journeymen.

I. The penalties specified in Subdivision (h) of Labor Code Section 1776 for noncompliance with the provisions of Section 1776 may be deducted by the County from any moneys due or which may become due to the Contractor.

4 OWNER

4.1 DEFINITION

The Owner is the person or organization identified as such in the Agreement and is referred to as if singular in number and masculine in gender and includes his authorized representatives. The Owner may be the County of San Mateo, sometimes referred to as "The County".

4.2 GENERAL

A. The Owner may furnish information after the bid date and not included in the Contract Documents in the form of drawings, reports, survey data, utility locations, plans of existing facilities and such other information. This information is not part of the Contract Documents.

B. The Owner shall receive copies of all correspondence, notices, approved shop drawings, test reports and such material pertinent to the Contract. The Owner shall have access to the Work at all times.

4.3 THE DIRECTOR OF PUBLIC WORKS

The Director of Public Works for the County of San Mateo or his duly appointed representative is the duly appointed agent for the Owner and as such is empowered to act for the Owner in all matters as stated in the Contract Documents or as provided by law.

4.4 OWNER'S CONSTRUCTION MANAGER

A. The Owner may engage a Construction Manager as an Owner's Representative for the Project. The Owner's Construction Manager shall receive copies of all communications regarding the Project, have full access to the Work, and be kept informed of all actions taken by the Contractor.

B. The Owner's Construction Manager shall not interpret the plans, coordinate the Work, order changes in the Work, supervise the workmen, or perform any duty which is the responsibility of the Architect or the Contractor.

5 ARCHITECT

5.1 DEFINITION

For the purpose of this Contract, the Architect is identified in the Project Manual. The term "Architect" is the individual, partnership, corporation, joint venture, or any combination thereof, who will have the rights and authority assigned to the Architect in the Construction Documents. The Term Architect means the County's Architect on this Project or the Architect's authorized representatives and consultants. Nothing contained in the Contract Documents shall create any contractual relationship between the Architect and the Contractor.

5.2 GENERAL

A. The Architect and the Construction Manager will provide general administration of the Contract between Owner and Contractor.

B. The Architect will have authority to act on behalf of the Owner to the extent pro-

vided in the Contract Documents. The Owner's instructions to the Contractor may be issued through the Architect.

C. The Architect shall at all times have access to the Work. The Contractor shall provide facilities for such access so the Architect may perform his functions under the Contract Documents. The Architect will make periodic visits to the site to familiarize himself with the progress and quality of the work and to determine if the work is proceeding in accordance with the Contract Documents. Architect will endeavor to guard the Owner against defects and deficiencies in the Work.

D. The Architect will be the interpreter of the requirements of the Contract Documents and the judge of the Contractor’s performance thereunder. The Architect will, within ten (10) working days, render interpretations or answers to questions submitted by Contractor. All interpretations and decisions of the Architect shall be consistent with the intent of the Contract Documents. In Architect’s capacity as interpreter and judge he will exercise his best efforts to insure faithful performance by all parties of the Contract. The Architect's decision in matters relating to esthetic effect will be final.

E. The Architect will review submittals, samples, adjustments to the Contract, applications for payment, written guarantees, operation and maintenance manual and other documents required by the Contract.

6 PERFORMANCE OF THE WORK

6.1 DEFINITION

A. The term “Work” as used herein is all of the Contractors obligations under the Contract including, but not limited, to providing all labor, material, equipment and services indicated by the Contract Documents, as-built drawings, punchlist, inspections and approvals required or necessary for occupancy, and guarantees.

B. The term “Project” is the total construction planned or contemplated by the Owner of which the Work may be the whole or a part. The Owner may perform or contract for other work on the Project site during the progress of the Work.

6.2 GENERAL

A. The Contractor shall provide, maintain and remove upon completion of the Work, all tools, machinery, equipment, temporary rigging, scaffolding, hoisting equipment, rubbish chutes, barricades around openings and excavation, ladders between floors, fences around buildings, and all other items as required for safe completion of the Work, whether specifically designated or not and shall conform to all requirements in regard to operation, safety, and fire hazards of State and local authorities and of underwriters.

B. Deliver all materials and equipment in the manufacturer's original sealed, labeled containers and protect items against moisture, rust, dust, tampering, or damage.

C. Place all materials and equipment orders in time to avoid job delay or hindrance. Schedule deliveries to coincide with the construction schedule so that materials and equipment are promptly installed upon delivery.

D. Except as specifically noted otherwise, the installation and/or maintenance directions provided by the manufacturer shall be followed for all materials and equipment.

E. All materials and equipment shall be new, unless specifically marked otherwise.

F. All materials and equipment not conforming to the Contract Documents shall be rejected and shall be immediately removed from the site of the Work.

G. All utilities and services required by the Contractor including electrical power, water, temporary telephones, temporary sanitary facilities, and temporary heat as required for the proper installation of materials and the completion of the Work shall be provided by Contractor.

H. Shut down of utilities for any reason or duration shall be subject to approval by the Owner. The Owner requires a minimum 48 hour advance notice for a utility shut down. When shut-downs of 30 minutes or more are required, the Contractor shall provide alternate service for normal occupancy requirements. Utility shut-downs shall be scheduled during non-business hours.

I. Prior to ordering materials, the Contractor shall verify all measurements, material handling pathway and logistical dimensions at the site and shall be held responsible for their accuracy. No extra compensation will be allowed for differences between actual measurements and the dimensions shown on the Drawings.

J. Fences, office facilities, enclosures, storage sheds, etc., required by the Contractor in the performance of the Work shall be located where approved by the Owner.

K. The Contractor shall confine operations at the site to areas permitted by law, ordinances, permits and the Contract Documents and shall not unreasonably encumber the site with any materials or equipment.

L. During the progress of the Work, Contractor shall keep the premises orderly and safe and free from accumulation of waste materials and rubbish.

M. At the completion of the Work, Contractor shall remove all waste, surplus materials, and rubbish and shall clean all surfaces, removing all extraneous paint, mortar, dust, and stains, leaving the Work bright, clean and polished.

N. The project is not exempt from any Federal, State or local taxes.

O. Royalty and License Fees incidental to the use of any patented material, device or process shall be paid by the Contractor and in the event of a Claim of alleged infringement of patent rights, the Contractor shall save the Owner free and harmless from loss on account thereof; and also defend, at his own expense, all suits that may be brought in such connection.

P. Contractor shall continuously maintain adequate protection of all Work and shall protect the Owner's property from damage or loss arising in connection with this Contract.

Q. Precaution shall be exercised at all times for the protection of persons (including Contractor's and Owner's employees) and property. The safety provisions of applicable laws, building and construction codes shall be observed. Machinery, equipment and all hazards shall be guarded or eliminated in accordance with the safety provisions of the latest safety orders of the State of California: California Code of Regulations, Title 8, Construction Safety Orders (see Department of Industrial Relations at: https://dir.ca.gov), the California Occupational Safety and Health Administration (CAL/OSHA) Safety Orders (at https://dir.ca.gov/dosh/), and CAL/OSHA and Statewide Industry Guidance on COVID-19 (at https://dir.ca.gov/dosh/coronavirus/Health-Care-General-Industry.html).

R. All materials and workmanship shall be subject to inspection, examination, test, and acceptance by the Owner at all times during manufacture and construction and at all places where such manufacture and construction occurs.

6.3 EXISTING CONDITIONS

A. The Contractor by executing the Contract represents that he has visited the site and familiarized himself with the local conditions under which the Work is to be performed and has correlated his site observations with the requirements of the Contract Documents.

B. The contractor shall carefully study and compare the Contract Documents and existing conditions and dimensions and the connection of the Work to existing conditions and shall report to the Architect any error, conflict, inconsistency, omission, or any variance with laws, ordinances, codes, rules or regulations bearing on the Work. Contractor shall report such conditions to the Architect in writing at such time as to allow at least ten (10) working days for a response with no delay to the Work. All necessary changes shall be accomplished in

accordance with Section 2, Contract Modifications.

6.4 ADJACENT FACILITIES

A. The Contractor shall provide adequate protection for all parts of the Project site, and adjacent property, its improvements and its occupants throughout the Work. All damage done to existing property shall be repaired or replaced at the Contractor's expense and determined to be acceptable by the Architect and Owner.

B. Work shall be executed in careful, orderly manner, with the least possible disturbance to public and occupants of the area.

C. The Owner will continue to use adjacent areas of the facilities. Contractor shall take care to disrupt the Owner as little as possible. Contractor shall provide legal and safe access to all facilities at all times. In order to facilitate use of adjacent facilities Owner may order Contractor to alter or temporarily cease operations.

6.5 PERMITS

A. It shall be the responsibility of the Owner to obtain and pay for all permits, licenses, certificates, approvals, utility connections and services necessary for the proper execution and completion of the Work.

B. All fees which are for temporary approvals or services, such as those which are necessary for construction procedures, shall be paid by the Contractor.

C. In the event the Special Provisions require the Owner to pay any fee, the Contractor shall notify the Owner in writing, twenty (20) working days in advance of a required fee payment.

D. It is the policy of the County to cooperate with State, County and City officials in regard to the construction of this Project, and it is the responsibility of the Contractor and all his Subcontractors to meet the requirements of government officials having responsibility for inspecting or observing construction by taking out permits for the Work, calling for inspections and adhering to safety practices in accordance with standard practice. In the case of conflict of any of these provisions, the Owner shall be notified. The term Inspector means a Public Building Construction Inspector or an individual performing the inspection as required by building codes or jurisdiction.

6.6 LAWS

A. The Contractor shall give all notices and comply with all laws, ordinances, rules and regulations bearing on the conduct of the Work. If the Contractor performs

any Work contrary to such laws, ordinances, rules and regulations, he shall bear all costs and delays arising therefrom.

B. Owner and Contractor have all rights provided by law not specifically waived by this Contract.

6.7 EMERGENCIES

A. In an emergency affecting the safety of life, the Work, or property, the Contractor, without special instruction or authorization from the Owner, is hereby permitted to act, at his discretion, to prevent such threatened loss or injury; he shall so act without appeal if so instructed or authorized. Any compensation, claimed by the Contractor on account of emergency work, beyond Contractor's contractual obligations, shall be determined by agreement. The Contractor shall immediately notify the Owner in writing.

B. In an emergency affecting the safety of life, the Work, or property or if an unsafe condition exists, the Owner may, but is not obligated, take measures to mitigate the condition. Such measures may include expending labor or material, engaging other contractors, entering the Project site utilizing materials, equipment, or facilities of Contractor. The Owner's actions may be performed immediately and without notice to Contractor. Contractor shall pay Owner for all costs which are attributable to Contractor.

6.8 SUBMITTALS

A. Submittals include, but are not limited to shop drawings, product data, maintenance information, samples, manufactures instructions, certifications, and similar documents or items which demonstrate the way the Contractor proposes to perform the Work to the information in the Contract Documents. Contractor shall review the entire Contract Documents for other provisions relating to submittals and individual submittal requirements, if any.

B. The Contractor shall review, stamp with his approval and submit to the Architect in orderly sequence so as to cause no delay in his Work or in the work of any other contractor, all submittals required by the Contract. Submittals shall be properly identified with specification section. At the time of submission, the Contractor shall note in writing any deviation in the submittals from the requirements of the Contract Documents. By approving and submitting shop drawings and samples, the Contractor thereby represents that he has determined and verified all field measurements, field construction criteria, materials, catalogue numbers and similar data, and that he has checked and coordinated each shop drawing and sample with the requirements of the Work and of the Contract Documents.

C. The Architect will review submittals for conformance with the designed concept

and with the information given in the Contract Documents. A minimum of 10 working days is required for each submittal review. The Architect's review will not relieve the Contractor of responsibility for complying with the Contract Documents. If a submittal is required to be resubmitted, the time and cost of resubmission is the responsibility of the Contractor.

6.9 SUBSTITUTIONS

A. The intent of the Specifications is to specify high grade equipment and materials appropriate for the Project. It is not the intent of the Specifications to exclude or limit the products of any responsible manufacturer, except when the Owner has adopted a specific system or product which will be noted, "No Substitutions Allowed", or similar language. Where equipment, material, or process is specified by trade name or by patentee, manufacturer or dealer, it shall mean the specified item or product. No substitution shall be made by the Contractor without written approval of the Architect. The Architect shall be the sole judge of a Contractor proposed substitution. See Division 01 for Substitution requirements. The Architect's refusal to approve a substitution shall not effect the progress of the Work and is not grounds for a Claim against the Owner.

B. The Contractor shall pay a $200, lump sum, for the Architect's time to review substitution requests. Payment is to be included with the substitution request package.

6.10 CORRECTING WORK

A. The Contractor shall promptly correct all Work rejected by the Owner or Architect, whether observed before or after the Notice of Completion and whether or not fabricated, installed or completed. The Contractor shall not receive a time extension for correcting such rejected Work. All such defective or non-conforming Work shall be corrected to comply with the Contract Documents without cost to the Owner. The Contractor shall bear the cost of making good all Work of separate contractors which may be destroyed or damaged by such removal or correction.

B. If any Work should be covered before it is inspected, the Contractor at his expense, must uncover the Work for inspection and then replace the Work.

C. If the Contractor defaults or neglects to carry out the Work in accordance with the Contract Documents, or fails to perform any provisions of the Contract Documents, the Owner may, after seven (7) working days written notice to the Contractor and without prejudice to any other remedy Owner may have, and without Contract termination or ordering the Contractor to stop Work make good such deficiencies in any manner the Owner deems expedient. In such case an adjustment to the Contract shall be made in accordance with Section 2, Contract Modifications, deducting from the payment then or thereafter due the Contractor, the cost of

correcting such deficiencies, including the cost of additional services made necessary by such default, neglect or failure.

D. If the Owner deems it not expedient to correct Work damaged or not done in accordance with the Contract Documents, a deduction from the Contract price shall be made.

E. If the Contractor fails to correct defective Work or fails to supply materials or equipment in accordance with the Contract Documents, the Owner may order the Contractor to stop the Work or any portion thereof until the cause of such order for the Work has been eliminated. Contractor shall not receive a time extension or compensation as a result of stopping Work as required by this provision.

6.11 TESTING

A. The Owner will provide for testing of materials or workmanship as required by these Specifications. The Contractor shall coordinate and schedule tests directly with the testing firm. The costs of tests on materials at the Project site will be borne by the Owner, except for retesting, as specified below, the material required for testing, and the Contractor's labor required to facilitate the test or delayed by the test, which the Contractor shall furnish. The Contractor will cooperate with the Owner's testing representative in the taking of test Samples. The Contractor shall pay for all tests which are not performed at the job site.

B. Required tests are specified elsewhere in the Specifications.

C. Should the results of any required tests fail to meet the requirements of the Contract Documents, Contractor shall either correct the unacceptable condition or furnish new materials, as directed by the Owner. Additional tests shall be made at the Contractor's expense until the materials are found to meet the requirements of the Contract Documents.

D. Should the results of any soil compaction tests fail to meet the requirements of the Specifications, Contractor shall recondition and/or recompact the fill, and additional tests shall be made at the Contractor's expense until the compaction is found to meet the requirements of the Specifications.

E. Testing or inspection services required outside of regular working hours shall be paid for by the Contractor.

F. When existing building systems such as fire alarms, fire sprinkler systems, smoke detectors, halon systems, etc., are modified by the Work, the Contractor shall test the entire system at the completion of the Work and demonstrate to the Owner that the system is functioning correctly and reliably.

6.12 RECORD DOCUMENTS

A. The Contractor shall maintain at the site record documents consisting of all Drawings, Specifications, addenda, approved shop drawings and samples, Change Orders, Construction Change Directives, instructions from the Architect, and other documents relating to the Project. All record documents shall be marked legibly by the Contractor to record all changes to the Work, field measurements, actual conditions, and adjustments made during construction.

B. Upon completion of the Work, Contractor shall transfer all record document information to a clean set of Drawing and Specifications and electronic media compatible with the Owner's software and deliver them to the Architect. CAD documents shall be in sheet format. Contractor shall provide any explanation or clarification of the record documents requested by Owner or Architect.

6.13 OPERATING AND MAINTENANCE MANUALS

Assemble and bind two (2) hardcopy sets and one (1) electronic PDF file, clearly categorized according to the Project Specifications, of all guarantees, certificates, warranties, operating instructions, as-built specification, and maintenance manuals into clearly organized files with an index, a list of Subcontractors and suppliers including their names, addresses, and phone numbers and present to Architect at the completion of the Work.

6.14 TRAINING TO OWNER/OWNER'S REPRESENTATIVE

Contractor shall provide training to the Owner and Owner's representatives for all operating systems, features, and equipment. Training shall be sufficient to explain and demonstrate the location, function, and operation and shall be a minimum of four (4) hours for each item of Work. Training shall be given by a person familiar with the Project. Operation and Maintenance manuals must be available to the Owner prior to training and referenced during the training. Contractor to provide Owner with videos taken of the training(s), particularly of systems such as fire alarm, HVAC, and building management system(s). Contractor and Owner shall agree which systems will require videos of training.

7 TIME

7.1 DEFINITION OF OFFICIAL DATES

A. The Contract Time is the period of time indicated in the Agreement for achieving completion of the Work. Time is of the essence for the Contract. The term day as used in reference to Contract Time shall mean calendar day.

B. The Notice to Proceed from the Owner shall establish the official date the Work may commence and the start of the Contract Time.

C. The date of Substantial Completion of the Work is the date established by the Architect. The date of beneficial occupancy or acceptance of the Work may be determined by the Owner but not effect the Contract Time or terms of the Agreement.

D. The date of Final Completion is the date established by the Architect after Substantial Completion when the Work is complete in every detail. Retention may be withheld until after Final Completion.

7.2 SUBSTANTIAL COMPLETION

A. Substantial Completion is the stage in the progress of the Work when the entire Work, or a designated portion thereof, is sufficiently complete in accordance with the Contract Documents to allow the Owner to use and occupy the entire Work or portion as intended. Prior to Substantial Completion the Contractor shall have inspected the Work, completed corrective measures, obtained all approvals necessary for occupancy, placed into operation all equipment and systems, and obtained the Architects concurrence that Substantial Completion of the Work has been achieved.

B. When the Contractor considers that the Work, or designated portion thereof , is substantially complete, the Contractor shall provide a written notice to the Architect and Owner in which the Contractor certifies that the Work or portion is Substantially Complete, lists all remaining incomplete deficiencies of the Work, and requests inspection and acceptance. The failure to include any items on such list does not alter the responsibility of the Contractor to complete the Work in accordance with the Contract Documents.

C. Upon receiving notice in accordance with paragraph 7.2.B, the Architect and/or Owner will review the Work or designated portion thereof. If the Architect determines the Work or portion is substantially complete, the Architect will establish a date of Substantial Completion. If the Architect determines the Work or portion is not Substantially Complete the Contractor will be notified. Contractor is required to initiate re-inspections by providing notice in accordance with Section 7.2B and reimburse the Owner for the cost of the reinspection.

D. The guarantee period, and associated warranty period(s), shall begin on the date of Substantial Completion. A separate date of Substantial Completion shall be established for designated portions of Work according to the Contract Documents or as agreed to by Owner.

E. Any Work used by Contractor prior to Substantial Completion shall be made new as of the date of Substantial Completion. Such Work may include lights, filters and

systems or equipment requiring periodic maintenance.

7.3 LIQUIDATED DAMAGES

A. Should the Work not be Substantially Complete, as defined herein, and within the Contract Time, damages will be sustained by the Owner. The Owner may impose liquidated damages to portions of the Work. As it may be extremely difficult, not feasible, or may be impracticable to use County resources to determine the amount of actual damage the County may suffer should Contractor fail to complete the work withing the time specified, it is understood and agreed the Contractor shall pay the Owner as fixed and liquidated damages, and not a penalty, the amount set forth in the Agreement for each calendar day of delay in completion. Contractor and its surety shall be liable for the amount thereof pursuant to Government code Section 53069.85. It is therefore agreed that the Contractor will pay the Owner the amount specified in the Notice to Contractors Document 00 11 16, as and for the Owner's liquidated damages. The liquidated damages amount covers Owner's damages only and is not in lieu of the indemnification obligations set forth separately in Section 9 nor shall these liquidated damages cover damages, including delay damages, claimed by third parties. Third parties shall include other contractors working on the Project. In the event the Contractor fails to make such payment, the Owner may deduct the amount thereof from any money due or that may become due to the Contractor under the Contract and should the balance due under the Contract not be sufficient to cover the amount owed, the Owner shall have the right to recover the balance from the Contractor, or from the Contractor’s sureties.

B. The Owner may impose liquidated damages to portions of the Work.

7.4 USE AND OCCUPANCY PRIOR TO SUBSTANTIAL COMPLETION

A. The Contractor agrees to use and occupancy of a portion of the Work by the Owner upon Substantial Completion.

B. Prior to the Owner occupying a portion of the Work, a list of Work to be completed or corrected shall be prepared jointly by the Contractor and Architect.

C. Occupancy by the Owner shall not be construed by the Contractor as being an acceptance of the Work by Owner of that part of the Work to be occupied.

D. The Contractor shall not be held responsible for any damage to the occupied part of the Work resulting from the Owner’s occupancy after Substantial Completion.

E. Occupancy by the Owner shall not be deemed to constitute a waiver of any claims which Owner or Contractor may have.

F. Use and occupancy of a portion of the Work by the Owner prior to Substantial Completion does not relieve the Contractor of his responsibility to maintain all insurance and bonds required under the Contract until the Work is completed and accepted by Owner.

7.5 SCHEDULE

A. Contractor shall submit to the Owner and Architect a schedule for the Work.

The schedule shall be a series of tasks representing the Contractor's plan for performing the Work including all activities both onsite and offsite, submittal due dates, submittal review periods, material purchasing, lead or fabrication times, a period for punchlist and corrections, final inspection and approvals, and other events or activities having an effect on the progress or completion of the Work. For each task, the schedule shall show the duration, the starting and finish dates, predecessors, successors, and the average manpower and equipment planned. The schedule shall be submitted in bar chart and pert chart format and with a separate task list showing all data in spreadsheet format. No single task on the schedule may exceed two weeks in duration. See General Requirements 01 00 00 for additional Schedule requirements.

(1) PRELIMINARY SCHEDULE

A. Submission

1. Submit the Preliminary Contract Schedule to Owner either within 10 working days after receipt of Notice of Award and/or with the Agreement.

2. Within seven (7) working days after receipt of the Preliminary Schedule, Owner will notify Contractor of its acceptance of, or its review comments about, the schedule so that appropriate adjustments may be made by Contractor in the development of the Schedule.

B. Form

1. Prepare the Preliminary Schedule in sufficient detail to demonstrate preliminary planning for the Work and to represent a practical plan to complete the Work within the Contract Time

2. Identify the following milestone events on the Preliminary Schedule:

Demolition
Utilities Shutdowns
Exterior Work

Rough Framing
Interior Partitions
Rough-Outs (Mechanical, Plumbing, Electrical and Fire Alarm, Fire Sprinklers)
Trimming
Electrical
Interior Drywall
Finishes
Painting
Signage
Agencies' Inspections
Beneficial Occupancy
Punchlist
Project Closeout

3. Identify all holidays and non-working days on the Preliminary Schedule.

C. Activities

1. Identify all Work activities which constitute the critical path, including any known material and equipment lead times.

2. Shutdowns for all utilities as determined from listing provided by Owner's Representative as part of Contract Documents.

(2) SCHEDULE

A. Submission

1. Submit the Schedule, also known as the Baseline Schedule, in the form and having general content acceptable to Owner and shall be based on the review and comments to or acceptance of the Preliminary Schedule, within ten (10) working days following Owner's written acceptance of the Preliminary Schedule.

2. Owner, with Owner's Representative will determine acceptability of the Schedule within seven (7) working days after its receipt.

3. No Application for Payment will be processed nor shall any progress payment become due until the Baseline Schedule is accepted by Owner in writing.

B. Form

1. The Schedule shall be suitable for monitoring progress of the Work, in sufficient detail to demonstrate adequate planning for the

Work, and shall represent a practical plan to complete the Work within the Contract Time.

2. Identify the milestone events as indicated above including additional milestones identified by Owner upon review of the Preliminary Schedule.

3. Identify all holidays and non-working days on the Schedule.

4. If the Schedule is shown on more than one (1) sheet, provide a summary sheet.

C. Activities

1. Identify all Work activities in correct sequence for the completion of the Work. Work activities shall include the following:

a. Major Contractor-furnished equipment, materials, and building elements, lead times, and scheduled activities requiring submittals or Owner's prior approval.

b. Show dates for the submission, review, and approval of each submittal. Dates shall be shown for the procurement, fabrication, delivery, and installation of major equipment, materials, and building elements, and for scheduled activities designated by Owner.

c. For Submittals, a minimum of ten (10) working days shall be allotted in the Schedule for the Architect to review each submittal.

d. Contractor’s internal pre-functional testing and final System test dates.

e. Scheduled overtime Work if required by Contract Documents.

f. Dates Contractor requests designated working spaces, storage areas, access, and other facilities to be provided by Owner.

g. Dates Contractor requests orders and decisions from Owner on designated items.

h. Dates Contractor requests Owner-furnished equipment.

i. Dates Contractor requests Owner-furnished utilities.

j. Connection and relocation of existing utilities.

k. Connecting to or penetrating existing structures.

l. Scheduled inspections as required by Codes, or as otherwise specified.

2. Identify all Work activities that constitute the critical path.

3. Critical Work activities are defined as Work activities which, if delayed or extended, will delay the scheduled completion of one or more of the milestones specified in this Section or the scheduled completion of the Work, or both. All other Work activities are defined as non-critical Work activities and are considered to have float.

4. Float is defined as the time that a non-critical Work activity can be delayed or extended without delaying the scheduled completion of milestones specified in this Section or the scheduled completion of the Work, or both. Neither Contractor nor Owner shall have an exclusive right to the use of float. The party using float shall document the effect on the updated Schedule.

5. Delays of any non-critical Work activity shall not be the basis for an extension of Contract Time until the delays consume the float associated with that non-critical Work activity and cause the Work activity to become critical.

6. The presentation of each Work activity on the Schedule shall include a brief description of the Work activity, the duration of the Work activity in days, and a responsibility code identifying the organization or trades performing the Work activity.

7. See 8.2 Contract Amount Breakdown – Schedule of Values for requirements to establish costs for each Work activity of the Schedule which cumulatively equal the total Contract amount.

(3) PROGRESS SCHEDULE

A. Updating the Schedule provides the Owner with a schedule of the progress of the work (Progress Schedule). The Contractor must submit Progress Schedule(s) prepared in accordance with the requirements of the Contract Documents.

B. Updating

1. Review the Schedule with Owner once each week to incorporate in the Progress Schedule all changes in the progress, sequences, and scope of Work activities.

2. Prepare and submit to Owner an updated Schedule, as the Progress Schedule, once each month, or as mutually agreed.

a. A Progress Schedule shall accurately represent the as-built condition of all completed and in-progress Work activities as of the date submitted.

b. The Progress Schedule shall incorporate all changes mutually agreed upon by Contractor and Owner during preceding periodic reviews and all changes resulting from Change Orders, Field Orders and Amended Construction Documents.

c. Contractor shall perform the Work in accordance with the updated Schedule. Contractor may change the Project Schedule to modify the order or method of accomplishing the Work only with prior agreement by Owner.

3. Contractor shall submit the updated Schedule, as the Progress Schedule, in the form acceptable to Owner, at least five (5) working days prior to submitting the Application for Payment. Contractor will provide a written progress report of the Schedule to the Owner in a format approved by Owner.

4. Owner’s Representative will determine acceptability of each Progress Schedule within five (5) working days after its receipt.

5. No Applications for Payment will be processed nor shall any progress payments become due until updated Progress Schedules are accepted by Owner.

6. The accepted Progress Schedule shall be the Schedule of record for the period it is current, shall be in compliance with the Contract Documents, and shall be the basis for the Owner’s approval of the Contractor’s monthly (or as mutually agreed) payment requests during that period.

7. The Owner’s review and acceptance of the Contractor’s updated Progress Schedule is for compliance with the requirements of the Contract Documents only. Review and acceptance by the Owner of the Contractor’s Progress Schedule(s) does not mean approval of the sequence or duration of the tasks shown, and does not relieve the Contractor of any of the Contractor’s responsibility for the accuracy or feasibility of the Schedule, or of the Contractor’s obligation to meet the milestone dates established in the Schedule and the date of contract completion to the Contract Time.

8. The Owner's review and acceptance of the Contractor's Progress Schedule does not expressly or implicitly warrant, acknowledge, or admit the reasonableness of the logic, durations, cost, manpower or equipment loading indicated in the Progress Schedule.

(4) 3-WEEK LOOK AHEAD SCHEDULE

A. During the course of construction, Contractor shall provide a 3-week schedule at each construction meeting referred to as a 3-week look ahead schedule. This schedule shall indicate the construction schedule activities for that time period. This schedule shall identify any critical items impacting the Schedule or progress and any items requiring additional Work or Time.

B. The Contractor shall carry on with the Work, for the construction of the various elements of the project concurrently, to the extent reasonable, and shall not defer construction of any portion of the work in favor of any other portion without the express written approval of the Owner.

B. The Schedule may be revised as required by the progress and conditions of the Work, change orders and all other factors that could influence the date of Substantial Completion and/or Contract Time.

C. Contractor shall post the current Schedule on the Project site in a location readily accessible to the Owner and Architect.

D. Weather delays shall be allowed for in the Contractor's Schedule. Additional time will be granted for adverse weather to the extent the number of scheduled work days lost due to weather.

7.6 DETERMINATION OF WEATHER DELAYS

A. Except for rain, if weather conditions are the basis for delays for continuing or completion of the Work or any designated portion of the Work, Contractor must substantiate that the weather conditions were abnormal, based on the climatologically data for the immediate preceding 10-year period. The Contractor must establish that the adverse weather conditions could not have been reasonably anticipated to constitute a weather delay.

B. When the amount of rain is considered to be abnormal, additional rain days will be allowed and extensions to the Contract Time(s) will be granted where the

condition of the site (exterior or interior location) or access to the site as determined by the Owner, is such that Contractor can perform no Work identified on the current version of the Progress Schedule in effect at the time the delay occurred. Rainfall will be considered unusually severe only when the Days of Rain (defined as more than one-tenth (1/10th) of an inch of rain per day) in any month exceed the number of allowed rain days per month.

C. No Contract Time extension for rain will be allowed for any month until the established number of allowed rain days for the that month have been exceeded. The allowable rain days per month for this Project are as follows:

January: 2
February: 2
March: 2
April: 0
May: 0
June: 0
July: 0
August: 0
September: 0
October: 2
November: 2
December: 2

D. Contractor must exercise due diligence in protecting the Work and the Work site from the adverse impacts of weather by:

1. Taking appropriate preventative actions before anticipated inclement weather to protect the Work and Work site from the potential adverse effects of the weather;
2. Taking corrective action during the inclement weather to protect the Work and Work site from the actual and potential adverse effects of the inclement weather; and
3. Taking correction action after the inclement weather to remedy, prevent, and/or mitigate the negative impacts of the adverse weather on the Work and the Work site.

7.7 DELAY AND TIME EXTENSIONS

A. The Owner will consider extensions to the Contract Time for the following reasons only if they affect the Critical Path of the Official Progress Schedule.

1. Acts of God (as defined in PCC 7105 (b) (2)) or of the public enemy, acts of Government, acts of Owner, fires, floods, epidemics, quarantine restrictions, sanctioned strikes, freight embargoes, unusually severe weather, or delays of Subcontractors or Suppliers arising from unforeseeable causes beyond the control and without the fault or negligence of both Contractor and such Subcontractors or Suppliers.

2. Delays in progress due to an act of neglect by Owner only for the amount of delay time that occurs after Contractor has notified Owner in writing and the Owner has had a reasonable time to respond to the notification.

3. An Approved Change Order that extends the Contract Time.

B. Within twenty-four (24) hours from the beginning of any critical path delay to the current updated Schedule, Contractor must notify Owner in writing of the causes of delay.

C. Within ten (10) working days from the end of any critical path delay to the Schedule, Contractor must submit two (2) hard copies and electronic data files of all supporting information to validate the impact of the delay on the Contract Time.

D. The Owner will ascertain the facts and the extent of the delay and adjust the Contract Time for completing the Work when, in Owner's judgment, the facts justify an adjustment. Owner's determination is final and conclusive.

E. Delay and Contractor’s entitlement for delay will be determined as follows:

1. The following definitions apply to a Delay and Time Extension:

a. ***“Excusable Delay”*** means any delay in the Work caused by conditions beyond the control and without the fault or negligence of the Contractor.

b. ***“Excusable Non-Compensable Delay”*** means any Excusable Delay not solely the responsibility of the Contractor, such as, earthquake, fire, flood, and inclement weather conditions that caused a delay of Work on the critical path of the Schedule. The financial inability of the Contractor or any Subcontractor, Sub-subcontractor or Supplier, or the default of any Subcontractor, Sub-subcontractor or Supplier is not a condition beyond the Contractor’s control. An Excusable Non-Compensable Delay may entitle the Contractor to an extension of the Contract Time, but will not entitle the Contractor to any adjustment of the Contract Sum.

c. ***“Excusable Compensable Delay”*** means any Excusable Delay caused by a delay of the Work on the critical path of the Schedule

for which the Owner is solely responsible and which delay is unreasonable given the circumstances and not within the contemplation of the parties. An Excusable Compensable Delay may entitle the Contractor to an extension of the Contract Time and an adjustment of the Contract Sum.

d. ***"Non-Excusable Delay"*** means any delay in the Work resulting from causes within the control of the Contractor or due to the fault or negligence of the Contractor or its Subcontractors or Suppliers. A Non-excusable Delay shall not entitle the Contractor to an extension of the Contract Time or an adjustment of the Contract Sum.

2. Whenever the Contractor foresees any delay in the prosecution of the Work, the Contractor must notify the Owner in writing of the potential delay. Such notification must specify with detail the cause asserted by the Contractor for the potential delay and provide a description of the anticipated effect of the potential delay on the most recent updated Schedule including identification of the activity numbers of the affected activities. Failure of the Contractor to submit such a notice after recognition of any incident or event giving rise to the potential delay will constitute a waiver by the Contractor of any request for extension of the Contract Time, and no extension of the Contract Time will be granted as a consequence of such delay.

3. Within twenty-four (24) hours from the beginning of any critical path delay to the Progress Schedule, Contractor must submit written notice to the Owner of the delay. The notice must include identification of the affected activities, evidence of the cause of the delay, and within ten (10) working days of the end of the critical path delay, Contractor must submit a Time Impact Analysis per F. Time Impact Analysis.

4. Owner has no obligation to consider any request for extension to the Contract Time unless the Contractor satisfies the requirements set forth in the Contract Documents for providing notice of potential delay and submission of a Time Impact Analysis establishing the impact of the delay on the critical path of the latest Progress Schedule.

5. Owner is not responsible to the Contractor for any constructive acceleration due to Contractor's failure to comply with the submission and justification requirements of the Contract Documents for Contract Time extension requests. The Contractor's failure to perform in accordance with the latest Progress Schedule shall not be excused because the Contractor

has submitted Contract Time extension requests, unless and until Owner approves such requests.

6. Extension to the Contract Time will not be allowed for delays on paths of activities containing Total Float Time per the latest Progress Schedule, providing such delay does not exceed the Total Float Time(s) on paths of activities on the latest Progress Schedule.

7. Any extension of Contract Time granted the Contractor pursuant to this section, does not constitute a waiver by Owner of, nor a release of the Contractor from, the Contractor's obligation to perform the Work within the Contract Time specified by the Contract Documents, as modified by the particular extension in question. Owner's decision to grant an extension of the Contract Time due to one circumstance set forth in one request, shall not be construed as a grant of an extension for any other circumstance or the same circumstance occurring at some other time, and shall not be viewed by the Contractor as a precedent for any other request for extension of the Contract Time.

8. If Owner orders the Contractor to suspend Work pursuant to the Contract Documents, the Contractor will not be entitled to any extension of the Contract Time, damages resulting from the suspension, unless the Contractor can establish that the suspension was Ordered without reasonable justification.

F. Time Impact Analysis

1. The time impact analysis must provide information justifying the request for extension of the Contract Time and stating the extent of the adjustment requested for the alleged delay. Time impact analysis must be in form and content acceptable to the Owner and include, but not be limited to, the following:

a. Time impact analyses must be based on analyzing the Progress Schedule in effect at the time the alleged delay or impact first occurred.

b. The Contractor must present fragmentary Critical Path Method (CPM) type network windows (fragments) in time scaled precedent format, illustrating how Contractor proposes to incorporate the alleged delay into the Progress Schedule in effect at the time the alleged delay or impact first occurred.

c. The Contractor must identify the activities that are proposed to be amended due to the alleged delay.

d. The Contractor must identify the preceding and succeeding activities in the Official Progress Schedule to which the fragment(s) is to be connected.

H. Concurrent Delays

1. If an Excusable Non-Compensable Delay and an Excusable Compensable Delay operate to concurrently delay completion of the Work, the maximum extension of the Contract Time will be the number of Calendar Days from the commencement of the first delay to the cessation of the delay which ends last. Any adjustment of the Contract Sum will be in accordance with changes in the Work, and will be based only on the number of days of Excusable Compensable Delay, less the duration of the concurrence.

2. If a Non-Excusable Delay operates to concurrently delay completion of the Work with an Excusable Non-Compensable Delay, the maximum extension of the Contract Time will be the number of days of concurrent delay plus the non-concurrent portion of the Excusable Non-Compensable Delay. The entire delay is non-compensable.

3. If a Non-Excusable Delay operates to concurrently delay completion of the Work with an Excusable Compensable Delay the maximum extension of the Contract Time will be the number of days of concurrent delay plus the non-concurrent portion of the Excusable Compensable Delay. Any adjustment of the Contract Sum will be in accordance with changes in the Work, and will be based only on the non-concurrent portion of the Excusable Compensable Delay.

4. Where the period of concurrent delay is sixty (60) calendar days or longer, the Owner will pay 50% of labor and material cost escalations experienced as a result of the concurrent delay following Contractor's demonstration of the cost escalations to the reasonable satisfaction of Owner.

8 PAYMENTS

8.1 CONTRACT AMOUNT

The Contract Amount as stated in the Agreement, including adjustments authorized under the terms of the Contract, is the total amount payable by the Owner to the Contractor for the complete Work.

8.2 CONTRACT AMOUNT BREAKDOWN – SCHEDULE OF VALUES

The Contractor shall, before the first application for payment, submit to the Architect and the Owner a Schedule of Values document which is a dollar value amount breakdown for the entire scope the Work of the Contract divided into categories so as to facilitate certification of completed Work for payment. The Schedule of Values shall be in such form as may be agreed upon by the parties and supported by such evidence as to its correctness that may allow the Architect and/or Owner's Representative to certify progress payments corresponding to the percentage of completed Work..

8.3 PROGRESS PAYMENTS

A. The Owner shall make progress payments to the Contractor for labor and materials incorporated into the Work as called for by the Contract Documents and approved Change Orders. Not more often than once each month and on a day of each month agreed upon between the Owner and the Contractor, the Contractor shall submit to the Owner and the Architect, through the Owner's Representative, an application for payment consisting of a Certificate of Payment, a calculation of completed Work based on the approved payment breakdown and, if required by Owner, receipts, releases, or other evidence showing the Contractor's payments for materials, labor, Subcontractors, and any such information as the Owner may require. Payment shall not be owed if the application does not conform to these requirements.

B. Payment for materials stored on site which have not been permanently incorporated into the Work is at the discretion of the Owner. Payment for materials stored off-site, whether or not specially fabricated for the Project, can be made only when payment for such materials has been previously approved by the Owner and shown on the approved payment breakdown and such payment shall be conditional upon submission by the Contractor of a Bill of Sale in a form acceptable to the Owner or other such evidence as is required by the Owner to establish the Owner's title to such material. All materials stored off-site shall be stored in a bonded warehouse at no additional expense to the Owner.

C. The Contractor shall present the application for payment, as required herein, to the Architect for approval using the Owner's previously approved Schedule of Values. The Architect will review and adjust the Certificate of Payment to such amount as he decides is properly due and deliver it to the Owner for payment.

D. The Owner will retain five (5) percent of the amount of each payment due the Contractor until after the date of Owner's Certificate of Project Completion has been accepted by the County.

E. No Certificate of Payment issued nor payment made to the Contractor nor partial or entire use of occupancy of the Work by the Owner shall be an acceptance of any Work not in accordance with the Contract Documents.

F. The Contractor shall not assign any monies due or to become due hereunder without the written consent of the Owner and of all sureties executing bonds on behalf of the Contractor in connection with this Contract.

8.4 OWNER'S FAILURE TO ISSUE PAYMENT

Should the County fail to issue a progress payment to the Contractor for properly submitted, undisputed and approved amounts owed under the Contract within 30 calendar days , then the Owner shall pay interest to the Contractor equivalent to the legal rate set forth in subdivision (a) of Section 685.010 of the Code of Civil Procedure. Refer to the California Public Contract Code, Division 2, Part 2, Chapter 1, Article 8, Section 102.5 and other applicable sections. Contractor may, upon written notice to the Owner and provided the Owner does not pay the Contractor per the terms agreed to between the Owner and Contractor, stop Work only until Contractor receives the progress payment amount owed.

8.5 PAYMENTS WITHHELD

A. The Owner may withhold payment, on account of subsequently discovered information, nullify the whole or a part of any progress payment or retention payment to such extent as may be necessary to protect the Owner from loss on account of:

1. Defective Work.

2. Third party claims or reasonable evidence indicating probable filing of third-party claims.

3. Failure of the Contractor to make payments to Subcontractors or for material, labor or equipment.

4. The Owner's doubt that the Work can be completed for the unpaid portion of the Contract Amount.

5. Damage to another contractor's work.

6. Damage to Owner's property.

7. Failure to pay fees in accordance with the Contract Documents.

8. Owner's cost of correcting deficiencies in the Work or undertaking any

Work.

9. Liquidated damages or anticipated liquidated damages.

10. Any amount owed to Owner or claimed by Owner.

11. Contractor's failure to deliver as-built drawings, guarantees, operating manuals or other documents.

12 Failure by Contractor to fulfill any Contract requirement.

8.6 FINAL PAYMENT AND RETENTION PAYMENT

A. The final payment shall be the one made in response to the Contractor's one hundred percent (100%) complete application for payment which will bring the total paid to date to the Contractor to ninety-five percent (95%) of the Contract Amount. Contractor's acceptance of the final payment shall constitute a waiver of all claims by Contractor except those previously made in writing.

B. The Owner is entitled to retain five percent (5%) of the amount of each payment due Contractor, as Retention, until at least sixty (60) calendar days after the date of recording the Notice of Completion, as per California Pubic Contract Code, Division 2, Part 1, Chapter 7, Section 7107.

C. As a prerequisite to the release of retention, Contractor shall sign a Release of Liens in a form prescribed by Owner.

D. Contractor shall not be paid interest on retention.

9 INSURANCE

9.1 HOLD HARMLESS/INDEMNIFICATION

A To the full extent permitted by law, CONTRACTOR shall indemnify and save harmless the COUNTY, its officers, employees, and servants from all claims, suits, or actions of every name, kind, and description, brought for, or on account of: (A) injuries to or death of any person, including CONTRACTOR, its officers, employees and servants, or (B) damage to any property of any kind whatsoever and to whomsoever belonging, (C) any sanctions, penalties or claims of damages resulting from CONTRACTOR'S failure to comply with applicable laws, or (D) any other loss or cost resulting from the CONTRACTOR'S negligent or reckless acts or omissions or willful misconduct in connection with the performance of any work required of CONTRACTOR or payments made pursuant to this Agreement, provided that this shall not apply to injuries or damage for which the COUNTY has been found in a court of competent jurisdiction to be solely liable by reason of its own negligence or willful misconduct.

B The duty of CONTRACTOR to indemnify and save harmless as set forth herein, shall include the duty to defend as set forth in Section 2778 of the California Civil Code.

C. The obligations set forth in this section shall continue beyond the term of this Agreement as to any act or omission which occurred during or under this Agreement.

9.2 INSURANCE

A. The Contractor shall not commence Work under this Contract until all required insurance has been obtained and such insurance has been approved by the Owner. The Contractor shall furnish the Owner with Certificates of Insurance evidencing the required coverage, and there shall be a specific contractual liability endorsement extending the Contractor's coverage to include the contractual liability assumed by the Contractor pursuant to this Contract. Certificates of Insurance shall be filed with the Owner within ten (10) calendar days after award of the Contract. These certificates shall specify or be endorsed to provide that thirty (30) calendar days notice must be given, in writing, to the Owner of any pending change in the limits of liability or of any cancellation or modification of the policy.

B. The Contractor shall have in effect during the entire life of this Contract Workers Compensation and Employers Liability Insurance providing full statutory coverage; and in case any work is sublet, the Contractor shall require all Subcontractors similarly to provide Workers Compensation and Employers Liability Insurance to full statutory limits of the California Labor Code. In signing this Contract, the Contractor makes the following certification, required by Section 1861 of the Labor Code:

> "I (Contractor Name/Company), am aware of the provisions of Section 3700 of the California Labor Code which require every employer to be insured against liability for Workers' Compensation or to undertake self-insurance in accordance with the provisions of the Code, and I (Contractor Name/Company) will comply with such provisions before commencing the performance of the work of this Contract".

C. The Contractor shall take out and maintain during the term of this Contract such Bodily Injury Liability and Property Damage Liability Insurance as shall protect Contractor and any Subcontractor performing Work covered by this Contract, from any and all Claims for damages for bodily injury, including accidental death, as well as any and all Claims for property damage including third party property damage to include coverage on property in the care, custody and control of the Contractor, which may arise from the Contractor's operations under this Contract, whether such operations be by Contractor or by any Subcontractor or by anyone

directly or indirectly employed by either of them. Such insurance shall be combined single limit bodily injury and property damage for each occurrence and shall not be less than the amount specified below. Such insurance shall include:

1. Comprehensive Commercial or General Liability Insurance
   a. $1,000,000 Bodily Injury/Property Damage Each Occurrence
   b. $2,000,000 Product/Completed Operations Aggregate
   c. $2,000,000 General Aggregate
   d. $50,000 Fire Damage Legal Liability
   e. $5,000 Medical Payments
   f. Coverage shall include but not be limited to the following supplementary coverages:
      Contractual Liability to cover liability assumed under the Agreement;
      Product and Completed Operations Liability Insurance;
      Broad Form Property Damage Liability Insurance;
      Explosion, collapse and underground hazards (deletion of the X, C, U exclusions) if such exposure exists; and
      Independent Contractors.
2. Motor Vehicle/Automobile Liability Insurance: $1,000,000 Combined Single Limit.
3. Workers' Compensation and Employer's Liability Insurance, Workers' Compensation Insurance Statutory benefits as provided by the California statute and Employer's Liability Limits as follows:
   a. $1,000,000 Bodily Injury with Accident – Each Accident
   b. $1,000,000 Bodily Injury by Disease – Policy Limit
   c. $1,000,000 Bodily Injury by Disease – Each Employee

D. The Owner and its officers, agents, employees and servants shall be named as additional insured on any such policies of insurance, which shall also contain a provision that the insurance afforded thereby to the Owner, its officers, agents, employees and servants shall be primary insurance to the full limits of liability of the policy, and that if the Owner or its officers, agents? and employees have other insurance against the loss covered by such a policy, such other insurance shall be excess insurance only.

E. The Owner shall purchase and maintain at Owner's expense All Risk Property Insurance or Builder's Risk Insurance, excluding Earthquake and Flood coverage, in an amount covering all work and materials in the Contract, including that of Subcontractors, in an amount equal to the Contract Amount including adjustments. Subcontractors shall be included as insureds and the Owner shall be named as a Loss Payee as its interests may appear. Said insurance shall be maintained in complete coverage throughout the duration of the Contract until the one (1) year after the Completion Date of the Project.

9.3 FAILURE TO PROVIDE INSURANCE

If Contractor fails to provide insurance as required herein, the Owner, at its option, may take out and maintain such insurance as the Owner deems in its best interest and charge the cost thereof to the Contractor, which may be at a higher cost.

10 GUARANTEES

10.1 REQUIRED GUARANTEES

A. In addition to guarantees required elsewhere in the Contract Documents, the Contractor shall guarantee all of the Work, and each Subcontractor shall guarantee his own Work, against defective material or faulty workmanship for a minimum of one (1) year after the date of Substantial Completion. All guarantees must be submitted in triplicate to the Architect on the Contractor's own letterhead in the form prescribed by Owner.

B. In addition to the requirements of paragraph 10.1.A, all standard manufacturer warranties shall be passed to the Owner which may extend the warranty period beyond one (1) year.

C. The date of guarantee and all warranties for the Work shall commence upon the Owner's agreed Substantial Completion Date, when the County achieves beneficial use and occupancy of the Project, or phase of the Project.

D. In addition to the guarantees and warranties required by the Contract Documents, the Owner has all rights and remedies provided by law including those pertaining to latent defects.

10.2 REPAIR OF GUARANTEED WORK

A. If repairs are required in connection with guaranteed Work, the Contractor shall promptly upon receipt of written notice from the Owner, and without expense to the Owner:

1. Place in satisfactory condition in every detail all of such guaranteed Work;

2. Make good all damage to the building, site, equipment, furniture, or contents which, in the opinion of the Owner, is the result of work not in accordance with the terms of the Contract Documents or disturbed in the process of correcting guaranteed Work.

B. If the Contractor disturbs any work guaranteed under another contract in fulfilling the requirements herein he shall restore such disturbed work to a condition satisfactory to the Owner and guarantee such restored work to the same extent as

it was guaranteed under the Contract.

C. A new full term guarantee period shall apply to repaired work upon completion of repairs.

D. If Contractor fails to proceed to comply with the terms of the guarantee to make repairs of defective work within seven (7) calendar days of Notice from Owner, the Owner may remedy the Contractor's failure by whatever means the Owner deems expedient. The Owner may, at any time, take measures to mitigate damage or reduce undesirable effects of defective work. All costs expended by Owner pursuant to this Section shall be paid by Contractor.

END OF DOCUMENT 00 72 13

DOCUMENT 00 73 36

SAN MATEO COUNTY SUPPLEMENTARY GENERAL CONDITIONS EQUAL EMPLOYMENT OPPORTUNITY (EEO) PROGRAM FOR MINORITY EMPLOYMENT

1. STATEMENT OF INTENT

It is the intent of the Board of Supervisors of the County of San Mateo to prohibit and eliminate employment discrimination and to further the opportunities for minority persons to be gainfully employed in the performance of County building contracts. The Bidder's attention is directed to all the provisions set forth herein. The Board of Supervisors has by Ordinance No. 2174 added Title 2, Chapter 2.50 to Division II of the San Mateo County Ordinance Code prohibiting discrimination in employment and providing for an Equal Employment Opportunity Program by Contractors doing business with the County of San Mateo. The following provisions are a part of the contract documents.

2. LOWEST RESPONSIBLE BIDDER

Award of contract to the low bidder shall not be made until the requirements set forth in these Supplementary General Conditions have been complied with and reviewed by the County Compliance Officer and a satisfactory Equal Employment Opportunity Program as submitted by the low bidder has been accepted.

A. Criteria for Determining Lowest Bidder. Criteria to determine the acceptability of bids on construction contracts requiring public bidding and involving an expenditure of $6,500 or more shall include but not be limited to the following:

1. Criteria of Compliance with Federal and State Laws. Each bidder shall submit with his bid a certification that he is in compliance with the Equal Employment Opportunity Requirement of Executive Order 11246, Title VII of the Civil Rights Act of 1973, the California Fair Employment Practices Act and any other Federal or State Laws and regulations relating to Equal Employment Opportunities and the provisions of this article and the Board established guidelines implementing them. See report form entitled "Certification of Compliance with Laws Prohibiting Discrimination" bound herein after Form of Proposal.

2. Certification of Intent to Develop and Implement an Equal Employment Opportunity Program. Each bidder shall submit with

his bid a certification that he will develop, implement and maintain, during the course of work concerned, an affirmative action program in employment conducted without regard to race, religion, color, national origin, ancestry, physical or mental disability, or sex of the applicants. With this certification he shall submit any and all information which may be required by the County in connection with this program. As used in this Article, the term "minority" or "minority group" pertains to Latinos, Asians and Pacific Islanders, African Americans, American Indians, and women (regardless of her race or ethnicity). See report form entitled "Certification of Intent" bound herein after Form of Proposal.

3. Compliance by Subcontractors. The provision of this Section apply to any subcontractor engaged by the successful bidder, and each successful bidder shall notify his subcontractors of their obligations under the provisions of this Section.

3. PENALTIES FOR NON-COMPLIANCE WITH THE PROVISIONS OF THIS SECTION

A. Any bidder who fails to submit a proposed Equal Employment Opportunity Program or who is unable to make the certifications required in this Section of the Supplementary General Conditions may be disqualified from consideration for the award of the contract.

B. If, after an award is made, the Contractor is found by the County or by a Federal or State agency empowered to make such findings to be in substantial or material violation of the Fair Employment Practices Act of the State of California, the Equal Employment Opportunity Requirement of Executive Order 11246, Title VII of the Civil Rights Act of 1964, Section 503 of the Rehabilitation Act of 1973, or of the provisions of this Section, he may be found to be in material breach of his contract, and the County shall have the power to cancel the contract in whole or in part, or alternatively, to deduct for each working day during which the Contractor is found to have been in such non-compliance, two (2) percent of the total amount payable to the Contractor.

4. WAIVER OF COMPLIANCE

In the event that the requirements of this ordinance are found to work an undue hardship upon a low bidder, said bidder shall submit evidence of such hardship to the Board of Supervisors and shall petition the Board for a waiver of these requirements. This waiver shall only be granted by the Board of Supervisors and shall become an integral part of the contract.

5. DEFINITIONS

A. Equal Employment Opportunity Program. Equal Employment Opportunity Program is a set of specific and result oriented procedures to which a Contractor commits himself in order to achieve equal employment opportunity.

B. Compliance Officer. A Compliance Officer is the County official designated by the County Manager to represent him in the administration of these guidelines and in the enforcement of the provisions of Title 2, Chapter 2.50 of the County Ordinance Code.

6. CERTIFICATION OF COMPLIANCE AND INTENT

Every bidder shall submit with his bid a Certificate of Compliance with laws prohibiting discrimination and a Certification of Intent to implement an equal employment opportunity program on a form furnished by the County, as required by Title 2, Chapter 2.50 of the County Ordinance Code.

7. EQUAL EMPLOYMENT OPPORTUNITY PROGRAM

In addition to furnishing the Certification of Compliance, each Contractor will submit his Equal Employment Opportunity Program with his bid.

The EEO shall contain the following information:

A. Analysis of current work force:

1. Total number of employees

2. Numerical racial breakdown of employees by job classification

3. Information on apprentices

These figures will provide the base by which the Contractor's EEO will be evaluated. Factors to be considered both in the original statistics and in any plans for future employment will include the percentage of minority population in San Mateo County, the availability of minority construction workers and the present minority representation in the various construction trades.

B. The equal employment opportunity actions the Contractor has taken or will take to insure equal employment opportunity. These shall include:

1. Recruiting and hiring minority persons. If non-union personnel are employed this would involve employment advertising through

sources which serve areas of minority population. These include local minority newspapers, referral agencies, high schools, vocational schools, and community groups. Specific information on these sources may be obtained from the Compliance Officer. Union employees will be recruited in accordance with applicable labor agreements. The Contractor will seek to have included or will reaffirm clauses in all labor agreements prohibiting discrimination based on race, religion, color, national origin, age, ancestry, physical or mental handicap, or sex. Assistance for admission into the craft of minorities over the traditional apprenticeship age is also suggested. The Contractor will support Bay Area Construction Opportunity Program or similar groups as recruiting sources and will urge all labor organizations with which he has agreements to use BACOP.

2. Providing adequate opportunity for the upgrading or further training of all employees to insure equal opportunity in advancement and promotion. This might include a counseling service, information and assistance with night classes, or special career-directed program information.

3. Appointing an Equal Employment Opportunity Coordinator - full time or as an additional duty. He will have the responsibility of administering an active program, informing company personnel and union representatives of this company policy and advising all subcontractors of their obligation to this program.

4. Establishing or maintaining an apprenticeship or training program designed to insure hiring of additional minority employees in the journeyman or skilled classes, if possible. The Contractor is urged to support the Joint Apprenticeship Committee on this trade.

5. Selecting minority subcontractor or subcontractors who are known for their ongoing program of apprenticeship for minorities. This includes advising minority contractor associations of bids for subcontractors. Joint ventures with minority subcontractors are encouraged.

C. The EEO should state any previous experience the Contractor has had with similar plans and result of that effort. Any current equal employment opportunity plans should be described in detail and a copy attached, if printed plan is available. The Compliance Office will review the EEO submitted by each bidder in order to determine whether the program submitted complies with Title 2, Chapter 2.50 of the County Ordinance Code and these guidelines.

The EEO as submitted will be kept on file by the Compliance Officer. If the Contractor bids for other county contracts, he may refer to the EEO on file and state any changes, but will not be required to refile his program.

The Compliance Officer may request additional information from the bidder and will be available to answer questions relative to the guidelines and to advise those seeking assistance of resources known to him. He will not be responsible for the service or lack of service rendered by the resources recommended, nor will he develop an EEO for any bidder, or serve as a recruiter for any bidder.

Bidders may revise their EEO after consultation prior to award of contract. Deficiencies will be discussed and appropriate remedies suggested. If bidders withdraw their EEO for revision, their revised program must be submitted by a date established by the Compliance Officer.

The Compliance Officer will determine whether the low bidder's EEO is acceptable and will report to the appropriate county department. The EEO's of each subcontractor of the low bidder will also be evaluated by the Compliance Officer.

8. INCLUSION OF EEO AND CERTIFICATIONS

Upon award of the contract by the Board of Supervisors, the EEO and Certifications for the prime contractor and all subcontractors, which have been approved and accepted by the County, will become an integral part of the contract and subject to the provisions thereof.

9. PERFORMANCE OF CONTRACTOR

A. The Contractor will post, in conspicuous places available to employees and applicants for employment, notices to be provided by the County, stating that the Contractor is obliged to comply with the provisions of these guidelines and Title 2, Chapter 2.50 of the County Ordinance Code. These notices will also be sent to all union and employee organizations and other recruiting sources providing employees to the Contractor.

B. All announcements of job openings will include the statement: "An Equal Opportunity Employer".

C. The Contractor will make written Progress Reports on a form provided by the County to illustrate the effectiveness of his EEO at intervals established by the County.

D. The Compliance Officer will monitor the performance of the EEO until completion of the contract and will report the progress of the Contractor in living up to his EEO to the County Manager.

E. The Contractor shall permit, during Contractor's normal business hours and at Contractor's place of business, access by the County to his records of employment, employment advertisements, application forms and other data and records pertaining to Contractor's employment practices, for the purpose of determining whether Contractor is complying with the Non-Discrimination and Equal Employment Opportunity rules of the County.

10. PERFORMANCE OF SUBCONTRACTORS

A. All subcontractors listed in a general Contractor's bid are subject to all the provisions of these guidelines and Title 2, Chapter 2.50 of the County Ordinance Code.

B. All subcontractors will file their Certifications of Compliance and Intent and their EEO with the Equal Employment Coordinator of the prime Contractor for transmittal to the County, after award of the contract has been made.

END OF DOCUMENT

DOCUMENT 00 73 73

SUPPLEMENTARY CONDITIONS

COUNTY OF SAN MATEO
EQUAL BENEFITS COMPLIANCE ORDINANCE NO. 4324, CHAPTER 2.84

2.84.010 Definitions

For the purposes of this chapter:
(a) "Contract" means a legal agreement between the County and a Contractor for public works, consulting, or other services, or for purchase of supplies, material or equipment for which the consideration is in excess of $5,000.

(b) "Contractor" means a party who enters into a Contract with the County.

(c) "Contract Awarding Authority" means the Board of Supervisors or the individual authorized by the Board of Supervisors to enter into Contracts on behalf of the County.

(d) "Domestic Partner" means any person who is registered as a domestic partner with the Secretary of State, State of California registry or the registry of the state in which the employee is a resident.

(e) "Employee Benefits" means the provision of any benefit other than pension and retirement benefits provided to spouses of employees or provided to an employee on account of the employee's having a spouse, including but not limited to bereavement leave; disability, life, and other types of insurance; family medical leave; health benefits; membership or membership discounts; moving expenses; vacation; travel benefits; and any other benefits given to employees, provided that it does not include benefits to the extent that the application of the requirements of this chapter to such benefits may be preempted by federal or state law. (Ord. 4324, 08/15/06)

2.84.020 Discrimination in the provision of benefits prohibited

(a) No Contractor on a County Contract shall discriminate in the provision of Employee Benefits between an employee with a domestic partner and an employee with a spouse, subject to the following conditions:

1. In the event that the Contractor's actual cost of providing a particular benefit for the domestic partner of an employee exceeds that of providing it for the spouse of an employee, or the Contractor's actual cost of providing a particular benefit to the spouse of an employee exceeds that of providing it for the domestic partner of an employee, the Contractor shall not be deemed to discriminate in the provision of Employee Benefits if the Contractor conditions providing such benefit upon the employee's agreement to pay the excess costs.

2. The Contractor shall not be deemed to discriminate in the provision of Employee Benefits if, despite taking reasonable measures to do so, the Contractor is unable to extend a particular employee benefit to domestic partners, so long as the Contractor provides the employee with a cash payment equal to the Contractor's cost of providing the benefit to an employee's spouse.

(b) The Board of Supervisors may waive the requirements of this Chapter when it determines that it is in the best interests of the County. The County Manager may waive the requirements of this chapter for Contracts not needing the approval of the Board of Supervisors where waiver would be in the best interests of the County for such reasons as follows:

1. Award of a Contract or amendment is necessary to respond to an emergency;
2. The Contractor is a sole source;
3. No compliant Contractors are capable of providing goods or services that respond to the County's requirements;
4. The requirements are inconsistent with a grant, subvention or agreement with a public agency;
5. The County is purchasing through a cooperative or joint purchasing agreement.

(c) Contractors should submit requests for waivers of the terms of this Chapter to the Contract Awarding Authority for that Contract, or in the case of Contracts approved by the Board, the County Manager.

(d) The Contract Awarding Authority, or in the case of Contracts approved by the Board, the County Manager, may reject an entity's bid or proposals, or terminate a Contract, if the Contract Awarding Authority determines that the entity was set up, or is being used, for the purpose of evading the intent of this Chapter.

(e) No Contract Awarding Authority shall execute a Contract with a Contractor unless such Contractor has agreed that the Contractor will not discriminate in the provision of Employee Benefits as provided for in this Chapter. (Ord. 4324, 08/15/06)

2.84.030 Application of Chapter

The requirements of this Chapter shall only apply to those portions of a Contractor's operations that occur (a) within the County; (b) on real property outside of the County if the property is owned by the County or if the County has a right to occupy the property, and if the Contractor's presence at that location is connected to a Contract with the County; and (c) elsewhere in the United States where work related to a County Contract is being performed. The requirements of this Chapter shall not apply to subcontracts or subcontractors of any contract or Contractor. (Ord. 4324, 08/15/06)

2.84.040 Powers and duties of the County Manager

The County Manager's office shall have the authority to:

(a) Adopt rules and regulations, in accordance with this Chapter and the Ordinance Code of the County of San Mateo, establishing standards and procedures for effectively carrying out this Chapter.

(b) Receive notification from employees of Contractors regarding violations of this Chapter.

(c) Determine and recommend to the Board of Supervisors for final decision the imposition of appropriate sanctions for violation of this Chapter by Contractors including, but not limited to:

1. Disqualification of the Contractor from bidding on or being awarded a County contract for a period of up to 5 years; and;
2. Contractual remedies, including, but not limited to termination of contract;
3. Liquidated damages in the amount of $2,500;

(d) Examine Contractors' benefit programs covered by this chapter;

(e) Impose other appropriate contractual and civil remedies and sanctions for violations of this chapter;

(f) Allow for remedial action after a finding of non-compliance, as specified by rule;

(g) Perform such other duties as may be required or which are necessary to implement the purposes of this Chapter. (Ord. 4324, 08/15/06)

2.84.050 Date of Application

The provisions of this Chapter shall apply to any Contract awarded or amended on or after July 01, 2001, provided that if the Contractor is then signatory to a collective bargaining agreement, this Chapter shall only apply to any Contract with that Contractor which is awarded or amended after the effective date of the next collective bargaining agreement. (Ord. 4324, 08/15/06)

END OF DOCUMENT

01 10 00 - SUMMARY

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Project Information.
   2. Work covered by the Contract Documents.
   3. Work phases.
   4. Work under separate contracts.
   5. Use of premises.
   6. Owner's occupancy requirements.
   7. Specification formats and conventions.

1.2 WORK COVERED BY CONTRACT DOCUMENTS

A. Project Identification: East Palo Alto Government Center
   1. Project Location: 2415 University Ave., East Palo Alto, CA 94303

B. Owner: County of San Mateo

C. Owner's Representative:
   King Leong
   Capital Project Manager II
   555 County Center
   Redwood City, CA 94603

D. Architect:
   Swatt Miers Architects
   5845 Doyle Street, Suite 104
   Emeryville, CA 94608

E. The Work, per approved plans dated April 30, 2022, and Project Manual & Contract Documents dated September 6, 2022, consists of the following:

   1. Replacement of existing mechanical system
   2. Ceiling replacement including upgrade to all LED lighting
   3. New fire alarm system
   4. Elevator cab refurbishment

1.3 WORK UNDER OTHER CONTRACTS

A. General: Cooperate fully with separate contractors so work on those contracts may be carried out smoothly, without interfering with or delaying work under this Contract. Coordinate the Work of this Contract with work performed under separate contracts.

B. Concurrent Work by the Owner: The Owner **will award** separate contract(s) for, or will self- perform, the following phased construction operations at the Project site. Those operations may be conducted simultaneously with work under this Contract. Separate contracts will be awarded for separate and phased projects:
   1. City of Palo Alto Offices and Library
   2. San Mateo County Human Services Agency Lobby Remodel
   3. San Mateo County Health Services Administration
   4. San Mateo County Probation Depart

1.4 USE OF PREMISES

A. General: Contractor shall have full use of premises for construction operations, including use of Project site, during construction period. Contractor's use of premises is limited only by Owner's right to perform work or to retain other contractors on portions of Project.

B. General: Contractor shall have limited use of premises for construction operations as indicated on the Contract Drawings.

C. Use of Site: Limit use of premises to areas within the Contract limits indicated. Do not disturb portions of Project site beyond areas in which the Work is indicated.
   1. Limits: Confine constructions operations to boundaries as indicated on site plan, within the property line and phasing plan.
   2. Sidewalks, Driveways and Entrances: Keep sidewalks, driveways and entrances serving premises and public use areas available to the General Public, Owner, Owner's employees, and emergency vehicles at all times. Do not use these areas for parking or storage of materials.
      a. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.
      b. Schedule improvements to the building areas to minimize impacts to access by the public. All related improvements will need to be coordinated by the Contractor with the County and Contractor is responsible for all required encroachment permits and conditions thereof.

1.5 OWNER'S OCCUPANCY REQUIREMENTS

A. Owner Occupancy: Owner will vacate the premises prior to Notice to Proceed to the start of construction and during the entire construction period.

1.6 WORK RESTRICTIONS

A. Nonsmoking Building: Smoking is not permitted within the building or within 25 feet (7.6 m) of entrances, operable windows, or outdoor air intakes.

1.7 SPECIFICATION FORMATS AND CONVENTIONS

A. Specification Format: The Specifications are organized into Divisions and Sections using the CSI/CSC's "Master Format" numbering system.
   1. Division 01: Sections in Division 01 govern the execution of the Work of all Sections in the Specifications.

B. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:
   1. Abbreviated Language: Language used in the Specifications and other Contract Documents is abbreviated. Words and meanings shall be interpreted as appropriate. Words implied, but not stated, shall be inferred as the sense requires. Singular words shall be interpreted as plural and plural words shall be interpreted as singular where applicable as the context of the Contract Documents indicates.

   2. Imperative mood and streamlined language are generally used in the Specifications. Requirements expressed in the imperative mood are to be performed by Contractor. Occasionally, the indicative or subjunctive mood may be used in the Section Text for clarity to describe responsibilities that must be fulfilled indirectly by Contractor or by others when so noted.

      a. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.

-END OF SECTION-

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01 25 13 - SUBSTITUTIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General Conditions and Supplemental General Conditions and other Division 01 General Requirements, apply to this Section.

1.2 SUMMARY

A. This Section specifies administrative and procedural requirements for handling requests for Substitutions.

B. Pre-bid substitutions will not be considered. No Substitution request will be accepted or considered by County prior to bid.

C. Procedural requirements governing the Contractor's selection of products and product options are included under General Requirements - Product Requirements.

1.3 DEFINITIONS

A. Definitions used in this Section are not intended to change or modify the meaning of other terms used in the Contract Documents.

B. Substitutions: Requests for changes in products, materials, equipment, and methods of construction required by Contract Documents are considered requests for "substitutions." Where phrases such as "or equal" or "or equal as approved by the Architect" occurs in the Contract Documents, do not assume that materials or equipment will be approved as equal unless the item has been specifically approved for this work by the Architect prior to Bid Opening Date, or as otherwise allowed in these Contract Documents.

The following are not considered substitutions:

1. Revisions to Contract Documents requested by the Owner or Architect.

2. Specified options of products and construction methods included in Contract Documents.

3. The Contractor's determination of and compliance with governing regulations and orders issued by governing authorities.

1.4 SUBMITTALS:

A. If the Contractor desires to use material or equipment other than that specified, they shall submit a request for approval of such substitution, in writing, to the

Construction Manager.

Product Substitutions for all Specification Sections must be requested within the time period specified in the general conditions. Substitution Request Form: Use CSI Form 13.1A.

B. Submit Substitution Request packages using the form provided and in a quantity to be returned to the Contractor plus four (4) copies of each request for substitution for review by the Architect.

C. Identify the product, or the fabrication or installation method to be replaced in each request. Include related Specification Section and Drawing numbers. Provide complete documentation showing compliance with the requirements for substitutions, and the following information, as appropriate:

1. Product Data, including Drawings and descriptions of products, fabrication and installation procedures.

2. Samples where applicable or requested.

3. A detailed, side-by-side comparison of the significant qualities of the proposed substitution with those of the Work specified. Significant qualities may include but is not necessarily limited to elements such as size, weight, durability, performance and visual effect.

4. Coordination information, including a list of changes or modifications needed to other parts of the Work and to construction performed by the Owner and separate Contractors will become necessary to accommodate the proposed substitution.

5. A statement indicating the substitution's effect on the Contractor's Construction Schedule compared to the schedule without approval of the substitution. Indicate the effect of the proposed substitution on overall Contract Time.

6. Cost information, including a proposal of the net change, if any, in the Contract Sum.

7. Certification by the Contractor that the substitution proposed is equal-to or better in every significant respect to that required by the Contract Documents, and that it will perform adequately in the application indicated. Include the Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of the failure of the substitution to perform adequately.

8. The Contractor warrants that they have investigated the proposed product and determined that it is equal to or superior in all respects to that indicated or specified.

9. The Contractor waives claim for additional costs and time associated with the proposed product, which may subsequently become apparent.

10. The Contractor shall provide a signed statement that the proposed product is in full compliance with the Contract Documents, and applicable regulatory requirements, requires no changes to specified controls and monitoring systems that may be specified in other Sections, and Certify that the Contractor will be responsible for coordination at no additional expense to the Owner

11. The Contractor shall provide information on availability of maintenance service, and source of replacement materials, and provide a sample of Manufacturer's standard form of guarantee or warranty for proposed product.

1.5 CONSTRUCTION MANAGER'S ACTION

A. Within ten (10) days of receipt of the request, the Construction Manager will notify the Contractor of acceptance or rejection of the proposed substitution. The Architect at their sole discretion will determine the acceptability of proposed products and their determination shall be final. If a decision on use of a proposed substitution cannot be made or obtained within the time allocated, use the product specified by name in the Contract Documents.

B. No consideration will be given to a substitute product unless, in the Architect's judgment, it complies with the following conditions.

1. Substitution Request is complete.

2. It is equal in quality, performance and serviceability.

3. Its use does not entail changes in details or related construction.

4. It is acceptable in regards to design and aesthetic effect.

5. There is a cost and/or time advantage to the Owner.

C. Acceptance of a product shall not relieve the Contractor from responsibility for the proper execution of the Work and any other requirements of the Contract Documents.

D. If a proposed product is not accepted, use the product originally specified or indicated in the Contract Documents.

E. No products other than those indicated or specified in the Contract Documents shall be purchased or incorporated in the Work without the Architect's prior

written acceptance.

PART 2 - PRODUCTS

2.1 SUBSTITUTIONS

A. Conditions: The Contractor's substitution request will be received and considered by the Architect when one (1) or more of the following conditions are satisfied, as determined by the Architect; otherwise requests will be returned without action except to record noncompliance with these requirements.

1. Extensive revisions to Contract Documents are not required.

2. Proposed changes are in keeping with the general intent of the Contract Documents.

3. The request is timely, fully documented and properly submitted.

4. The request is directly related to an "or equal" clause or similar language in the Contract Documents.

5. The Specified product or method of construction cannot be provided within the Contract Time. The request will not be considered if the product or method cannot be provided as a result of failure to pursue the Work promptly or coordinate activities properly.

6. The specified product or method of construction cannot receive necessary approval by a governing authority, and the requested substitution can be approved.

7. A substantial advantage is offered the Owner, in terms of cost, time, energy conservation or other considerations of merit, after deducting offsetting responsibilities the Owner may be required to bear. Additional responsibilities for the Owner may include additional compensation to the Architect for redesign and evaluation services, increased cost of other construction by the Owner or Separate Contractors, and similar considerations.

8. The specified product or method of construction cannot be provided in a manner that is compatible with other materials, and where the Contractor certifies that the substitution will overcome the incompatibility.

9. The specified product or method of construction cannot be coordinated with other materials, and where the Contractor certifies that the proposed substitution can be coordinated.

10. The specified product or method of construction cannot provide a

warranty required by the Contract Documents and where the Contractor certifies that the proposed substitution provides the required warranty.

B. The Contractor's submittal and Architect's acceptance of Shop Drawings, Product Data or Samples that relate to construction activities not complying with the Contract Documents, does not constitute an acceptable or valid request for substitution, nor does it constitute approval.

PART 3 - EXECUTION (not used)

-END OF SECTION-

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Advancement of Construction Technology

SUBSTITUTION REQUEST

(After the Bidding Phase)

Project: Insert project name

Substitution Request Number: For the Architect to fill in.

From: Insert your name and company name

To: Insert name of Architect, Engineer or GC

Date: Insert the current date

A/E Project Number: Fill in if you know the number

Re: Substitution request

Contract For: Insert your contract scope (in general)

Specification Title: Insert spec title from specification book

Description: Copy section title from specification

Section: Copy from spec book

Page: insert page Article/Paragraph: insert para

Proposed Substitution:

Manufacturer:

Address: Phone: insert plant phone number

Trade Name: Model No.:)

Installer: insert subs company Address: insert subs address Phone: insert subs phone number

History: ☐ New product ☐ 2-5 years old X☐ 5-10 years old ☐ More than 10 years old

Differences between proposed substitution and specified product:

X☐ Point-by-point comparative data attached - REQUIRED BY A/E.

Reason for not providing specified item:

Similar Installation:

Project: List a completed project Architect: Insert name of Architect on completed project

Address: Insert project address Owner: Insert name of Owner on completed project

Date Installed:

Proposed substitution affects other parts of Work: X ☐ No ☐ Yes; explain

Savings to Owner for accepting substitution: ($).

Proposed substitution changes Contract Time: ☐ No ☐ Yes [Add] [Deduct] days.

Supporting Data Attached: ☐ Drawings ☐ Product Data ☐ Samples ☐ Tests ☐ Reports ☐

SUBSTITUTION

REQUEST
(Continued)

The Undersigned certifies:

- Proposed substitution has been fully investigated and determined to be equal or superior in all respects to specified product.
- Same warranty will be furnished for proposed substitution as for specified product.
- Same maintenance service and source of replacement parts, as applicable, is available.
- Proposed substitution will have no adverse effect on other trades and will not affect or delay progress schedule.
- Cost data as stated above is complete. Claims for additional costs related to accepted substitution which may subsequently become apparent are to be waived.
- Proposed substitution does not affect dimensions and functional clearances.
- Payment will be made for changes to building design, including A/E design, detailing, and construction costs caused by the substitution.
- Coordination, installation, and changes in the Work as necessary for accepted substitution will be complete in all respects.

Submitted by: Insert submitters name, normally project manager for sub

Signed by: Submitter to sign

Firm: InsertSubmitters company name

Address: Insert

Telephone: Insert company phone number

Attachments: List name of attachments

A/E's REVIEW AND ACTION

☐ Substitution approved - Make submittals in accordance with Specification Section 01330.
☐ Substitution approved as noted - Make submittals in accordance with Specification Section 01330.
☐ Substitution rejected - Use specified materials.
☐ Substitution Request received too late - Use specified materials.

Signed by: Date:

Additional Comments: ☐ Contractor ☐ Subcontractor ☐ Supplier ☐ Manufacturer ☐ A/E ☐ _____

September 1996
CSI Form 13.1A

01 29 00 - PAYMENT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section specifies administrative and procedural requirements necessary to prepare and process Applications for Payment.

1.2 SCHEDULE OF VALUES

A. Coordination: Coordinate preparation of the Schedule of Values with preparation of Contractor's Construction Schedule.
   1. Correlate line items in the Schedule of Values with other required administrative forms and schedules, including; Application for Payment forms with Continuation Sheets, Submittals Schedule and Contractor's Construction Schedule.
   2. Submit the Schedule of Values to the Construction Manager at earliest possible date but no later than seven (7) days before the date scheduled for submittal of initial Applications for Payment.
   3. Sub schedules: Where the Work is separated into phases requiring separately phased payments, provide sub schedules showing values correlated with each phase of payment.

B. Format and Content: Use the Project Manual table of contents as a guide to establish line items for the Schedule of Values. Provide at least one-line item for each Specification Section.
   1. Identification: Include the following Project identification on the Schedule of Values:
      a. Project name and location.
      b. Name of Architect.
      c. Architect's project number.
      d. Contractor's name and address.
      e. Date of submittal.
   2. Submit draft of AIA Document G703 Continuation Sheets.
   3. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Coordinate with the Project Manual table of contents. Provide several line items for principal subcontract amounts, where appropriate. (Include separate line items under required principal subcontracts for operation and maintenance manuals, punch list activities, Project Record Documents, and demonstration and training in the amount of 5 percent of the Contract Sum.)
   4. Round amounts to nearest whole dollar; total shall equal the Contract Sum.
   5. Provide a separate line item in the Schedule of Values for each part of the Work where Applications for Payment may include materials or equipment purchased or fabricated and stored, but not yet installed.

6. Provide separate line items in the Schedule of Values for initial cost of materials, for each subsequent stage of completion, and for total installed value of that part of the Work.
7. Allowances: Provide a separate line item in the Schedule of Values for each allowance. Show line-item value of unit-cost allowances, as a product of the unit cost, multiplied by measured quantity. Use information indicated in the Contract Documents to determine quantities.
8. Each item in the Schedule of Values and Applications for Payment shall be complete. Include total cost and proportionate share of general overhead and profit for each item.
    a. Temporary facilities and other major cost items that are not direct cost of actual work-in-place may be shown either as separate line items in the Schedule of Values or distributed as general overhead expense, at Contractor's option.
9. Schedule Updating: Update and resubmit the Schedule of Values before the next Applications for Payment when Change Orders or Construction Change Directives result in a change in the Contract Sum.

1.3 APPLICATIONS FOR PAYMENT

A. Each Application for Payment shall be consistent with previous applications and payments as certified by Construction Manager and paid for by Owner.
    1. Initial Application for Payment, Application for Payment at time of Substantial Completion, and final Application for Payment involve additional requirements.

B. Payment Application Times: The date for each progress payment is indicated in the Agreement between Owner and Contractor. The period of construction Work covered by each Application for Payment is the period indicated in the Agreement.

C. Payment Application Times: Progress payments shall be submitted to CM by the 25th of the month. Provide a “draft copy” of proposed % complete values for review by the Construction Manager, Architect and Owner. The period covered by each Application for Payment is one month, ending on the last day of the month.

D. Payment Application Forms: Use forms provided by Owner as form for Applications for Payment.

E. Application Preparation: Complete every entry on form. Notarize and execute by a person authorized to sign legal documents on behalf of Contractor. Architect will return incomplete applications without action.
    1. Entries shall match data on the Schedule of Values and Contractor's Construction Schedule. Use updated schedules if revisions were made.
    2. Include amounts of Change Orders and Construction Change Directives issued before last day of construction period covered by application.

F. Transmittal: Upon approval of the “draft copy” by the Construction Manager, Architect and Owner, submit a signed and notarized original copy of each Application for

Payment to the Construction Manager by a method ensuring receipt (within 24 hours). Submittal shall include waivers of lien and similar attachments if required.

1. Transmit each copy with a transmittal form listing attachments and recording appropriate information about application.
2. Contractor shall submit a Construction Schedule Update (hard copy and electronic copy) in accordance with Section 01 32 16 (Construction Progress Documentation) along with the final copies of each months Application for Payment.
3. Contractor shall submit copies of the current months Photographic Documentation (electronic copy) in accordance with Section 01 32 33 (Photographic Documentation) along with the final copies of each months Application for Payment.

G. Waivers of Mechanic's Lien: With each Application for Payment, submit waivers of mechanic's lien from every entity who is lawfully entitled to file a mechanic's lien arising out of the Contract and related to the Work covered by the payment.

1. Submit partial waivers on each item for amount requested in previous application, after deduction for retainage, on each item.
2. When an application shows completion of an item, submit final or full waivers.
3. Owner reserves the right to designate which entities involved in the Work must submit waivers.
4. Waiver Forms: Submit waivers of lien on forms, executed in a manner acceptable to Owner.

H. Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of first Application for Payment include the following:

1. List of subcontractors.
2. Schedule of Values.
3. Contractor's Construction Schedule (preliminary, if not final).
4. Schedule of unit prices.
5. Submittals Schedule (preliminary, if not final).
6. List of Contractor's staff assignments.
7. List of Contractor's principal consultants.
8. Copies of building permits.
9. Copies of authorizations and licenses from authorities having jurisdiction for performance of the Work.
10. Initial progress report.
11. Report of preconstruction conference.
12. Certificates of insurance and insurance policies.

I. Application for Payment at Substantial Completion: After issuing the Certificate of Substantial Completion, submit an Application for Payment showing 100 percent (100%) completion for portion of the Work claimed as substantially complete.

1. Include documentation supporting claim that the Work is substantially complete and a statement showing an accounting of changes to the Contract Sum.

2. This application shall reflect Certificates of Partial Substantial Completion issued previously for Owner occupancy of designated portions of the Work.

J. Final Payment Application: Submit final Application for Payment with releases and supporting documentation not previously submitted and accepted, including, but not limited, to the following:
   1. Evidence of completion of Project closeout requirements.
   2. Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.
   3. Updated final statement, accounting for final changes to the Contract Sum.
   4. AIA Document G706-1994, "Contractor's Affidavit of Payment of Debts and Claims."
   5. AIA Document G706A-1994, "Contractor's Affidavit of Release of Liens."
   6. AIA Document G707-1994, "Consent of Surety to Final Payment."
   7. Evidence that claims have been settled.
   8. Final meter readings for utilities, a measured record of stored fuel, and similar data as of date of Substantial Completion or when Owner took possession of and assumed responsibility for corresponding elements of the Work.
   9. Final, liquidated damages settlement statement.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

- END OF SECTION –

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01 31 00 - PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:
   1. Coordination Drawings.
   2. Project meetings.
   3. Requests for Interpretation (RFIs).
   4. Project Web site (web-based project management software).

B. See Section 01 73 00 "Execution Requirements" for procedures for coordinating general installation and field-engineering services, including establishment of benchmarks and control points.

1.2 DEFINITIONS

A. RFI: Request For Information from Contractor seeking interpretation or clarification of the Contract Documents.

1.3 WEB-BASED PROJECT MANAGEMENT SOFTWARE

A. Software: Prolog Converge will be the software package utilized to manage the following processes:
   1. Requests for Information
   2. Submittals
   3. Change Management Documentation
   4. Daily Report Management
   5. Meeting Notes
   6. Document Management (including Photos)
   7. Close-Out Submittals

B. The Contractor will be required to utilize Converge for all of the above processes. The Contractor may, at their option, utilize their own software for their own management purposes, but data must still be entered into the Prolog Converge web based software. Data entered into other management systems will not be recognized by the project team.

C. Licenses: Three (3) Licenses will be provided to the Contractor at no cost. Additional licenses will be available at a cost of $60 per month per license.

1.4 COORDINATION

A. Coordination: Coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations, included in different Sections that depend on each other for proper installation, connection, and operation.

1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
2. Coordinate installation of different components with other contractors to ensure maximum accessibility for required maintenance, service, and repair.
3. Make adequate provisions to accommodate items scheduled for later installation.
4. Where availability of space is limited, coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair of all components, including mechanical and electrical.

B. Prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings.
   1. Prepare similar memoranda for Owner and separate contractors if coordination of their Work is required.

C. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities and activities of other contractors to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:
   1. Preparation of Contractor's Construction Schedule.
   2. Preparation of the Schedule of Values.
   3. Installation and removal of temporary facilities and controls.
   4. Delivery and processing of submittals.
   5. Progress meetings.
   6. Pre-installation conferences.
   7. Project closeout activities.
   8. Startup and adjustment of systems.
   9. Project closeout activities.

1.5 SUBMITTALS

A. Coordination Drawings: Prepare Coordination Drawings if limited space availability necessitates maximum utilization of space for efficient installation of different components or if coordination is required for installation of products and materials fabricated by separate entities.
   1. Content: Project-specific information, drawn accurately to scale. Do not base Coordination Drawings on reproductions of the Contract Documents or standard printed data. Include the following information, as applicable:
      a. Indicate functional and spatial relationships of components of architectural, structural, civil, mechanical, and electrical systems.
      b. Indicate dimensions shown on the Contract Drawings and make specific note of dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide alternate sketches to Architect for resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.

2. Sheet Size: At least 8-1/2 by 11 inches (215 by 279 mm) but no larger than 30 by 42 inches (750 by 1067 mm).
3. Number of Copies: Submit electronic files for each submittal and produce hard copies as required by the Architect.
4. Refer to individual Sections for Coordination Drawing requirements for Work in those Sections.

1.6 PROJECT MEETINGS

A. General: Schedule and conduct meetings and conferences at Project site, unless otherwise indicated.
   1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Owner, Construction Manager and Architect of scheduled meeting dates and times.
   2. Agenda: Prepare the meeting agenda. Distribute the agenda to all invited attendees.
   3. Minutes: Record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner, Construction Manager and Architect, within three (3) days of the meeting.

B. Preconstruction Conference: Schedule a preconstruction conference before starting construction, at a time convenient to Owner but no later than fifteen (15) days after execution of the Agreement. Hold the conference at Project site or another convenient location. Conduct the meeting to review responsibilities and personnel assignments.
   1. Attendees: Authorized representatives of Owner, Construction Manager, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. All participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
   2. Agenda: Discuss items of significance that could affect progress, including the following:
      a. Tentative construction schedule.
      b. Phasing.
      c. Critical work sequencing and long-lead items.
      d. Designation of key personnel and their duties.
      e. Procedures for processing field decisions and Change Orders.
      f. Procedures for RFIs.
      g. Procedures for testing and inspecting.
      h. Procedures for processing Applications for Payment.
      i. Distribution of the Contract Documents.
      j. Submittal procedures.
      k. LEED requirements.
      l. Preparation of Record Documents.
      m. Use of the premises and existing buildings.
      n. Work restrictions.
      o. Owner's occupancy requirements.
      p. Responsibility for temporary facilities and controls.
      q. Construction waste management and recycling.

r. Parking availability.
s. Office, work, and storage areas.
t. Equipment deliveries and priorities.
u. First aid.
v. Security.
w. Progress cleaning.
x. Working hours.

3. Notes: Construction Manager or Architect will record and distribute meeting notes.

C. Progress Meetings: Construction Manager will conduct progress meetings at **weekly** intervals. Coordinate dates of meetings with preparation of payment requests.

1. Attendees: In addition to representatives of Owner, Construction Manager and Architect, each subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. General Contractor's designated Project Manager and Superintendent must attend all Progress Meetings in addition to all other project related meetings. All participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
2. Agenda: Review and correct or approve notes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.
   a. Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's Construction Schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
      1) Review schedule for next period.
   b. Review present and future needs of each entity present, including the following:
      1) Interface requirements.
      2) Sequence of operations.
      3) Status of submittals.
      4) Deliveries.
      5) Off-site fabrication.
      6) Access.
      7) Site utilization.
      8) Temporary facilities and controls.
      9) Work hours.
      10) Hazards and risks.
      11) Progress cleaning.
      12) Quality and work standards.
      13) Status of correction of deficient items.
      14) Field observations.
      15) Status of RFIs.

16) Status of proposal requests.
17) Pending changes.
18) Status of Change Orders.
19) Pending claims and disputes.
20) Documentation of information for payment requests.

3. Notes: Construction Manager will conduct the meeting will record and distribute meeting notes to Owner, Architect and Contractor.
4. Reporting: Distribute notes of the meeting to each party present and to parties who should have been present.
   a. Schedule Updating: Contractor shall update the Construction Schedule after each progress meeting where revisions to the schedule have been made or recognized.

1.7 REQUESTS FOR INTERPRETATION (RFIs)

A. Procedure: Immediately on discovery of the need for interpretation of the Contract Documents, and if not possible to request interpretation at Project meeting, prepare and submit an RFI via the web-based project management software.
   1. RFIs shall originate with Contractor. RFIs submitted by entities other than Contractor will be returned with no response.
   2. RFIs shall be submitted to the Construction Manager in the specified format.
   3. Coordinate and submit RFIs in a prompt manner so as to avoid delays in Contractor's work or work of subcontractors.

B. Content of the RFI: Include a detailed, legible description of item needing interpretation and the following:
   1. Project name.
   2. Project number
   3. Date.
   4. Name of Contractor.
   5. Name of Architect and Construction Manager.
   6. RFI number, numbered sequentially.
   7. Specification Section number and title and related paragraphs, as appropriate.
   8. Drawing number and detail references, as appropriate.
   9. Field dimensions and conditions, as appropriate.
   10. Contractor's suggested solution(s). If Contractor's solution(s) impact the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
   11. Contractor's signature.
   12. Attachments: Include drawings, descriptions, measurements, photos, Product Data, Shop Drawings, and other information necessary to fully describe items needing interpretation.

C. Architect's Action: Architect will review each RFI, determine action required, and return it. Allow fourteen (14) working days for Architect's response for each RFI. RFIs received after 1:00 p.m. will be considered as received the following working day.
   1. The following RFIs will be returned without action:
      a. Requests for approval of submittals.

b. Requests for approval of substitutions.
c. Requests for coordination information already indicated in the Contract Documents.
d. Requests for adjustments in the Contract Time or the Contract Sum.
e. Requests for interpretation of Architect's actions on submittals.
f. Incomplete RFIs or RFIs with numerous errors.

2. Architect's action may include a request for additional information, in which case Architect's time for response will start again.
3. Architect's action on RFIs that may result in a change to the Contract Time or the Contract Sum may be eligible for Contractor to submit Change Proposal according to **procedures defined in the General Condition, Section 2. Contract Modifications.**
   a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Architect in writing within ten (10) days of receipt of the RFI response.

D. On receipt of Architect's action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify Architect within seven (7) days if Contractor disagrees with response.

E. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Submit log (CSI Log Form 13.2B) weekly. Include the following:
1. Project name.
2. Name and address of Contractor.
3. Name and address of Architect.
4. RFI number including RFIs that were dropped and not submitted.
5. RFI description.
6. Date the RFI was submitted.
7. Date Architect's response was received.
8. Identification of related Minor Change in the Work, Construction Change Directive, and Proposal Request, as appropriate.
9. Identification of related Field Order, Work Change Directive, and Proposal Request, as appropriate.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

-END OF SECTION-

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01 32 16 - CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS AND PROVISIONS

All Contract Documents should be reviewed for applicable provisions related to the provisions in this document, including without limitation:

A. General Conditions;

B. Special Conditions;

C. Summary of Work; and

D. Submittals.

1.2 SECTION INCLUDES

A. Scheduling of Work under this Contract shall be performed by Contractor in accordance with requirements of this Section.

1. Development of Project Schedule (including Initial, Baseline, and Progress Schedule). Contractor shall employ computerized Critical Path Method ("CPM") scheduling ("CPM Schedule").

2. Work Plan Cash Flow of the schedule shall be:

(a) Related to the Project Schedule of Values as approved by the Owner.

(b) Represent the intended work plan cash-flow.

(c) The basis of Earned Value assessment.

3. Submit schedules and reports as specified in the General Conditions.

4. Scheduling best practices identifying technical issues and project float.

B. Time Impacts including directed scope additions, unexpected critical impacts, inclement weather, and defined liability assignments.

C. Earned Value Management including schedule health assessment, forecast completion estimation, and schedule efficiency performance indicators.

D. Monthly Schedule Reporting.

1.3 QUALIFICATIONS

A. Contractor shall employ experienced scheduling personnel qualified to use the latest version of Primavera P6 Professional or approved equivalent software. Experience level required is set forth below. Contractor may employ such personnel directly or may employ a consultant for this purpose.

1. Project Scheduler qualifications shall be submitted in writing at the Notice of Intent to Award.

2. The written statement shall identify the individual who will perform CPM scheduling and experience shall be verified by description of construction projects on which individual has successfully applied computerized CPM.

3. Required level of experience shall include at least two (2) projects of similar nature and scope, with a minimum of five (5) years of verifiable experience. The written statement shall provide contact persons for referenced projects with current telephone and address information.

4. Project Scheduler with capability of producing schedule reports and diagrams within 24 hours of Owner's request.

B. County reserves the right to approve or reject Contractor's scheduler or consultant at any time. County reserves the right to refuse replacing of Contractor's scheduler or consultant, if County believes replacement will negatively affect the scheduling of Work under this Contract.

1.4 GENERAL

A. Project Schedule shall be based on and incorporate milestone and completion dates specified in Contract Documents.

B. Overall time of completion and time of completion for each milestone shown on Project Schedule shall adhere to times in the Contract, unless an earlier (advanced) time of completion is requested by Contractor and agreed to by County. Any such agreement shall be formalized by a Change Order.

1. County is not required to accept an early completion schedule, i.e., one that shows an earlier completion date than the Contract Time.

2. Contractor shall not be entitled to extra compensation in event agreement is reached on an earlier completion schedule and Contractor completes its Work, for whatever reason, beyond completion date shown in its early completion schedule but within the Contract Time.

3. A schedule showing the work completed in less than the Contract Time, and that has been accepted by County, shall be considered to have Project Float. The Project Float is the time between the scheduled completion of the work and the Completion Date. Project Float is a resource available to both County and the Contractor.

C. Ownership Project Float: Neither the County nor Contractor owns Project Float. The Project owns the Project Float. As such, liability for delay of the Completion Date rests with the party whose actions, last in time, actually cause delay to the Completion Date.

1. Float defined as the amount of time between the early start date and the late start date, or the early finish date and the late finish date, of any of the activities in the schedule. Float is not for the exclusive use of or benefit of either the Owner or the Contractor, but its use shall be determined solely by the Owner.

2. Free float is the amount of time an activity can be delayed without adversely affecting the early start of the successor activity.

3. For example, if Party A uses some, but not all of the Project Float and Party B later uses remainder of the Project Float as well as additional time beyond the Project Float, Party B shall be liable for the time that represents a delay to the Completion Date.

4. Party A would not be responsible for the time since it did not consume the entire Project Float and additional Project Float remained; therefore, the Completion Date was unaffected by Party A.

D. The Project Schedule shall be the basis for evaluating job progress, payment requests, and time extension requests. The Contractor is responsible for developing the based on the critical path method (CPM), logical activity duration derivation, using standard scheduling best practices, and logical sequence of execution.

E. Failure of the Project Schedule to include any element of the Work, or if there are any inaccuracies, will not relieve Contractor from the responsibility of accomplishing the Work in accordance with the Contract. County's acceptance of schedule shall be for its use in monitoring and evaluating job progress, payment requests, and time extension requests and shall not, in any manner, impose a duty of care upon County, or act to relieve Contractor of its responsibility for means and methods of construction.

F. Recommended scheduling software is the latest version of Primavera P6 or an approved equivalent. Contractor shall transmit contract file to County on USB flash drive or project management system at times requested by County.

G. Transmit each item under the form approved by County.

1. Identify Project with County Contract number and name of Contractor as well as the data date.

2. Provide space for Contractor's approval stamp and County's review stamps.

3. Submittals received from sources other than Contractor will be returned to the Contractor without County's review.

1.5 INITIAL SCHEDULE (90-day)

A. At the Notice to Proceed, Contractor shall immediately commence development of Initial and Baseline Schedules to ensure compliance with Project Schedule submittal requirements.

B. Within fourteen (14) calendar days of the Notice to Proceed and before request for first progress payment, the Contractor shall prepare and submit to the Owner an Initial Schedule conforming to, and containing, the milestones required by the Contract Documents.

C. The Initial Schedule is the basis for the subsequent Baseline Schedule.

D. Indicate detailed plan for the Work to be completed in first ninety (90) days of the Contract; details of planned mobilization of equipment; sequence of early operations; procurement of materials and equipment. Show Work beyond ninety (90) calendar days in summary form.

E. Initial Schedule shall be time scaled.

F. County and Contractor shall meet to review and discuss the Initial Schedule within seven (7) calendar days after it has been submitted to County.

1. County's review and comment on the schedule shall be limited to Contract conformance (with sequencing, coordination, and milestone requirements).

2. Contractor shall make corrections to schedule necessary to comply with Contract requirements and shall adjust schedule to incorporate any missing information requested by County. Contractor shall resubmit Initial Schedule if requested by County.

3. Prescheduling Conference: Conduct conference at Project site to review methods and procedures related to the Preliminary Construction Schedule and Contractor's Construction Schedule, including, but not limited to, the following:

(a) Review software limitations and content and format for reports.

(b) Verify availability of qualified personnel needed to develop and update schedule.

(c) Discuss constraints, including phasing, work stages, area separations, interim milestones, and partial Owner occupancy.

(d) Review delivery dates for Owner-furnished products.

(e) Review schedule for work of Owner's separate contracts.

(f) Review time required for review of submittals and resubmittals.

(g) Review requirements for tests and inspections by independent testing and inspecting agencies.

(h) Review time required for completion and startup procedures.

(i) Review time required for Project closeout and Owner startup procedures, including commissioning activities.

(j) Review and finalize list of construction activities to be included in schedule.

(k) Review submittal requirements and procedures.

(l) Review procedures for updating schedule.

1.6 BASELINE SCHEDULE

A. Contractor shall, within thirty (30) calendar days from the Notice to Proceed date, submit a detailed proposed Baseline Schedule presenting an orderly and realistic plan for completion of the Work in conformance with requirements as specified herein.

B. The Baseline Schedule shall include or comply with following requirements:

1. No activity on schedule shall have duration longer than fifteen (15) work days, with exception of submittal, approval, fabrication and procurement activities, unless otherwise approved by County.

(a) Activity durations shall be total number of actual work days required to perform that activity.

(b) It is recommended activity durations are derived using one of the following best practices methods:

1) Analogous

2) Parametric

3) PERT Method

2. Constraints: Should be limited to 'start on or after' or 'finish on or before'.

3. Phasing: Arrange list of activities on schedule by phase.

4. Work under More Than One Contract: Include a separate activity for each contract.

5. Work by Owner: Include a separate activity for each portion of the Work performed by Owner.

6. Products Ordered in Advance: Include a separate activity for each product. Delivery dates indicated stipulate the earliest possible delivery date.

7. Owner-Furnished Products: Include a separate activity for each product. Delivery dates indicated stipulate the earliest possible delivery date.

8. Work Stages: Indicate important stages of construction for each major portion of the Work, including, but not limited to, the following:

   (a) Submittals.

   (b) Purchases.

   (c) Mockups.

   (d) Fabrication.

   (e) Sample testing.

   (f) Deliveries.

   (g) Installation.

   (h) Tests and inspections.

   (i) Adjusting.

   (j) Curing.

   (k) Building flush-out.

   (l) Startup and placement into final use and operation.

   (m) Commissioning.

9. Construction Areas: Identify each major area of construction for each major portion of the Work. Indicate where each construction activity within a major area must be sequenced or integrated with other construction activities to provide for the following:

    (a) Structural completion.

    (b) Permanent space enclosure.

    (c) Completion of mechanical installation.

    (d) Completion of electrical installation.

    (e) Substantial Completion.

10. County furnished materials and equipment, if any, identified as separate activities.

11. Activities for maintaining Project Record Documents.

12. Dependencies (or relationships) between activities.

    (a) Relationships shall consist of finish-start, finish-finish, and start-start only.

    (b) Open-end activities should be seen on the Notice to Proceed (NTP) and Final Completion milestones only.

    (c) Finish-start relationships with positive lag are not allowed.

    (d) Negative lag is not allowed.

13. Processing/approval of submittals and shop drawings for all material and equipment required per the Contract. Activities that are dependent on submittal acceptance or material delivery shall not be scheduled to start earlier than expected acceptance or delivery dates.

    (a) Include time for submittals, re-submittals and reviews by County. Coordinate with accepted schedule for submission of Shop Drawings, samples, and other submittals.

    (b) Contractor shall be responsible for all impacts resulting from re-submittal of Shop Drawings and submittals.

14. Procurement of major equipment, through receipt and inspection at jobsite, identified as separate activity.

    (a) Include time for fabrication and delivery of manufactured

products for the Work.

(b) Show dependencies between procurement and construction.

15. Activity description; what Work is to be accomplished avoiding duplicates.

16. The Work Plan Cash Flow will provide the cash flow used as the basis for subsequent earned value metric calculation. The total cost of performing each activity shall be total of labor, material, and equipment, as well as overhead and profit of Contractor. Sum of cost for all activities shall equal total Contract value and be correlated with the Schedule of Values.

    (a) The intent is to identify the monthly cash-flow for the duration of the project.

17. Responsibility code for each activity corresponding to Contractor or Subcontractor responsible for performing the Work.

18. Identify the activities which constitute the controlling operations or critical path. No more than twenty-five (25%) of the activities shall be critical or near critical. Near critical is defined as float in the range of one (1) to (10) days.

19. Twenty (20) working days for developing punch list(s), completion of punch-list items, and final clean-up for the Work or any designated portion thereof. No other activities shall be scheduled during this period.

20. Interface with, and coordinate, the work of other contractors, County, and agencies such as, but not limited to, utility companies.

21. Show detailed Subcontractor Work activities. In addition, furnish copies of Subcontractor schedules upon which the Project Schedule was built.

    (a) Also furnish for each Subcontractor, as determined by County, submitted on Subcontractor letterhead, a statement certifying that Subcontractor concurs with Contractor's Baseline Schedule and that Subcontractor's related schedules have been incorporated, including activity duration, cost and resource loading.

    (b) Subcontractor schedules shall be independently derived and not a copy of Contractor's schedule.

    (c) In addition to Contractor's schedule, obtain from electrical, mechanical, and plumbing Subcontractors, and other

Subcontractors as required by County, productivity calculations common to their trades, such as units per person day, feet of pipe per day per person, feet of wiring per day per person, and similar information.

(d) Furnish schedule for Contractor/Subcontractor schedule meetings which shall be held prior to submission of Baseline Schedule to County. County shall be permitted to attend scheduling meetings as an observer.

22. Activity durations shall be in Work days.

23. Submit with the schedule a list of anticipated non-Work days, such as weekends and holidays. The Project Schedule shall exclude in its Work day calendar all non-Work days on which Contractor anticipates critical Work will not be performed.

24. The anticipated days lost due to weather shall be included as a single Adverse Weather Allowance activity with a duration defined in table below prorated for the length of the project and based on NOAA historical data. The duration shall be in working days and be the predecessor to the Substantial Completion milestone on the critical path. Adverse weather day impacts will be managed as prescribed in section 1.12F.

Month	Adverse Weather Allowance (days)
January	6
February	7
March	6
April	4
May	1
June	0
July	0
August	0
September	0
October	2
November	4
December	8

C. Baseline Schedule Review Meeting: Contractor shall, within fourteen (14) calendar days from the Notice to Proceed date, meet with County to review the Baseline Schedule submittal.

1. Contractor shall have its Project Manager, Project Superintendent, Project Scheduler, and key Subcontractor representatives, as required by County, in attendance. The meeting will take place over a continuous one (1) day period.

2. County's review will be limited to submittal's conformance to Contract requirements including, but not limited to, coordination requirements. However, review may also include:

   (a) Clarifications of Contract Requirements.

   (b) Directions to include activities and information missing from submittal.

   (c) Requests to Contractor to clarify its schedule.

3. Within seven (7) calendar days of the Schedule Review Meeting, Contractor shall respond in writing to all questions and comments expressed by County at the Meeting.

1.7 BASELINE SCHEDULE REVISIONS

A. Adjustments to Baseline Schedule: Contractor shall have adjusted the Baseline Schedule submittal to address all review comments from Baseline Schedule review meeting and resubmit network diagrams and reports for County's review.

   1. County, within fourteen (14) calendar days from date that Contractor submitted the revised schedule, will either:

      (a) Accept schedule as submitted, or

      (b) Advise Contractor in writing to review any part or parts of schedule which either do not meet Contract requirements or are unsatisfactory for County to monitor Project's progress, resources, and status or evaluate monthly payment request by Contractor.

   2. When schedule is accepted, it shall be considered the "Baseline Schedule" which will then be immediately updated to reflect the current status of the work.

   3. County reserves right to require Contractor to adjust, add to, or clarify any portion of schedule which may later be discovered to be insufficient for monitoring of Work or approval of partial payment requests. No additional compensation will be provided for such adjustments,

additions, or clarifications.

B. Acceptance of Contractor's schedule by County will be based solely upon schedule's compliance with Contract requirements.

1. By way of Contractor assigning activity durations and proposing sequence of Work, Contractor agrees to utilize sufficient and necessary management and other resources to perform work in accordance with the schedule.

2. Upon submittal of schedule update, updated schedule shall be considered "current" Project Schedule.

3. Submission of Contractor's schedule to County shall not relieve Contractor of total responsibility for scheduling, sequencing, and pursuing Work to comply with requirements of Contract Documents, including adverse effects such as delays resulting from ill-timed Work.

C. Submittal of Baseline Schedule, and subsequent schedule updates, shall be understood to be Contractor's representation that the Schedule meets requirements of Contract Documents and that Work shall be executed in sequence indicated on the schedule.

D. Contractor shall distribute Baseline Schedule to Subcontractors for review and written acceptance, which shall be noted on Subcontractors' letterheads to Contractor and transmitted to County for the record.

1.8 PROGRESS SCHEDULE (MONTHLY SCHEDULE UPDATE)

A. Following acceptance of Contractor's Baseline Schedule, Contractor shall monitor progress of Work and adjust schedule on at least a monthly basis to reflect actual progress and any anticipated changes to planned activities.

1. Each schedule update submitted shall be complete, including all information requested for the Baseline Schedule submittal.

2. Each update shall continue to show all work activities including those already completed. These completed activities shall accurately reflect "as built" information by indicating when activities were actually started and completed. The "as-built" activities shall be reviewed and accepted prior to the update schedule review.

B. A meeting will be held on approximately the twenty-fifth (25th) of each month to review the schedule update submittal and progress payment application.

1. At this meeting, at a minimum, the following items will be reviewed: Percent (%) complete of each activity; Time Impact Evaluations for Change Orders and Time Extension Request; actual and anticipated

activity sequence changes; actual and anticipated duration changes; and actual and anticipated Contractor delays.

2. These meetings are considered a critical component of overall monthly schedule update submittal and Contractor shall have appropriate personnel attend. At a minimum, these meetings shall be attended by Contractor's General Superintendent and Scheduler.

3. Contractor shall plan on the meeting taking no less than four (4) hours.

C. Within five (5) working days after monthly schedule update meeting, Contractor shall submit the Progress Schedule.

D. Within five (5) work days of receipt of above noted revised submittals, County will either accept or reject Progress Schedule.

E. Neither updating, changing or revising of any report, curve, schedule, or narrative submitted to County by Contractor under this Contract, nor County's review or acceptance of any such report, curve, schedule or narrative shall have the effect of amending or modifying in any way the Completion Date or milestone dates or of modifying or limiting in any way Contractor's obligations

1.9 PROGRESS SCHEDULE REVIEW AND REVISIONS

A. County, within seven (7) days from date that Contractor submitted the schedule update, will either:

1. Accept schedule as submitted, or

2. Advise Contractor in writing to review any part or parts of schedule which either do not meet Contract requirements or are unsatisfactory for County to monitor Project's progress, resources, and status or evaluate monthly payment request by Contractor.

B. Updating the Project Schedule to reflect actual progress shall not be considered revisions to the Schedule.

C. To reflect revisions to the Schedule, the Contractor shall provide County with a written narrative with a full description and reasons for each Work activity revised. For revisions affecting the sequence of work, the Contractor shall provide a schedule diagram which compares the original sequence to the revised sequence of work. The Contractor shall provide the written narrative and schedule diagram for revisions two (2) working days in advance of the monthly schedule update meeting.

D. Schedule revisions shall not be incorporated into any schedule update until the revisions have been reviewed by County. County may request further

information and justification for schedule revisions and Contractor shall, within three (3) working days, provide County with a complete written narrative response to County's request.

E. If the Contractor's revision is still not accepted by County, and the Contractor disagrees with County's position, the Contractor has seven (7) calendar days from receipt of County's letter rejecting the revision to provide a written narrative providing full justification and explanation for the revision. The Contractor's failure to respond in writing within seven (7) calendar days of County's written rejection of a schedule revision shall be contractually interpreted as acceptance of County's position, and the Contractor waives its rights to subsequently dispute or file a claim regarding County's position.

F. At County's discretion, the Contractor can be required to provide Subcontractor certifications of performance regarding proposed schedule revisions affecting said Subcontractors.

1.10 RECOVERY SCHEDULE

A. A Recovery Schedule will be submitted when a delay of fourteen (14) calendar days or more to the Final Completion milestone is identified.

B. The Recovery Schedule is herein defined as the Contractor plan to reconcile current delay days to complete the project on the contract completion date.

1.11 COMPLETION SCHEDULE

A. If schedule performance, estimated through earned value analysis, is forecasting a trending delay of greater than 21 days over 3 or more months, the Contractor and PMCM will meet to discuss remediation through a Completion Schedule.

B. The Completion Schedule is herein defined as the Contractor plan to establish a project completion date when the current Final Completion date is deemed no longer achievable. When this happens, the Contractor will submit a schedule to complete that demonstrates a new probable project completion (for example, using cash flow analysis).

1.12 PROJECT DELAYS

A. Time Allowances

0. Time is of the essence. Contract Time may only be changed by Change Order, and all time limits stated in the Contract Documents are to mean that time is of the essence.

B. Excusable Delay and Inexcusable Delay Defined

0. In the event the Contractor requests an extension of Contract Time for unavoidable delay, such request shall be submitted in accordance with the

provisions in the Contract Documents governing Claims and Disputes (Division F, Section 33 and 34). When requesting time, requests must be submitted with full justification and documentation.

If the Contractor fails to submit justification, it waives its right to a time extension at a later date. Such justification must be based on the official Construction Schedule as updated at the time of occurrence of the delay or execution of Work related to any changes to the Scope of Work. Any Claim for delay must include the following information as support, without limitation.

1. Excusable Delay. Subject to the provisions on Notice of Delay below, Contract Time may be adjusted in an amount equal to the time lost due to:

   (a) Changes in the Work ordered by County ("Changes");

   (b) Acts or neglect by County, Architect/Engineer, any County Representative, utility owners or other contractors performing other work, not permitted or provided for in the Contract Documents, provided that Contractor has performed its responsibilities under the Contract Documents (including but not limited to pre-bid investigations) ("Acts or Neglect"); or

   (c) Fires, floods, epidemics, **pandemics,** quarantines, abnormal weather conditions beyond the parameters otherwise set forth in this Article, earthquakes, civil or labor disturbances, **acts of war or terrorism**, or acts of God (together, "force majeure events"), provided damages resulting therefrom are not the result of Contractor's failure to protect the Work as required by Contract Documents ("Force Majeure").

   (d) Work delayed which is out of the control of the Contractor may be an Excusable Delay.

2. Inexcusable Delay. Contract Time shall not be extended for any period of time where Contractor (and/or any Subcontractor) is delayed or prevented from completing any part of the Work due to a cause that is within Contractor's risk or responsibility under the Contract Documents. Delays attributable to or within the control of a Subcontractor, or its subcontractors, or supplier, are deemed delays within the control of Contractor.

   (a) Work delayed which is in the control of the Contractor is an Inexcusable Delay.

3. Float. Float shall be treated as a Project resource. Contractor shall not be

entitled to a time extension for impacts that consume float, but do not impact the critical path.

C. Notice of Delay

1. Within seven (7) calendar days of the beginning of any delay (excepting adverse weather delays), Contractor shall notify County in writing, by submitting a Notice of Delay that shall describe the anticipated delays resulting from the delay event in question. If Contractor requests an extension of time, Contractor shall submit a Time Impact Evaluation (TIE) within 10 calendar days of the Notice of Delay. County will determine all claims and adjustments in the Contract Time. No claim for an adjustment in the Contract Time will be valid and such claim will be waived if not submitted in accordance with the requirements of this subparagraph. In cases of substantial compliance with the seven- day notice requirement here (but not to exceed twenty-one calendar days from the beginning of the delay event), County may in its sole discretion recognize a claim for delay accompanied with the proper TIE, provided Contractor also shows good faith and a manifest lack of prejudice to County from the late notice. Contractor will follow the guidelines set forth in section 1.13 and include description of activities impacted by the delay, including the activity ID.

D. Compensable Time Extensions

1. Subject to other applicable provisions of the Contract Documents, Contractor may be entitled to adjustment in Contract Sum in addition to Contract Time only when all of the following conditions are met:

(a) The Owner is the sole cause of the delay to the current critical path;

(b) The delay is unreasonable under the circumstances involved;

(c) The delay was not within the contemplation of Owner and Contractor; and

(d) Contractor complies with the claims procedure of the Contract Documents.

(e) Excusable delay caused solely by Changes in the Work ordered by County, as provided above, and/or

(f) Excusable delay caused solely by Acts or Neglect by County or other person, as provided above.

E. Non-Compensable Time Extensions

1. Subject to other applicable provisions of the Contract Documents, Contractor may be entitled to adjustment in Contract Time only, without adjustment in Contract Sum, for

   (a) Periods of excusable delay caused solely by weather (beyond the adverse weather day allowance shown herein) or Force Majeure events as provided above in this Article, or

   (b) Periods of concurrent delay, where delay results from two or more causes, one of which is compensable (resulting from Changes or Acts or Neglect as set forth above in this Article), and the other of which is non-compensable or inexcusable, such as: acts or neglect of Contractor, Subcontractors or others for whom Contractor is responsible; other acts, omissions and conditions which would not entitle Contractor to adjustment in Contract Time; adverse weather; and/or actions of Force Majeure as provided above in this Article.

F. Adverse Weather

0. The Contract Adverse Weather Time has been determined with consideration given to the average climate weather conditions prevailing in the County in which the Project is located. (1.06B.24)

1. Contractor shall provide proof that adverse weather actually caused delays to work on the critical path. The proof shall contain the activity ID and name of impacted critical activity. Contractor shall give written notice of intent to claim an adverse weather day within one day of the adverse weather day occurring (1.06B.24).

2. In order to qualify as an adverse weather delay with respect to the foregoing parameters: daily rainfall must exceed 0.1 inch at the NOAA station located closest to the Project site, as measured and reported by NOAA. Notwithstanding these allowances, Contractor shall at all times employ all available mitigation measures to enable Work to continue, Contractor shall take reasonable steps to mitigate potential weather delays, such as dewatering the Site, lime treatment, and covering Work and material that could be affected adversely by weather. Failure to do so shall be cause for County to not grant a time extension due to adverse weather, where Contractor could have avoided or mitigated the potential delay by exercising reasonable care.

3. Contractor shall include the foregoing precipitation parameters as a monthly activity in its progress schedule. As Work on the critical path is affected by precipitation, Contractor shall notify County and request that the days be moved to the affected activities. Any adverse weather

days remaining shall be considered Project float available to either County or Contractor.

4. Adverse weather delay for precipitation shall be recognized for the actual period of time Contractor proves it was delayed by precipitation exceeding the specified parameters. For example, and not by way of limitation, if precipitation exceeding the specified parameters does not in fact delay Contractor's progress on the critical path, then no time extension shall be recognized; and conversely, if Contractor proves to County's satisfaction that precipitation exceeding the specified parameters causes delay to Contractor for a period longer than the number of precipitation days incurred (e.g., if it rains or snows during grading work), then Contractor shall be entitled to a time extension equal to the actual period of such delay. Note: Time extension is mitigated in the weather day allowance activity (see section 1.06B24),

5. During unfavorable weather, wet ground, or other unsuitable construction conditions, Contractor shall employ best practices to protect the Work, manage the construction site and rainwater during inclement weather. Persons performing the Work shall examine surfaces to receive their Work and shall report in writing to Contractor, with copy to County representative and the Architect conditions detrimental to the Work. Failure to examine and report discrepancies makes the Contractor responsible, at no increase in Contract Sum, for correction, County may require. Commencement of Work constitutes acceptance of surface.

G. Liquidated Damages

1. Time is of the essence. Execution of Contract Documents by Contractor shall constitute its acknowledgement that County will actually sustain damages in the form of Contract administration expenses (such as Project management and consultant expenses) in the amount fixed in the Contract Documents for each and every Day during which completion of Work required is delayed beyond expiration of time fixed for completion plus extensions of time allowed pursuant to provisions hereof.

2. Contractor and County agree that because of the nature of the Project, it would be impractical or extremely difficult to fix the amount of such actual damages incurred by County because of a delay in completion of all or any part of the Work. Contractor and County agree that specified measures of liquidated damages shall be presumed to be the amount of such damages actually sustained by County, and that because of the nature of the Project, it would be impracticable or extremely difficult to fix the actual damages.

3. Liquidated damages for delay shall cover administrative, overhead,

interest on bonds, and general loss of public use damages suffered by County as a result of delay. Liquidated damages shall not cover the cost of completion of the Work, damages resulting from Defective Work, lost revenues or costs of substitute facilities, or damages suffered by others who then seek to recover their damages from County (for example, delay claims of other contractors, subcontractors, tenants, or other third-parties), and defense costs thereof. County may deduct from any money due or to become due to Contractor subsequent to time for completion of entire Work and extensions of time allowed pursuant to provisions hereof, a sum representing then-accrued liquidated damages.

3. Contractor shall not be charged for liquidated damages because of any delays in completion of Work on the critical path which are not the fault or negligence of Contractor or its Subcontractors, including acts of God as defined in Public Contract Code Section 7105, acts of enemy, epidemics, and quarantine restrictions. Contractor shall, within ten (10) days of beginning of any delay, notify Owner in writing of causes of delay including documentation and facts explaining the delay. Owner shall review the facts and extent of any delay and shall grant extension(s) of time for completing Work when, in its judgment, the findings of fact justify an extension. Extension(s) of time shall apply only to that portion of Work affected by delay and shall not apply to other portions of Work not so affected. An extension of time may only be granted if Contractor has timely submitted the notice and supporting documentation required by all relating Contract Documents as required herein.

1.13 TIME IMPACT EVALUATION ("TIE") FOR CHANGE ORDERS, AND OTHER DELAYS

A. Owner Directed Added Work

1. When Contractor is directed to proceed with changed Work, the Contractor shall prepare and submit within seven (7) calendar days from the Notice to Proceed a TIE which includes both a written narrative and a delay fragnet integrated into the contemporaneous schedule depicting how the changed Work affects other schedule activities. The schedule diagram shall show how the Contractor proposes to incorporate the changed Work in the schedule and how it impacts the current schedule-update critical path. The Contractor is also responsible for requesting time extensions based on the TIE's impact on the critical path. The diagram must be tied to the main sequence of schedule activities to enable County to evaluate the impact of changed Work to the scheduled critical path.

2. Contractor shall be responsible for all costs associated with the preparation

of TIEs, and the process of incorporating them into the current schedule update.

3. Once agreement has been reached on a TIE, the Contract Time will be adjusted accordingly (via Change Order Request and Change Order). If agreement is not reached on a TIE, the Contract Time may be extended in an amount County allows, and the Contractor may submit a claim for additional time claimed by contractor.

B. Contract Added Work Claim

1. If the schedule final completion date is extended due to added work scope, the Contractor is required to provide a time and cost impact within fourteen (14) calendar days and prior to proceeding with added work, unless approved by Owner.

2. If the Contractor believes critical work has been delayed due to circumstances beyond their control, a TIE shall be submitted as described above.

3. The TIE will be reviewed with fourteen (14) calendar days and assessed as excusable / compensable, excusable / non-compensable, or non-excusable / non-compensable.

4. Delay Fragnet

(a) The duration of the activity relating to the changes in the Work and the resources (manpower, equipment, material, etc.) required to perform the activities within the stated duration.

(b) Specific logical ties to the Contract Schedule for the proposed changes and/or delay showing the activity/activities in the Construction Schedule that are affected by the change and/or delay. (A portion of any delay of seven (7) days or more must be provided.)

(c) A revised Construction Schedule must be submitted showing the delay and impact on the Final Completion date.

1.14 TIME EXTENSIONS

A. The Contractor is responsible for requesting time extensions for time impacts that, in the opinion of the Contractor, impact the critical path of the current Progress Schedule update. Notice of time impacts shall be given in accord with the General Conditions.

B. Where an event for which County is responsible impacts the projected Final Completion date, the Contractor shall provide a written mitigation plan,

including a schedule diagram, which explains how (e.g., increase crew size, overtime, etc.) the impact can be mitigated. The Contractor shall also include a detailed cost breakdown of the labor, equipment, and material the Contractor would expend to mitigate County-caused time impact. The Contractor shall submit its mitigation plan to County within fourteen (14) calendar days from the date of discovery of the impact. The Contractor is responsible for the cost to prepare the mitigation plan.

C. Failure to request time, provide A, or provide the required mitigation plan will result in Contractor waiving its right to a time extension and cost to mitigate the delay.

D. No time will be granted under this Contract for cumulative effect of changes.

E. County will not be obligated to consider any time extension request unless the Contractor complies with the requirements of Contract Documents.

F. Failure of the Contractor to perform in accordance with the current schedule update shall not be excused by submittal of time extension requests.

G. If the Contractor does not submit a TIE within the required seven (7) calendar days for any issue, it is mutually agreed that the Contractor does not require a time extension for said issue.

H. To avoid possible delay risks, the Contractor is aware that governmental agencies, including, without limitation, the County, gas companies, electrical utility companies, water districts, and other agencies may have to approve Contractor-prepared drawings or approve a proposed installation. Accordingly, Contractor shall include in its schedule and bid, time for possible review of its drawings and for reasonable delays and damages that may be caused by such agencies. Thus, Contractor is not entitled to make a claim for damages or delays arising from the required review of Contractor's drawings by third parties.

1.15 SCHEDULE REPORTS

A. Submit the following reports with the Baseline Schedule and each monthly update.

B. Required Reports:

1. Two activity listing reports: one sorted by activity number and one by total Project Float. These reports shall also include each activity's early/late and actual start and finish dates, original and remaining duration, Project Float, responsibility code, and the logic relationship of activities.

2. Report showing the longest critical path.

3. Work Plan Cash Flow Report including the following: percentage of Work accomplished, earned value- to date, previous payments, and amount earned for current update period.

4. Schedule plots presenting time-scaled network diagram showing activities and their relationships with the controlling operations or critical path clearly highlighted.

5. Upon request, the Contractor may be required to submit a Planned versus Actual labor histogram calculated by early start.

6. 3-week look-ahead schedule. The 3-week look ahead shall be derived from the update schedule with referenced correlating activities.

7. Actual dates achieved on activities for the past period. This report should be submitted to the County prior to the overall update submittal for field verification.

8. Schedule update narrative describing items such as current critical path, issues, schedule revisions, and other.

9. All reports noted above shall be clearly dated (including data date) and titled.

C. Other Reports:

In addition to above reports, County may request, from month to month, any of the following reports.

1. Activities by early start.

2. Activities by late start.

3. Activities grouped by Subcontractors or selected trades.

D. Furnish County with report files on media as described previously in this document.

1.16 PROGRESS SCHEDULE NARRATIVE

A. In addition to report submittal requirements for Project Schedule identified in the previous Section, Contractor shall provide a monthly project status report (i.e., written narrative report) to be submitted in conjunction with each schedule as specified herein. Status reporting shall be in form specified below.

B. Contractor shall prepare monthly written narrative reports of status of Project for submission to County. Written status reports shall include:

1. Status of major Project components (percent (%) complete, amount of time ahead or behind schedule) and an explanation of how Project will be brought back on schedule if delays have occurred.

2. Progress made on critical activities indicated on Project Schedule.

3. Explanations for any lack of work on critical path activities planned to be performed during last month.

4. Explanations for any schedule changes, including changes to logic or to activity durations.

5. List of critical activities scheduled to be performed next month.

6. Status of major material and equipment procurement.

7. Any delays encountered during reporting period.

8. Contractor may include any other information pertinent to status of Project. Contractor shall include additional status information requested by County at no additional cost.

9. Status reports, and the information contained therein, shall not be construed as claims, notice of claims, notice of delay, or requests for changes or compensation.

1.17 LOOKAHEAD SCHEDULE REPORT

By the end of the business day on the day prior to the Weekly Progress Meeting, the Contractor shall provide a time-scaled three (3) week Look-ahead Schedule that is based on, and correlated by activity number to, the current accepted schedule (i.e., Initial, Baseline or Progress Schedule). Look-ahead Schedule shall reflect ALL schedule activities that were planned to take place during this period based on the current schedule. Schedule shall include at least the following: area/building, activity ID, activity description, responsible contractor/subcontractor, as well as planned start date, duration and completion date. Activities noted to be on the critical path per the current schedule shall be highlighted accordingly. Contractor may include multiple activities that relate to a single activity ID if this provides clarity to sequencing, etc.

1.18 DAILY CONSTRUCTION REPORTS

On a daily basis (prior to the end-of-business on the day of the work being reported), Contractor shall submit via the Project Management Software a Daily Construction Report to County for each workday, including weekends and holidays. Contractor shall develop the Daily Construction Reports on a computer-generated database

capable of sorting daily Work, manpower, and man-hours by Contractor, Subcontractor, area, sub-area, and Change Order Work. Obtain County's written approval of Daily Construction Report data base format prior to implementation. Include in report:

A. Project name and Project number.

B. Contractor's name and address.

C. Weather, temperature, and any unusual site conditions. Contractor shall note on this report any Notices issued that day relating to these conditions.

D. Brief description and location of the day's scheduled activities and any special problems and accidents, including Work of Subcontractors. Descriptions shall be referenced to scheduled activities and include all related schedule activity IDs (as well as CORs, CDs, etc).

E. Worker quantities for its own Work force and for Subcontractors of any tier.

F. Equipment, other than hand tools, utilized by Contractor and Subcontractors.

G. Material deliveries.

H. High and low temperatures and general weather conditions.

I. Accidents.

J. Meetings and significant decisions.

K. Unusual events (refer to special reports).

L. Stoppages, delays, shortages, and losses.

M. Meter readings and similar recordings.

N. Emergency procedures.

O. Orders and requests of authorities having jurisdiction.

P. Change Orders received and implemented.

Q. Construction Change Directives received and implemented.

R. Services connected and disconnected.

S. Equipment or system tests and startups.

T. Partial Completions and occupancies.

U. Updates to any and all Activity IDs projected to have activity based on the current

accepted Project Schedule.

PART 2 -PRODUCTS – Not used

PART 3 -EXECUTION - Not used

- END OF SECTION –

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01 32 19 - SUBMITTAL SCHEDULES / DAILY REPORTS / FIELD REPORTS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:
   1. Submittals Schedule.
   2. Daily construction reports.
   3. Field condition reports.

B. See Section 01 29 00 "Payment Procedures" for submitting the Schedule of Values.

C. See Section 01 32 33 "Photographic Documentation" for submitting construction photographs.

1.2 DEFINITIONS

A. Activity: A discrete part of a project that can be identified for planning, scheduling, monitoring, and controlling the construction project. Activities included in a construction schedule consume time and resources.
   1. Critical activities are activities on the critical path. They must start and finish on the planned early start and finish times.
   2. Predecessor Activity: An activity that precedes another activity in the network.
   3. Successor Activity: An activity that follows another activity in the network.

B. Fragnet: A partial or fragmentary network that breaks down activities into smaller activities for greater detail.

C. Major Area: A story of construction, a separate building, or a similar significant construction element.

1.3 SUBMITTALS

A. Submittals Schedule: Submit via the web-based project management software. Arrange the following information in a tabular format:
   1. Scheduled date for first submittal.
   2. Specification Section number and title.
   3. Submittal category (action or informational).
   4. Name of subcontractor.
   5. Description of the Work covered.
   6. Scheduled date for Architect's final release or approval.

B. Daily Construction Reports: Submit PDF file via the web-based project management software prior to close-of-business on the day covered by the report.

C. Field Condition Reports: Submit PDF file via the web-based project management software at time of discovery of differing conditions.

1.4 COORDINATION

A. Coordinate preparation and processing of reports with performance of construction activities and with scheduling and reporting of separate contractors.

PART 2 - PRODUCTS

2.1 SUBMITTALS SCHEDULE

A. Preparation: Submit a schedule of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, re-submittal, ordering, manufacturing, fabrication, and delivery when establishing dates.
   1. Coordinate Submittals Schedule with list of subcontracts, the Schedule of Values, and Contractor's Construction Schedule.
   2. Submit concurrently with the first complete submittal of Contractor's Construction Schedule.

2.2 REPORTS

A. Daily Construction Reports: Prepare a daily construction report recording the following information concerning events at Project site:
   1. List of subcontractors at Project site and quantities relating to labor force.
   2. Equipment at Project site.
   3. Material deliveries.
   4. High and low temperatures and general weather conditions.
   5. Accidents.
   6. Stoppages, delays, shortages, and losses.
   7. Meter readings and similar recordings.
   8. Orders and requests of authorities having jurisdiction.
   9. Services connected and disconnected.
   10. Equipment or system tests and startups.
   11. Progress on any schedule activity, including all related activity IDs.

B. Field Condition Reports: Immediately on discovery of a difference between field conditions and the Contract Documents, prepare and submit a detailed report. Submit with a request for interpretation [**on CSI Form 13.2A**]. Include a detailed description of the differing conditions, together with recommendations for changing the Contract Documents.

PART 3 - EXECUTION – (Not Used)

- END OF SECTION-

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01 32 33 - PHOTOGRAPHIC DOCUMENTATION

PART 1 - GENERAL

1. 1 SUMMARY

A. This Section describes the requirements for furnishing photographs depicting work progress.

1. 2 DESCRIPTION

A. Furnish photographs of the site construction throughout the progress of the Work.

B. Take photographs on cutoff date for each Application for Payment.

C. In addition, take photographs at beginning and completion of the following elements:

1. Site clearing.
2. Excavation
3. Utility Trenching & Placement
4. Foundations
5. Structural Framing
6. Steel Erections
7. Enclosure of Building
    a. Interior
    b. Exterior
8. Landscaping
9. Substantial Completion
10. Final Completion
11. As requested by Owner.

1. 3 PRINTS

A. NOT USED

1. 4 Electronic Files

A. Upload photos to web-based project management software, indexed in folders by

date and in chronological order.

B. All photos to be in a JPEG format.

C. Make photos available to Construction Manager at any time in electronic format.

D. Provide a progress photo from 2 agreed upon vantages with each payment application.

1. 5 TECHNIQUE

A. Factual presentation, with correct exposure and focus, high resolution and sharpness, maximum depth of field, and minimum distortion.

1. 6 VIEWS

A. Take ten (10) photographs at each specified time, until Date of Substantial Completion. Consult with Construction Manager at each time for instructions on views required.

PART 2 – PRODUCTS (Not Used)

PART 3 – EXECUTION (Not Used)

-END OF SECTION-

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01 33 00 - SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes requirements for the submittal schedule and administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other submittals.

B. Related Sections:
1. Section 01 32 16 "Construction Progress Documentation" for submitting schedules and reports, including Contractor's construction schedule.
2. Section 01 78 23 "Operation and Maintenance Data" for submitting operation and maintenance manuals.
3. Section 01 78 39 "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.
4. Section 01 79 00 "Demonstration and Training" for submitting video recordings of demonstration of equipment and training of Owner's personnel.

C. See Section 01 77 00 "Closeout Procedures" for submitting warranties.

1.2 DEFINITIONS

A. Action Submittals: Written and graphic information and physical samples that require Architect's and Construction Manager’s responsive action.

B. Informational Submittals: Written and graphic information and physical samples that do not require Architect's and Construction Manager’s responsive action. Submittals may be rejected for not complying with requirements.

1.3 ACTION SUBMITTALS

A. Submittal Schedule: Submit a schedule of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, ordering, manufacturing, fabrication, and delivery when establishing dates. Include additional time required for making corrections or modifications to submittals noted by the Architect and Construction Manager and additional time for handling and reviewing submittals required by those corrections.

1.4 SUBMITTAL ADMINISTRATIVE REQUIREMENTS

A. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.
1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.

2. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.
    a. Architect and Construction Manager reserve the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

B. Processing Time: Allow time for submittal review, including time for re-submittals, as follows. Time for review shall commence on Architect's receipt of submittal. Contractor is to notify the Architect and Construction Manager when new materials for review have been posted to the designated web-based project management software. Time will begin upon successful download of that information. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including re-submittals.
    1. Initial Review: Allow fourteen (14) calendar days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Construction Manager will advise Contractor when a submittal being processed must be delayed for coordination.
    2. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.
    3. Resubmittal Review: Allow fourteen (14) calendar days for review of each re-submittal.

C. Architect's Digital Data Files: Electronic copies of digital data files of the Contract Drawings will be provided by Architect for Contractor's use in preparing submittals.
    1. Architect will furnish Contractor one set of digital data drawing files of the Contract Drawings for use in preparing Shop Drawings and Project record drawings.
        a. Architect makes no representations as to the accuracy or completeness of digital data drawing files as they relate to the Contract Drawings.
        b. Contractor shall execute a data licensing agreement in the form of AIA Document
        C106, Digital Data Licensing Agreement as well as any further waivers required by the Architect.

D. Submittals are to be submitted electronically via the web-based project management software.
    1. The following submittals are to be submitted electronically:
        a. Product Data
        b. Shop Drawings
        c. Certifications
        d. Test Data
        e. Schedules
    2. Samples shall not be submitted electronically but a transmittal should be to document delivery of such samples.

E. Identification and Information: Place a permanent label or title block on each cover of submittal item for identification.
   1. Indicate name of firm or entity that prepared each submittal on label or title block.
   2. Provide a space approximately 6x8 inches on label or beside title block to record Contractor's review and approval markings and action taken by Architect and Construction Manager.
   3. Include the following information for processing and recording action taken:
      a. Project name.
      b. Date.
      c. Name of Architect.
      d. Name of Construction Manager.
      e. Name of Contractor.
      f. Name of subcontractor.
      g. Name of supplier.
      h. Name of manufacturer.
      i. Submittal number or other unique identifier, including revision identifier.
         1) Submittal number shall use Specification Section number followed by a decimal point and then a sequential number (e.g., 061000.01). Re-submittals shall include an alphabetic suffix after another decimal point (e.g., 061000.01.A).
      j. Number and title of appropriate Specification Section.
      k. Drawing number and detail references, as appropriate.
      l. Location(s) where product is to be installed, as appropriate.
      m. Other necessary identification.

F. Identification and Information: Identify and incorporate information in each electronic submittal file as follows:
   1. Assemble complete submittal package into a single indexed file with links enabling navigation to each item.
   2. Name file with submittal number or other unique identifier, including revision identifier.
      a. File name shall use project identifier and Specification Section number followed by a decimal point and then a sequential number (e.g., 061000.01-LNHS). Re-submittals shall include an alphabetic suffix after another decimal point (e.g., 061000.01.A-LNHS).
   3. Provide means for insertion to permanently record Contractor's review and approval markings and action taken by Architect and Construction Manager.
   4. Include the following information on an inserted cover sheet:
      a. Project name.
      b. Date.
      c. Name and address of Architect.
      d. Name of Construction Manager.
      e. Name of Contractor.
      f. Name of firm or entity that prepared submittal.
      g. Name of subcontractor.
      h. Name of supplier.
      i. Name of manufacturer.

j. Number and title of appropriate Specification Section.
k. Drawing number and detail references, as appropriate.
l. Location(s) where product is to be installed, as appropriate.
m. Related physical samples submitted directly.
n. Other necessary identification.

G. Options: Identify options requiring selection by the Architect.

H. Deviations: Highlight, encircle, and otherwise specifically identify deviations from the Contract Documents on submittals.

I. Additional Paper Copies: Unless additional copies are required for final submittal, and unless Architect or Construction Manager observes noncompliance with provisions in the Contract Documents, initial electronic submittal may serve as final submittal.

J. Transmittal: Assemble each submittal individually and appropriately for transmittal and handling. Transmit each submittal using a transmittal form. Architect and Construction Manager will return submittals, without review, received from sources other than Contractor.
1. On an attached separate sheet, prepared on Contractor's letterhead, record relevant information, requests for data, revisions other than those requested by Architect and Construction Manager on previous submittals, and deviations from requirements in the Contract Documents, including minor variations and limitations. Include same identification information as related submittal.

K. Re-submittals: Make re-submittals in same form as initial submittal.
1. Note date and content of previous submittal.
2. Note date and content of revision in label or title block and clearly indicate extent of revision.
3. Resubmit submittals until they are marked with approval notation from Architect's and Construction Manager's action stamp.

L. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.

M. Use for Construction: Retain complete set of paper copies of submittals on Project site. Use only final submittals that are marked with approval notation from Architect's and Construction Manager's action stamp.

1.5 CONTRACTOR'S USE OF ARCHITECT'S CAD FILES

A. At Contractor's written request, copies of Architect's CAD files of select plans will be provided to Contractor for Contractor's use in connection with Project, subject to the following conditions.
1. Only major site/floor/ceiling/roof plans, or building elevations/sections will be provided.
2. Wall section, details, schedules will not be provided.

3. Title blocks will be removed from the file.
4. Notes and dimensions may be removed from the file.
5. Compliance of the requests for consultant files is at the discretion of the consultant.
6. The following disclaimer will be added to the file:

DISCLAIMER AND INDEMNIFICATION AGREEMENT FOR
COMPUTER-BASED INFORMATION

The attached computer-based information for the **Construction of Radio Shop** are provided to **(The User**) as a courtesy for their sole convenience. The User recognizes that computer-based information is easily changeable, that changes are difficult to detect and that use or conversion of the information provided may introduce errors, inaccuracies or anomalies that the Architect and their consultants can neither predict nor control. The delivery of this electronic data does not constitute the delivery of the professional work product of the Architect shall not be responsible for any modifications made to the electronic files or any products derived from the electronic files which are not prepared by us. By accepting and utilizing this electronic data in lieu of the corresponding drawings and specifications prepared by the Architect, the User agrees that such data is an instrument of service of the Architect, who shall be deemed to be the author of the drawings and data, and shall retain all common law, statutory law and other rights, including copyrights. The User, by accepting the electronic files, agrees to assume all risk and liabilities associated with the use of the information provided by the Architect and understand the Architect makes no claim or warranty as to the suitability or usefulness of the information for any purpose. The User also agrees, to the fullest extent permitted by law, to hold harmless and indemnify the Architect from and against any and all claims, liabilities, losses, damages and costs, including but not limited to attorney's fees, arising from or in connection with the use, misuse, modification, or misinterpretation of the electronic data provided by the Architect. Use of the attached computer-based information indicates acceptance and constitutes agreement to abide by the terms and conditions of this agreement.

PART 2 - PRODUCTS

2.1 SUBMITTAL PROCEDURES

A. General Submittal Procedure Requirements:
   1. Post electronic submittals as PDF electronic files directly to the web-based project management software (Prolog Converge). Notify the Architect and Construction Manager of the presence of the submittal(s) via email with identification of the specific materials posted. In web-based project management software, include link for all submittal register items associated with the submittal package. Where possible, endeavor to include all required action submittals for that specification section.
      a. Architect, through Construction Manager, will return annotated file. Annotate and retain one copy of file as an electronic Project record document file.

2. Submit electronic submittals via email as PDF files.
    a. Architect will return annotated file. Annotate and retain one copy of file as an electronic Project record document file.
3. Closeout Submittals and Maintenance Material Submittals: Comply with requirements specified in Section 01 77 00 "Closeout Procedures."
4. Certificates and Certifications Submittals: Provide a statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity.
    a. Provide a digital signature with digital certificate on electronically-submitted certificates and certifications where indicated.
    b. Provide a notarized statement on original paper copy certificates and certifications where indicated.
5. Test and Inspection Reports Submittals: Comply with requirements specified in Section 01 40 00 "Quality Requirements."

B. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.
1. If information must be specially prepared for submittal because standard published data are not suitable for use, submit as Shop Drawings, not as Product Data.
2. Mark each copy of each submittal to show which products and options are applicable.
3. Include the following information, as applicable:
    a. Manufacturer's catalog cuts.
    b. Manufacturer's product specifications.
    c. Standard color charts.
    d. Statement of compliance with specified referenced standards.
    e. Testing by recognized testing agency.
    f. Application of testing agency labels and seals.
    g. Notation of coordination requirements.
    h. Availability and delivery time information.
4. For equipment, include the following in addition to the above, as applicable:
    a. Wiring diagrams showing factory-installed wiring.
    b. Printed performance curves.
    c. Operational range diagrams.
    d. Clearances required to other construction, if not indicated on accompanying Shop Drawings.
5. Submit Product Data before or concurrent with Samples.
6. Submit Product Data in the following format:
    a. PDF electronic file with transmittal as noted above.

C. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data. Submittals based upon Architect's digital data drawing files will be permitted.

1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:
   a. Identification of products.
   b. Schedules.
   c. Compliance with specified standards.
   d. Notation of coordination requirements.
   e. Notation of dimensions established by field measurement.
   f. Relationship and attachment to adjoining construction clearly indicated.
   g. Seal and signature of professional engineer if specified.
2. Sheet Size: Except for templates, patterns, and similar full-size drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches but no larger than 30 by 42 inches. Provide hard copies as required by the Architect and Construction Manager
3. Submit Shop Drawings in the following format:
   a. PDF electronic file.

D. Samples: Submit Samples for review of kind, color, pattern, and texture for a check of these characteristics with other elements and for a comparison of these characteristics between submittal and actual component as delivered and installed.
   1. Transmit Samples that contain multiple, related components such as accessories together in one submittal package. Provide transmittal listing all samples submitted along with quantities.
   2. Identification: Attach label on unexposed side of Samples that includes the following:
      a. Generic description of Sample.
      b. Product name and name of manufacturer.
      c. Sample source.
      d. Number and title of applicable Specification Section.
   3. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.
      a. Samples that may be incorporated into the Work are indicated in individual Specification Sections. Such Samples must be in an undamaged condition at time of use.
      b. Samples not incorporated into the Work, or otherwise designated as Owner's property, are the property of Contractor.
   4. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available.
      a. Number of Samples: Submit one (1) full set(s) of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Architect will return submittal, through Construction Manager, with options selected.
   5. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and physically identical with material or product proposed for

use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.

a. Number of Samples: Submit three (3) sets of Samples. Architect will retain two (2) Sample sets; remainder will be returned. Mark up and retain one returned sample set as a project record sample.

1) If variation in color, pattern, texture, or other characteristic is inherent in material or product represented by a Sample, submit at least three (3) sets of paired units that show approximate limits of variations.

E. Product Schedule: As required in individual Specification Sections, prepare a written summary indicating types of products required for the Work and their intended location. Include the following information in tabular form:

1. Submit product schedule in the following format:
   a. PDF electronic file.

F. Contractor's Construction Schedule: Comply with requirements specified in Section 01 32 16 "Construction Progress Document."

G. Application for Payment: Comply with requirements specified in Section 01 29 00 “Payment Procedures."

H. Schedule of Values: Comply with requirements specified in Section 01 29 00 "Payment Procedures."

I. Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Wherever possible, including CSI numbers with description of work being completed. Also, provide DIR numbers for all subcontractors and vendors listed. Provide an updated list when any changes take place along with and explanation of what changed and why.

1. Submit subcontract list in the following format:
   a. PDF electronic file.

J. Coordination Drawings: Comply with requirements specified in Section 01 31 00 "Project Management and Coordination."

K. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, contact information of architects and owners, and other information specified.

L. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of Welding Procedure Specification and Procedure Qualification Record on American Welding Society (AWS) forms. Include names of firms and personnel certified.

M. Installer Certificates: Submit written statements on manufacturer's letterhead certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.

N. Manufacturer Certificates: Submit written statements on manufacturer's letterhead certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.

O. Product Certificates: Submit written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.

P. Material Certificates: Submit written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.

Q. Material Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.

R. Product Test Reports: Submit written reports indicating current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.

S. Research Reports: Submit written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project.

T. Schedule of Tests and Inspections: Comply with requirements specified in Section 01 40 00 “Quality Requirements."

U. Preconstruction Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in the Contract Documents.

V. Compatibility Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for primers and substrate preparation needed for adhesion.

W. Field Test Reports: Submit reports indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.

X. Maintenance Data: Comply with requirements specified in Section 01 78 23 "Operation and Maintenance Data."

Y. Design Data: Prepare and submit written and graphic information, including, but not limited to, performance and design criteria, list of applicable codes and regulations, and calculations. Include list of assumptions and other performance and design criteria and a summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Include page numbers.

2.2 DELEGATED-DESIGN SERVICES (Including DEFERRED APPROVALS)

A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.
   1. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to Architect.

B. Delegated-Design Services Certification: In addition to Shop Drawings, Product Data, and other required submittals, submit digitally-signed PDF electronic file and three (3) paper copies of certificate, signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional.
   1. Indicate that products and systems comply with performance and design criteria in the Contract Documents. Include list of codes, loads, and other factors used in performing these services.

PART 3 - EXECUTION

3.1 CONTRACTOR'S REVIEW

A. Action and Informational Submittals: Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Architect and Construction Manager.

B. Project Closeout and Maintenance/Material Submittals: Refer to requirements in Section 01 77 00 "Closeout Procedures."

C. Approval Stamp: Stamp each submittal with a uniform, approval stamp. Include Project name and location, submittal number, Specification Section title and number, name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

3.2 ARCHITECT'S AND CONSTRUCTION MANAGER'S ACTION

A. General: Construction Manager will not review submittals that do not bear Contractor's approval stamp and will return them without action.

B. Action Submittals: Architect and Construction Manager will review each submittal, make marks to indicate corrections or modifications required, and return it. Architect will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action taken, as follows:
   1. Final Unrestricted Release: Where the submittal is marked "No Exceptions Taken," the Work covered by the submittal may proceed provided it complies with the Contract Documents. Final acceptance will depend on that compliance.
   2. Final-but-Restricted Release: Where the submittal is marked "Reviewed with Exceptions as Noted," the Work covered by the submittal may proceed provided it complies with both Architect's notations and corrections on the submittal and the Contract Documents. Final acceptance will depend on that compliance.
   3. Returned for Resubmittal: Where the submittal is marked "Revise and Resubmit," do not proceed with the Work covered by the submittal, including purchasing, fabrication, delivery, or other activity for the product submitted. Revise or prepare a new submittal according to Architect's notations and corrections.
   4. Rejected: Where the submittal is marked "Rejected," do not proceed with the Work covered by the submittal. Prepare a new submittal for a product that complies with the Contract Documents.
   5. Incomplete: Where the submittal is marked "Submit Specified Item," do not proceed with the Work covered by the submittal. Prepare additional information requested, or required by the Contract Documents, that indicates compliance with requirements.

C. Informational Submittals: Architect and Construction Manager will review each submittal and will not return it, or will return it if it does not comply with requirements. Construction Manager will forward each submittal to appropriate party.

D. Incomplete submittals are not acceptable, will be considered nonresponsive, and will be returned without review.

E. Submittals not required by the Contract Documents may not be reviewed and may be discarded.

-END OF SECTION-

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01 35 33.21 - NOVEL CORONAVIRUS (COVID-19) SAFETY REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: COVID-19 safety requirements in response to the need for work on essential construction projects that are permissible under the Contra Costa County Public Health Department COVID-19 Health Officer Orders and applicable State and Federal guidelines/orders, to continue as safely as possible.

B. These COVID-19 safety requirements are not all encompassing and may need to be modified by the Contractor to individual construction tasks and updated as the COVID-19 pandemic evolves.

C. The Contractor and all its sub-tier level subcontractors and suppliers shall account in their Bid and sub-bids for all cost impacts whether affecting labor (including, but not limited to obtaining qualified workers, quantity of workers, as well as their productivity), deliveries, supervision, testing and/or procurement of materials and/or equipment and time caused by COVID-19 safety requirements found in this Section 01 11 70 and also all public health and/or governmental directives in place at the time Bids are received by the County for this Project.

D. Related Sections:

1. Section 01 33 00 – Submittal Procedures

1.2 COVID-19 EXPOSURE PREVENTION, PREPAREDNESS, AND RESPONSE PLAN

A. Contractor's Responsibility

1. The Contractor shall prepare a COVID-19 Exposure Prevention, Preparedness and Response Plan specific to this Project that describes how to prevent worker exposure to coronavirus, protective measures to be taken on the jobsite, personal protective equipment and work practice controls to be used, cleaning and disinfecting procedures, and what to do if a worker(s) shows symptoms of COVID-19 illness or tests positive for COVID-19. The Contractor should review the latest OSHA COVID-19 Workplace Safety Guidance document (https://www.osha.gov/Publications/OSHA3990.pdf) as a resource in preparation of their Site Specific Health and Safety Plan. Other reliable and current sources of COVID-19 information can be found at:

California Department of Public Health (CDPH, State)

https://www.cdph.ca.gov/Programs/CID/DCDC/Pages/Immunization/nCOV2019.aspx

Centers for Disease Control and Prevention (CDC, National)
http://www.cdc.gov/coronavirus/novel-coronavirus-2019.html

2. This plan shall at a minimum address the following COVID-19 safety guidelines:

   a. COVID-19 Employee and Visitor training and check-list before entering worksite.
   b. Employee distancing and strategies to maximize distancing when possible.
   c. Limitations on gathering size.
   d. Personal Protective Equipment (PPE) requirements.
   e. Identify "choke points" and "high risk areas" such as hallways, hoists and elevators, break areas and vehicles.
   f. Stagger trades and modify work schedules to reduce worker density to maximize distancing opportunities.
   g. COVID-19 employee good personal hygiene measures.
   h. Disinfecting and cleaning requirements.
   i. Personal prevention actions requirements for all employees.
   j. Toolbox and Tailgate COVID-19 employee training.
   k. Recognizing COVID-19 Symptoms.
   l. Establish a COVID-19 Exposure Action and Notification Plan.
   m. Establish daily screening protocols for arriving workers and visitors to ensure potentially infected workers and visitors do not enter the Site.
   n. Maintain daily attendance log of all workers and visitors who enter the Site.

3. Also, as part of this Plan, the Contractor shall draft and implement a COVID-19 Code of Safe Practices that is posted in areas visible to all employees and visitors.

4. The Contractor shall be prepared at each Progress and Coordination Meeting, if requested by the Construction Manager, to provide information relevant to the application, enforcement and implementation of such COVID-19 Safe Practices.

5. All Contractor managers and supervisors **(from forepersons to project managers)** must be familiar with this Plan and be ready to answer questions from employees, subcontractors, suppliers and visitors. Managers and supervisors must set a good example by following this Plan at all times. This involves practicing good personal hygiene and jobsite safety practices to prevent the spread of the virus. Managers and supervisors must encourage this same behavior from all employees, subcontractors, suppliers and visitors.

6. The Contractor shall immediately notify the Construction Manager if anyperson under the Contractor's control on this Project has tested positive forCOVID-19.

1.3 SUBMITTALS

A. The following information shall be provided in accordance with Section 01 33 00, Submittal Procedures, after the Award of Contract and before any work begins at the Site:

1. COVID-19 Exposure Prevention, Preparedness and Response Plan.
2. COVID-19 Code of Safe Practices.

B. To the extent that there are material amendments or modifications made to any of the above plans or practices during the performance of the Work, the Contractor shall provide to the Owner as soon as practicable the amendments and shall post them as part of the notification plan to all employees and visitors who enter the Site.

PART 2 – PRODUCTS (NOT USED)

PART 2 – EXECUTION (NOT USED)

-END OF SECTION-

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01 35 44 – STORM WATER POLLUTION PREVENTION

PART 1 - GENERAL

1.1 DESCRIPTION

A. The work of this section consists of implementing measures to prevent Storm Water Pollution during construction activities, in accordance with Federal, State, and local regulations, and in accordance with the Storm Water Pollution Prevention Plan (SWPPP) to be prepared for this project.

1.2 SUBMITTALS

A. Submit SWPPP to Owner after contract award and before the preconstruction conference.

B. Plans showing proposed arrangements and methods for control of erosion, sedimentation, and pollutant conveyance in storm water resulting from construction activities (Sheet C-7.2).The contractor shall provide final arrangement, methods of control and conveyance in the Storm Water Pollution Prevention Plan that satisfies all State NPDES permit requirements.

C. Provide sufficient information for evaluation of the following:
   1. Erosion protection measures and products
   2. Drainage management strategies
   3. Surface restoration

D. Submit schedules for inspection and monitoring of all SWPPP measures.

E. Submit manufacturer's product information and installation recommendations for silt fence, filter fabric and erosion control blanket, straw bales, and any other materials proposed for use on this project.

F. Contractor shall register on the State Water Resources Control Board (SWRCB) on-line Storm Water Multiple Application and Report Tracking System (SMARTS) database and submit the User Identification (ID) to the Owner. Owner will file a Notice of Intent (NOI) and link the Contractor User ID as a Data Entry Person for required entries (i.e., SWPPP, Annual Reports, Ad Hoc Reports) in accordance with the determined Risk Level monitoring and sampling requirements.

1.3 QUALITY ASSURANCE

A. Before commencing construction activities, such as grading, excavation or filling in any part of the site, Contractor shall plan for temporary structures to guide runoff away from the work area and to capture eroded material before it reaches natural water courses. The measures shall be in accordance with reviewed and approved SWPPP.

B. Arrange construction activities to minimize erosion to the maximum practical extent. Clearing, excavation, and grading shall be limited to those areas of the project site necessary for construction. Minimize the area exposed and unprotected.

C. Clearly mark and delineate the limits of work activities. Do not allow equipment to operate outside the limits of work or to disturb existing vegetation. Complete excavation and grading during the dry season to the maximum extent possible.

1.4 REGULATORY REQUIREMENTS

A. The Contractor shall comply with provisions of Federal, State, and local regulations and requirements that govern the Contractor's operations and storm water and non-storm water discharges from the project site and areas outside the project limits during construction.

B. The project site is more than one acre and therefore requires compliance with the State Water Resources Control Board statewide general permit entitled "Order No. 2009-0009–DWQ (as amended by Order No. 2010-0014-DWQ), National Pollutant Discharge Elimination System General Permit No. CAS000002, Waste Discharge Requirements for Discharges of Storm Water Runoff Associated with Construction and Land Disturbance Activities" (Construction General Permit) that regulates discharges of storm water and non-storm water from construction activities disturbing one acre or more of land surface, or that are part of a common plan of development. The Construction General Permit is available for review at:

http://www.waterboards.ca.gov/water_issues/programs/stormwater/

This project shall conform to applicable provisions of this Permit and modifications thereto.

C. This project lies within the boundaries of the San Francisco Bay Region (2) Regional Water Quality Control Board (SFRWQCB). The SFRWQCB has issued Waste Discharge Requirements and National Pollutant Discharge Elimination System (NPDES) Permit for the discharge of stormwater runoff from the municipal separate storm sewer systems (MS4s) including construction sites (San Francisco Bay Region Municipal Regional Stormwater NPDES Permit Order No. R2-2015-0049 NPDES Permit No. CAS612008 November 19, 2015). The MS4 Regional Stormwater NPDES Permit is available to review at:

https://www.waterboards.ca.gov/sanfranciscobay/water_issues/programs/stormwater/Municipal/R2_2015_0049_amended.pdf

This project shall conform to applicable provisions of this Permit and modifications thereto.

D. Storm Water Pollution Prevention Plan (SWPPP)

1. The SWPPP will include a description of best management practices (BMPs) that

will be implemented to reduce the pollutants in stormwater and non-stormwater discharges to assure compliance with the terms and conditions of the Construction

General Permit.

2. A Qualified Stormwater Developer (QSD) shall prepare the SWPPP and a Qualified Stormwater Practitioner shall ensure implementation of the SWPPP.

3. The SWPPP shall include the following information and forms:

   a. Site description
   b. Expected sequencing of operations and construction schedule
   c. Weather monitoring procedure
   d. Descriptions and details of erosion controls, including dust control
   e. Erosion control plans
   f. Controls for other potential onsite storm water pollutants
   g. Applicable specifications
   i. Maintenance and inspection procedures and forms
   i. Description of potential non-storm water discharges at site
   j. Notice of Intent (NOI) form
   k. Notice of Termination (NOT) form
   l. QSD/QSP Certification forms
   m. Other record keeping forms and procedures
   n. Good housekeeping practices and procedures, including vehicle wash-down areas, protection of equipment storage and maintenance areas, and sweeping of roadways related to hauling activities

4. The Owner will review the draft SWPPP. Contractor QSD will address Owner review comments and submit revised SWPPP for Owner approval. Upon Owner approval, Contractor QSD and Owner representative will sign the approved SWPPP.

5. Contractor will upload approved SWPPP onto SMARTS database for Notice of Intent (NOI) submittal.

6. When the SWRCB approves the NOI, the SWPPP will be the document in force on the project.

7. Place the SWPPP and all updates in a three-ring binder so that completed inspection forms and other records may be inserted. The Contractor shall maintain a copy of the SWPPP and all associated records and forms on site throughout the construction period.

8. The SWPPP shall be available for public inspection. The Contractor shall notify the Owner immediately upon request from the regulatory agencies to enter, inspect, sample, monitor, or otherwise access the project site or the Contractor's records pertaining to water pollution control work. The Contractor and the Owner shall provide copies of correspondence, notices of violation, enforcement actions, or proposed fines by regulatory agencies to the requesting regulatory agency.

9. Implement the SWPPP as required throughout the construction period and maintain all erosion control elements in proper working order until final acceptance of project.

10. Do not perform clearing and grubbing or earthwork until applicable BMPs have been installed.

11. Prior to construction, the Contractor and all subcontractors shall sign certifications (included in the SWPPP) that they understand the requirements of the Construction General Permit and SWPPP. All Contractor and subcontractor crews shall comply with the requirements of the Construction General Permit under the supervision of the Contractor QSP who will be responsible for implementing the SWPPP. The Contractor QSP shall ensure that emergency procedures and the SWPPP are updated as needed and available for inspection. The SWPPP (including inspection forms) and all data used to complete the NOI shall be provided to the Owner at the completion of the project.

12. SWPPP Inspections and Amendments

    a. The Contractor QSP and/or trained crew under QSP supervision will perform weekly inspections of the project site in accordance with the SWPPP. Inspections shall be documented on forms provided in the SWPPP binder.

    b. It may be necessary to revise the SWPPP during construction to make necessary improvements or to respond to unforeseen conditions noted during construction or site inspections. For that purpose, the SWPPP shall specify the mechanism whereby revisions may be proposed by the Contractor or the Owner and incorporated into the SWPPP, including review and acceptance of minor changes. The Contractor and the Owner will jointly accept and sign each revision to the SWPPP before implementation. Accepted modifications will be implemented within 7 calendar days following the date of the inspection when deficiencies or necessary corrections are first noted.

    c. Temporary erosion and pollution control measures shall be used to correct conditions that develop during construction that were not foreseen during design, that are needed prior to installation of permanent control features, or that are needed temporarily to control erosion that developed during normal construction practices but are not associated with permanent control features on the project.

    d. Provide additional temporary erosion and pollution controls made necessary by Contractor's errors or negligence at no additional cost to the Owner.

E. Notice of Intent (NOI)

1. Owner will complete NOI form on SMARTS and submit to SWRCB after accepted SWPPP has been uploaded by Contractor.

2. Annual Reports are due to the SWRCB SMARTS by September 1 of each year. Contractor shall submit Annual Reports and any Ad Hoc Reports onto SMARTS by

August 15 for Owner review.

F. Notice of Termination (NOT)

G. Upon final acceptance, the Owner will file the NOT.

1.5 PROJECT CONDITIONS

A. The Contractor shall maintain records of work performed on the sediment control structures.

B. The Contractor shall not remove any erosion or sediment control measure without prior permission from the Owner.

C. The Contractor shall obtain approval from the Owner prior to making changes to erosion control plans.

1.6 SEQUENCE OF CONSTRUCTION

A. The Contractor shall be responsible for arranging and conducting an Erosion and Sediment Control meeting/briefing to inform all parties scheduled to be on-site during the project of the measures to be implemented for proper erosion and sediment control (may be included as part of the preconstruction meeting).

1. Installation of silt fences, storm drain protection, and all other forms of erosion and sediment control shall not begin until after this meeting has occurred.

B. The Contractor shall notify the Owner in writing and by telephone of the following events:

1. The required erosion and sediment control meeting/briefing.
2. Following installation of required sediment control structures.
3. Prior to removal of or modification to sediment control structures.
4. Prior to removal of all sediment control structures.

C. Silt fences, storm drain protection, and all other forms of erosion and sediment control shall be installed, inspected, and accepted by the Contractor before beginning any utility excavation.

D. Temporary silt fences shall be installed around any stockpiles and/or excavated material that cannot be backfilled during the same day in which it was excavated. Temporary silt fences shall also be placed immediately downstream of any utility trench that has not been backfilled at the end of the working day. Temporary silt fences shall be installed prior to leaving the work site for the day.

E. Silt fences and storm drain protection shall be inspected by the Contractor weekly. Repairs to these devices shall be completed prior to leaving the work site for the day.

F. The Contractor shall prevent the deposition of materials onto paved areas. The Contractor shall inspect the paved areas for deposited materials weekly and remove the materials immediately.

G. Silt fences shall be removed with permission of the Owner within 20 working days after final acceptance of the project and/or after the establishment of permanent stabilization of all excavations and fill areas.

PART 2 - PRODUCTS

2.1 EQUIPMENT

A. Before the work begins, sufficient equipment shall be available on the site to assure that the operation and adequacy of the erosion control plans can be continuously maintained.

2.2 EROSION CONTROL MEASURES

A. Erosion control measures shall consist of silt fencing or equivalent (eg. wattles, etc.), barrier protectors, straw bales, temporary soil retention blankets, excelsior drainage filters, sediment traps and berms.

B. Berms and excelsior drainage filters shall be used to form sediment traps and to control run- on and run-off into other areas, including creeks, streams, marshes, access roads, well areas, and the staging areas.

C. Erosion control measures shall be used to contain only direct precipitation in the construction zone. The contained water shall be allowed to percolate into the ground or drain slowly through the drainage filter sediment traps.

D. Earthen sediment traps or holding ponds shall not be used unless accepted by the Owner.

PART 3 - EXECUTION

3.1 GENERAL DESCRIPTION

A. Furnish, install, maintain, and operate necessary control measures and other equipment necessary to prevent erosion to the maximum extent practical, including implementation of Best Management Practices (BMPs).
   1. Temporary measures shall be to Contractor's own design and Contractor shall be solely responsible for risks related to the management of erosion control during construction.

B. Effective measures shall be initiated prior to the commencement of clearing, grading,

excavation, or other operations that will disturb the natural erosion protection.

C. Schedule work to expose areas subject to erosion for the shortest possible time, and preserve natural vegetation to the greatest extent practicable. Temporary storage and construction buildings shall be located, and construction traffic routed, to minimize erosion. Temporary fast-growing vegetation or other suitable ground cover shall be provided as necessary to control runoff.

3.2 METHODS

A. Construct berms to reduce runoff velocity as well as direct surface runoff around and away from all fuel containment, storage, and borrow areas.

B. Divert surface runoff around and away from cut and fill slopes by constructing berms or ditches at the base of disturbed slopes. Provide conveyance for the runoff in temporary pipes or protected channels to temporarysediment traps.

C. Place drainage filters around all catch basins to create sediment traps to control run-offfrom the construction area.

D. Excess water used for dust control shall be contained within the demolition areas by the erosion control measures.

3.3 MAINTENANCE OF TEMPORARY FACILITIES

A. Inspect erosion and sediment control structures weekly. Ensure erosion and sediment control structures remain effective throughout excavation and grading operations. Relocate structures as necessary.

B. Inspect control structures after each significant rainfall. Promptly repair breaches which occur.

C. The Contractor shall remove entrapped sediment from behind excelsior drainage filter after each storm.

3.4 DISPOSAL OF SEDIMENT FROM STORM WATER POLLUTION CONTROL STRUCTURES

A. Sediment excavated from temporary sediment control structures shall be disposed on the site with general fill, or with topsoil. Sediment shall be allowed to dry out as required before reuse.

B. Contractor shall place the sediment removed from traps and other structures where it will not enter a storm drain or watercourse and where it will not immediately reenter the basin.

3.5 REMOVAL OF TEMPORARY STORM WATER POLLUTION CONTROL MEASURES

A. All temporary control measures shall be removed with permission of the Owner within 20 working days after final acceptance of the Project or once grading is completed and slopes have stabilized.

SWPPP Contents

a. SWPPP Certifications and Approval
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e. Legally Responsible Person
f. Amendment Log
g. SWPPP Requirements
   - Permit registration documents
   - SWPPP availability and implementation
   - SWPPP amendments
   - Retention of records
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h. Project Information
   - Site description
   - Existing conditions
   - Existing drainage
   - Geology and groundwater
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   - Developed condition
   - Permits and governing documents
   - Stormwater run-on from off-site areas
   - Findings of the construction site sediment and receiving water risk determination
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   - Potential construction activity and pollutant sources
   - Identification of non-stormwater discharges
   - Required site map information
i. Best Management Practices
   - Schedule for BMP implementation
   - Erosion and sediment control

- Non-stormwater controls and waste and materials management
- Post-construction stormwater management measures

j. BMP inspection and maintenance
- Rain Event Action Plans

k. Training

l. Responsible parties and operators
- Responsible parties
- Contractor list

m. Construction Monitoring Program
- Weather and rain event tracking
- Monitoring locations
- Safety and monitoring exemptions
- Visual monitoring
- Routine observations and inspections: Routine BMP inspections, Non-stormwater discharge observations
- Rain-event triggered observations and inspections: Visual observations prior to a forecasted qualifying rain event, BMP inspections during an extended storm event, Visual observations following a qualifying rain event
- Visual monitoring procedures
- Visual monitoring follow-up and reporting
- Visual monitoring locations
- Water quality sampling and analysis
- Sampling and analysis plan for non-visible pollutants in stormwater runoff discharges: Sampling scheduled, sampling locations, monitoring preparation, analytical constituents, sample collection, sample analysis, data evaluation and reporting
- Sampling and analysis plan for pH and turbidity and stormwater runoff discharges: Sampling schedule, sampling locations, monitoring preparation, field parameters, sample collection, field measurements, data evaluation and reporting
- Sampling and analysis plan for non-stormwater discharges: Sampling schedule, sampling locations, monitoring preparation, analytical constituents, sample collection, sample analysis, data evaluation and reporting
- Additional monitoring following an NEL exceedance
- Training of sampling personnel
- Sample collection and handling
- Sample documentation procedures
- Records retention

n. Attachments
- Construction General Permit

- Risk Level calculations
- Water Pollution Control Drawings
- Permit Registration Documents/Amendments
- QSD/QSP Certifications
- SWPPP Amendment Certifications
- Construction Schedule
- Construction Activities, Materials Used, and Associated Pollutants
- CASQA Stormwater BMP Handbook Portal: Construction Fact Sheets
- BMP Inspection Form
- Training Reporting Form
- Weather forecast reports
- Monitoring records
- Field meter instructions

- END OF SECTION-

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01 40 00 - QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes administrative and procedural requirements for quality assurance and quality control.

B. Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.
   1. Specified tests, inspections, and related actions do not limit Contractor's other quality-assurance and control procedures that facilitate compliance with the Contract Document requirements.
   2. Requirements for Contractor to provide quality-assurance and control services required by Architect, Owner, or authorities having jurisdiction are not limited by provisions of this Section.
   3. Specific test and inspection requirements are not specified in this Section.

1.2 DEFINITIONS

A. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.

B. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that actual products incorporated into the Work and completed construction comply with requirements. Services do not include contract enforcement activities performed by Architect.

C. Mockups: Full-size, physical assemblies that are constructed on-site. Mockups are used to verify selections made under sample submittals, to demonstrate aesthetic effects and, where indicated, qualities of materials and execution, and to review construction, coordination, testing, or operation; they are not Samples. Approved mockups establish the standard by which the Work will be judged.

D. Laboratory Mockups: Full-size, physical assemblies that are constructed at testing facility to verify performance characteristics.

E. Preconstruction Testing: Tests and inspections that are performed specifically for the Project before products and materials are incorporated into the Work to verify performance or compliance with specified criteria.

F. Product Testing: Tests and inspections that are performed by an NRTL, an NVLAP, or a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with industry

standards.

G. Source Quality-Control Testing: Tests and inspections that are performed at the source, i.e., plant, mill, factory, or shop.

H. Field Quality-Control Testing: Tests and inspections that are performed on-site for installation of the Work and for completed Work.

I. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.

J. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, Subcontractor, or Sub-subcontractor, to perform a particular construction operation, including installation, erection, application, and similar operations.
   1. Using a term such as "carpentry" does not imply that certain construction activities must be performed by accredited or unionized individuals of a corresponding generic name, such as "carpenter." It also does not imply that requirements specified apply exclusively to Tradespeople of the corresponding generic name.

K. Experienced: When used with an entity, "experienced" means having successfully completed a minimum of five previous projects similar in size and scope to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction. See specific specification sections for additional experience requirements.

1.3 CONFLICTING REQUIREMENTS

A. General: If compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement as defined in the General Conditions. Refer uncertainties and requirements that are different, but apparently equal, to Architect for a decision before proceeding.

B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Architect for a decision before proceeding.

1.4 SUBMITTALS

A. Qualification Data: For testing agencies specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include proof of qualifications in the form of a recent report on the inspection of the testing agency by a recognized authority.

B. Reports: Prepare and submit certified written reports that include the following:
   1. Date of issue.

2. Project title and number.
3. Name, address, and telephone number of testing agency.
4. Dates and locations of samples and tests or inspections.
5. Names of individuals making tests and inspections.
6. Description of the Work and test and inspection method.
7. Identification of product and Specification Section.
8. Complete test or inspection data.
9. Test and inspection results and an interpretation of test results.
10. Record of temperature and weather conditions at time of sample taking and testing and inspecting.
11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
12. Name and signature of laboratory inspector.
13. Recommendations on retesting and re-inspecting.

C. Permits, Licenses, and Certificates: For Owner's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents, established for compliance with standards and regulations bearing on performance of the Work.

1.5 QUALITY ASSURANCE

A. General: Qualifications paragraphs in this Article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.

B. Installer Qualifications: A firm or individual experienced in installing, erecting, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.

C. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

D. Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

E. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or products that are similar to those indicated for this Project in material, design, and extent.

F. Specialists: Certain sections of the Specifications require that specific construction activities shall be performed by entities who are recognized experts in those operations. Specialists shall satisfy qualification requirements indicated and shall be engaged for

the activities indicated.

1. Requirement for specialists shall not supersede building codes and regulations governing the Work.

G. Testing Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspecting indicated, as documented according to ASTM E 548; and with additional qualifications specified in individual Sections; and where required by authorities having jurisdiction, that is acceptable to authorities.
   1. NRTL: A nationally recognized testing laboratory according to 29 CFR 1910.7.
   2. NVLAP: A testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program.

H. Factory-Authorized Service Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.

I. Mockups: Before installing portions of the Work requiring mockups, build mockups for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work:
   1. Build mockups in location and of size indicated or, if not indicated, as directed by Architect.
   2. Notify Construction Manager seven (7) days in advance of dates and times when mockups will be constructed.
   3. Demonstrate the proposed range of aesthetic effects and workmanship.
   4. Obtain Architect's approval of mockups before starting work, fabrication, or construction.
   5. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
   6. Demolish and remove mockups when directed, unless otherwise indicated.

J. Laboratory Mockups: Comply with requirements of preconstruction testing and those specified in individual Sections in Divisions 02 through 48.

1.6 QUALITY CONTROL

A. Owner Responsibilities: Where quality-control services are indicated as Owner's responsibility, Owner will engage a qualified testing agency to perform these services.
   1. Owner will furnish Contractor with names, addresses, and telephone numbers of testing agencies engaged and a description of types of testing and inspecting they are engaged to perform.

   2. Costs for retesting and reinspecting construction that replaces or is necessitated by work that failed to comply with the Contract Documents will be charged to Contractor (contract sum adjusted through change order procedures).

B. Tests and inspections not explicitly assigned to Owner are Contractor's responsibility.

Unless otherwise indicated, provide quality-control services specified and those required by authorities having jurisdiction. Perform quality-control services required of Contractor by authorities having jurisdiction, whether specified or not.

1. Where services are indicated as Contractor's responsibility, engage a qualified testing agency to perform these quality-control services.
   a. Contractor shall not employ same entity engaged by Owner, unless agreed to in writing by Owner.
2. Notify testing agencies at least 24 hours in advance of time when Work that requires testing or inspecting will be performed.
3. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
4. Testing and inspecting requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
5. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.

C. Manufacturer's Field Services: Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections. Report results in writing as specified in Division 01 Section "Submittal Procedures."

D. Retesting/Re-inspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and reinspecting, for construction that replaced Work that failed to comply with the Contract Documents.

E. Testing Agency Responsibilities: Cooperate with Architect and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.
   1. Notify Architect and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
   2. Determine the location from which test samples will be taken and in which in-situ tests are conducted.
   3. Conduct and interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from requirements.
   4. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Contractor.
   5. Does not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.
   6. Do not perform any duties of Contractor.

F. Associated Services: Cooperate with agencies performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:
   1. Access to the Work.
   2. Incidental labor and facilities necessary to facilitate tests and inspections.

3. Adequate quantities of representative samples of materials that require testing and inspecting. Assist agency in obtaining samples.
4. Facilities for storage and field curing of test samples.
5. Delivery of samples to testing agencies.
6. Preliminary design mix proposed for use for material mixes that require control by testing agency.
7. Security and protection for samples and for testing and inspecting equipment at Project site.

G. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and -control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.
1. Schedule times for tests, inspections, obtaining samples, and similar activities.

1.7 SPECIAL TESTS AND INSPECTIONS

A. Special Tests and Inspections: Owner will engage a qualified testing agency, special inspector and/or Essential Services Inspector to conduct special tests and inspections required by authorities having jurisdiction as the responsibility of Owner, and as follows:
1. Verifying that manufacturer maintains detailed fabrication and quality-control procedures and reviewing the completeness and adequacy of those procedures to perform the Work.
2. Notifying Architect and Contractor promptly of irregularities and deficiencies observed in the Work during performance of its services.
3. Submitting a certified written report of each test, inspection, and similar quality-control service to Architect with copy to Contractor and to authorities having jurisdiction.
4. Submitting a final report of special tests and inspections at Substantial Completion, this includes a list of unresolved deficiencies.
5. Interpreting tests and inspections and stating in each report whether tested and inspected work complies with or deviates from the Contract Documents.
6. Retesting and reinspecting corrected work.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 TEST AND INSPECTION LOG

A. Test and Inspection Log: Prepare a record of tests and inspections. Include the following:
1. Date test or inspection was conducted.
2. Description of the Work tested or inspected.
3. Date test or inspection results were transmitted to Architect.
4. Identification of testing agency or special inspector conducting test or inspection.

B. Maintain log at Project site. Post changes and revisions as they occur. Provide access to test and inspection log for Architect's and Construction Manager's reference during

normal working hours.

3.2 REPAIR AND PROTECTION

A. General: On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.
   1. Provide materials and comply with installation requirements specified in other Specification Sections. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible.
   2. Comply with the Contract Document requirements for Section 01 73 29 "Cutting and Patching."

B. Protect construction exposed by or for quality-control service activities.

C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

-END OF SECTION-

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01 42 00 - REFERENCES

PART 1 - GENERAL

1.1 DEFINITIONS

A. General: Basic Contract definitions are included in the Conditions of the Contract.

B. "Approved": When used to convey Architect's action on Contractor's submittals, applications, and requests, "approved" is limited to Architect's duties and responsibilities as stated in the Conditions of the Contract.

C. "Directed": A command or instruction by Architect. Other terms including "requested," "authorized," "selected," "required," and "permitted" have the same meaning as "directed."

D. "Indicated": Requirements expressed by graphic representations or in written form on Drawings, in Specifications, and in other Contract Documents. Other terms including "shown," "noted," "scheduled," and "specified" have the same meaning as "indicated."

E. "Regulations": Laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, and rules, conventions, and agreements within the construction industry that control performance of the Work.

F. "Furnish": Supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.

G. "Install": Operations at Project site including unloading, temporarily storing, unpacking, assembling, erecting, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations.

H. "Provide": Furnish and install, complete and ready for the intended use.

I. "Project Site": Space available for performing construction activities. The extent of Project site is shown on Drawings and may or may not be identical with the description of the land on which Project is to be built.

1.2 INDUSTRY STANDARDS

A. Applicability of Standards: Unless the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.

B. Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated.

C. Copies of Standards: Each entity engaged in construction on Project should be familiar with industry standards applicable to its construction activity. Copies of applicable standards are not bound with the Contract Documents.
   1. Where copies of standards are needed to perform a required construction activity, obtain copies directly from publication source.

1.3 ABBREVIATIONS AND ACRONYMS

A. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list.

AA	Aluminum Association, Inc. (The)
AAADM	American Association of Automatic Door Manufacturers
AABC	Associated Air Balance Council
AAMA	American Architectural Manufacturers Association
AASHTO	American Association of State Highway and Transportation Officials
AATCC	American Association of Textile Chemists and Colorists (The)
ABAA	Air Barrier Association of America
ABMA	American Bearing Manufacturers Association
ACI	ACI International (American Concrete Institute)
ACPA	American Concrete Pipe Association
AEIC	Association of Edison Illuminating Companies, Inc. (The)
AF&PA	American Forest & Paper Association
AGA	American Gas Association
AGC	Associated General Contractors of America (The)
AHA	American Hardboard Association (Now part of CPA)
AHAM	Association of Home Appliance Manufacturers
AI	Asphalt Institute
AIA	American Institute of Architects (The)
AISC	American Institute of Steel Construction
AISI	American Iron and Steel Institute
AITC	American Institute of Timber Construction
ALCA	Associated Landscape Contractors of America (Now PLANET - Professional Landcare Network)
ALSC	American Lumber Standard Committee, Incorporated
AMCA	Air Movement and Control Association International, Inc.
ANSI	American National Standards Institute
AOSA	Association of Official Seed Analysts, Inc.
APA	Architectural Precast Association
APA	APA - The Engineered Wood Association
APA EWS	APA - The Engineered Wood Association; Engineered Wood Systems
API	American Petroleum Institute
ARI	Air-Conditioning & Refrigeration Institute
ARMA	Asphalt Roofing Manufacturers Association
ASCE	American Society of Civil Engineers

ASCE/SEI	American Society of Civil Engineers/Structural Engineering Institute (See ASCE)
ASHRAE	American Society of Heating, Refrigerating and Air-Conditioning Engineers
ASME	ASME International
ASSE	American Society of Sanitary Engineering
ASTM	ASTM International (American Society for Testing and Materials International)
AWCI	AWCI International (Association of the Wall and Ceiling Industry International)
AWCMA	American Window Covering Manufacturers Association (Now WCSC)
AWI	Architectural Woodwork Institute
AWPA	American Wood-Preservers' Association
AWS	American Welding Society
AWWA	American Water Works Association
BHMA	Builders Hardware Manufacturers Association
BIA	Brick Industry Association (The)
BICSI	BICSI
BIFMA	BIFMA International (Business and Institutional Furniture Manufacturer's Association International)
BISSC	Baking Industry Sanitation Standards Committee
CCC	Carpet Cushion Council
CDA	Copper Development Association
CEA	Canadian Electricity Association
CFFA	Chemical Fabrics & Film Association, Inc.
CGA	Compressed Gas Association
CIMA	Cellulose Insulation Manufacturers Association
CISCA	Ceilings & Interior Systems Construction Association
CISPI	Cast Iron Soil Pipe Institute
CLFMI	Chain Link Fence Manufacturers Institute
CRRC	Cool Roof Rating Council
CPA	Composite Panel Association
CPPA	Corrugated Polyethylene Pipe Association
CRI	Carpet & Rug Institute (The)
CRSI	Concrete Reinforcing Steel Institute
CSA	Canadian Standards Association
CSA	CSA International (Formerly: IAS - International Approval Services)
CSI	Cast Stone Institute
CSI	Construction Specifications Institute (The)
CSSB	Cedar Shake & Shingle Bureau
CTI	Cooling Technology Institute (Formerly: Cooling Tower Institute)
DHI	Door and Hardware Institute
EIA	Electronic Industries Alliance

EIMA	EIFS Industry Members Association
EJCDC	Engineers Joint Contract Documents Committee
EJMA	Expansion Joint Manufacturers Association, Inc.
ESD	ESD Association
FIBA	Federation Internationale de Basketball (The International Basketball Federation)
FIVB	Federation Internationale de Volleyball (The International Volleyball Federation)
FM Approvals	FM Approvals
FM Global	FM Global (Formerly: FMG - FM Global)
FMRC	Factory Mutual Research (Now FM Global)
FRSA	Florida Roofing, Sheet Metal & Air Conditioning Contractors Association, Inc.
FSA	Fluid Sealing Association
FSC	Forest Stewardship Council
GA	Gypsum Association
GANA	Glass Association of North America
GRI	(Now GSI)
GS	Green Seal
GSI	Geosynthetic Institute
HI	Hydraulic Institute
HI	Hydronics Institute
HMMA	Hollow Metal Manufacturers Association (Part of NAAMM)
HPVA	Hardwood Plywood & Veneer Association
HPW	H. P. White Laboratory, Inc.
IAS	International Approval Services (Now CSA International)
IBF	International Badminton Federation
ICEA	Insulated Cable Engineers Association, Inc.
ICRI	International Concrete Repair Institute, Inc.
IEC	International Electrotechnical Commission
IEEE	Institute of Electrical and Electronics Engineers, Inc. (The)
IESNA	Illuminating Engineering Society of North America
IEST	Institute of Environmental Sciences and Technology
IGCC	Insulating Glass Certification Council
IGMA	Insulating Glass Manufacturers Alliance
ILI	Indiana Limestone Institute of America, Inc.
ISO	International Organization for Standardization
ISSFA	International Solid Surface Fabricators Association
ITS	Intertek Testing Service NA
ITU	International Telecommunication Union
KCMA	Kitchen Cabinet Manufacturers Association
LMA	Laminating Materials Association

	(Now part of CPA)
LPI	Lightning Protection Institute
MBMA	Metal Building Manufacturers Association
MFMA	Maple Flooring Manufacturers Association, Inc.
MFMA	Metal Framing Manufacturers Association, Inc.
MH	Material Handling
MHIA	Material Handling Industry of America
MIA	Marble Institute of America
MPI	Master Painters Institute
MSS	Manufacturers Standardization Society of The Valve and Fittings Industry Inc.
NAAMM	National Association of Architectural Metal Manufacturers
NACE	NACE International (National Association of Corrosion Engineers International)
NADCA	National Air Duct Cleaners Association
NAGWS	National Association for Girls and Women in Sport
NAIMA	North American Insulation Manufacturers Association
NBGQA	National Building Granite Quarries Association, Inc.
NCAA	National Collegiate Athletic Association (The)
NCMA	National Concrete Masonry Association
NCPI	National Clay Pipe Institute
NCTA	National Cable & Telecommunications Association
NEBB	National Environmental Balancing Bureau
NECA	National Electrical Contractors Association
NeLMA	Northeastern Lumber Manufacturers' Association
NEMA	National Electrical Manufacturers Association
NETA	InterNational Electrical Testing Association
NFHS	National Federation of State High School Associations
NFPA	NFPA (National Fire Protection Association)
NFRC	National Fenestration Rating Council
NGA	National Glass Association
NHLA	National Hardwood Lumber Association
NLGA	National Lumber Grades Authority
NOFMA	NOFMA: The Wood Flooring Manufacturers Association (Formerly: National Oak Flooring Manufacturers Association)
NRCA	National Roofing Contractors Association
NRMCA	National Ready Mixed Concrete Association
NSF	NSF International (National Sanitation Foundation International)
NSSGA	National Stone, Sand & Gravel Association
NTMA	National Terrazzo & Mosaic Association, Inc. (The)
NTRMA	National Tile Roofing Manufacturers Association (Now TRI)
NWWDA	National Wood Window and Door Association (Now WDMA)

OPL	Omega Point Laboratories, Inc. (Now ITS)
PCI	Precast/Prestressed Concrete Institute
PDCA	Painting & Decorating Contractors of America
PDI	Plumbing & Drainage Institute
PGI	PVC Geomembrane Institute
PLANET	Professional Landcare Network (Formerly: ACLA - Associated Landscape Contractors of America)
PTI	Post-Tensioning Institute
RCSC	Research Council on Structural Connections
RFCI	Resilient Floor Covering Institute
RIS	Redwood Inspection Service
SAE	SAE International
SDI	Steel Deck Institute
SDI	Steel Door Institute
SEFA	Scientific Equipment and Furniture Association
SEI/ASCE	Structural Engineering Institute/American Society of Civil Engineers (See ASCE)
SGCC	Safety Glazing Certification Council
SIA	Security Industry Association
SIGMA	Sealed Insulating Glass Manufacturers Association (Now IGMA)
SJI	Steel Joist Institute
SMA	Screen Manufacturers Association
SMACNA	Sheet Metal and Air Conditioning Contractors' National Association
SMPTE	Society of Motion Picture and Television Engineers
SPFA	Spray Polyurethane Foam Alliance (Formerly: SPI/SPFD - The Society of the Plastics Industry, Inc.; Spray Polyurethane Foam Division)
SPIB	Southern Pine Inspection Bureau (The)
SPRI	Single Ply Roofing Industry
SSINA	Specialty Steel Industry of North America
SSPC	SSPC: The Society for Protective Coatings
STI	Steel Tank Institute
SWI	Steel Window Institute
SWRI	Sealant, Waterproofing, & Restoration Institute
TCA	Tile Council of America, Inc.
TIA/EIA	Telecommunications Industry Association/Electronic Industries Alliance
TMS	The Masonry Society
TPI	Truss Plate Institute, Inc.
TPI	Turfgrass Producers International
TRI	Tile Roofing Institute
UL	Underwriters Laboratories Inc.
UNI	Uni-Bell PVC Pipe Association
USAV	USA Volleyball
USGBC	U.S. Green Building Council

USITT	United States Institute for Theatre Technology, Inc.
WASTEC	Waste Equipment Technology Association
WCLIB	West Coast Lumber Inspection Bureau
WCMA	Window Covering Manufacturers Association (Now WCSC)
WCSC	Window Covering Safety Council (Formerly: WCMA - Window Covering Manufacturers Association)
WDMA	Window & Door Manufacturers Association (Formerly: NWWDA - National Wood Window and Door Association)
WI	Woodwork Institute (Formerly: WIC - Woodwork Institute of California)
WIC	Woodwork Institute of California (Now WI)
WMMPA	Wood Moulding & Millwork Producers Association
WSRCA	Western States Roofing Contractors Association
WWPA	Western Wood Products Association

B. Code Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list.

BOCA	BOCA International, Inc. (See ICC)
IAPMO	International Association of Plumbing and Mechanical Officials
ICBO	International Conference of Building Officials (See ICC)
ICBO ES	ICBO Evaluation Service, Inc. (See ICC-ES)
ICC	International Code Council
ICC-ES	ICC Evaluation Service, Inc.
SBCCI	Southern Building Code Congress International, Inc. (See ICC)
UBC	Uniform Building Code (See ICC)

C. Federal Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list.

CE	Army Corps of Engineers
CPSC	Consumer Product Safety Commission
DOC	Department of Commerce
DOD	Department of Defense
DOE	Department of Energy
EPA	Environmental Protection Agency

FAA	Federal Aviation Administration
FCC	Federal Communications Commission
FDA	Food and Drug Administration
GSA	General Services Administration
HUD	Department of Housing and Urban Development
LBL	Lawrence Berkeley National Laboratory
NCHRP	National Cooperative Highway Research Program
	(See TRB)
NIST	National Institute of Standards and Technology
OSHA	Occupational Safety & Health Administration
PBS	Public Building Service
	(See GSA)
PHS	Office of Public Health and Science
RUS	Rural Utilities Service
	(See USDA)
SD	State Department
TRB	Transportation Research Board
USDA	Department of Agriculture
USPS	Postal Service

D. Standards and Regulations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the standards and regulations in the following list.

ADAAG	Americans with Disabilities Act (ADA) Architectural Barriers Act (ABA)
CFR	Code of Federal Regulations
DOD	Department of Defense Military Specifications and Standards
DSCC	Defense Supply Center Columbus
	(See FS)
FED-STD	Federal Standard
	(See FS)
FS	Federal Specification
FTMS	Federal Test Method Standard
	(See FS)
MIL	(See MILSPEC)
MIL-STD	(See MILSPEC)
MILSPEC	Military Specification and Standards
UFAS	Uniform Federal Accessibility Standards

E. State Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list.

CALTRANS	State of California Transportation Agency
CBHF	State of California, Department of Consumer Affairs Bureau of Home Furnishings and Thermal Insulation
CCR	California Code of Regulations
CPUC	California Public Utilities Commission
TFS	Texas Forest Service Forest Resource Development

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

-END OF SECTION-

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01 43 39 - MOCKUPS

PART 1 – GENERAL

1.1 MOCKUP SUMMARY

A. Mockups will be used to review of appearance, quality of workmanship, coordination, compatibility, and relationships with adjacent materials. Unless otherwise specifically indicated mockups shall be constructed in place at location directed by Architect. Approved mock ups may remain as part of the work.

1.2 SUBMITTALS

A. General: Comply with Section 01 33 00.

B. Mockups shall not be fabricated until after acceptance of required submittals for all materials to be incorporated into the mockups. This means that the Project schedule shall take into account early submittal of these components to the Architect.

C. Samples: Prior to construction of mockups, provide samples as specified in the respective Specification Sections included as part of the mockups.

1.3 QUALITY ASSURANCE

A. Design Concept: Mockup requirements are intended to establish function, workmanship, finish, and color for conformance with the architectural design intent.

B. Purpose: To verify suitability of colors, finishes, and satisfactory integration of building materials and components indicated and required.

C. Performance: Mockups shall be constructed for the Architect's review for compliance with the Contract Documents and shall be used as a standard for the final installation.

D. Make necessary additions and modifications to mockups as directed by the Architect.

E. Modify mockups, or construct or install new components if requested by the Architect, until final acceptance is obtained.

F. Mockups shall serve as the standard for subsequent work of like kind after approval by the Architect. Be prepared, at no additional cost to the Owner, to make as many modifications as required to achieve mockups that are acceptable to the Architect and of sufficient quality to serve as the standard for the complete Project.

G. Following acceptance, mockups shall serve as a performance standard of quality

and appearance of the work it represents, including the interface with adjacent materials and components as applicable.

H. Coordinate fabrication, delivery, assembly, and installation with related materials to be included in the mockups. Construction of the mockup assemblies shall be under the supervision of the same personnel who will be employed for the subsequent work.

I. Maintain mockups in neat, clean condition until removal or final acceptance. Repair damage as required to maintain in condition suitable for review and approval.

J. Scheduling:

1. Construct mockups in a timely manner to permit review and modifications such that the work is not delayed.
2. Do not proceed with ordering of components or construction subject to mockup approval until after approvals have been obtained.
3. Provide the Architect not less than 10 working days notice of the time each component is ready for review.
4. Include line item in the construction schedule for the building section mockup, showing submittals, construction, review, and approval periods.

PART 2 – PRODUCTS

2.1 MATERIALS

A. As specified in the respective Sections of the Specifications.

PART 3 – EXECUTION

3.1 EXTERIOR BUILDING MOCKUP

A. Provide building mockup of building area indicated where directed by the Architect.

B. Purpose: Establish standards for work indicated and specified to be included in mock-ups to demonstrate quality of workmanship, materials, colors, and textures required by the Contract Documents. Include roof, roof overhang, soffits, windows, doors, glazing, sealants, siding and cladding, flashings, and other exterior materials.

1. Mockup will be used by the Architect to test color and material alternatives and to approve final colors, textures and workmanship.

2. Interior finishes will not be required to be installed on the interior side of the exterior building mockup.

-END OF SECTION-

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01 50 00 - TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes requirements for temporary fencing, utilities, support facilities, and security and protection facilities.

B. See Section 01 73 00 "Execution Requirements" for progress cleaning requirements.

C. See Divisions 02 through 33 Sections for temporary heat, ventilation, and humidity requirements for products in those Sections.

1.2 DEFINITIONS

A. Permanent Enclosure: As determined by Architect, permanent or temporary roofing is complete, insulated, and weather tight; exterior walls are insulated and weather tight; and all openings are closed with permanent construction or substantial temporary closures.

1.3 USE CHARGES

A. General: Cost or use charges for temporary facilities shall be included in the Contract Sum. Allow other entities to use temporary services and facilities without cost, including, but not limited to, Owner's construction forces, Construction Manager, Architect, occupants of Project, testing agencies, and authorities having jurisdiction.

B. Water Service: Water from Owner's existing water system is not available for use without metering and without payment of use charges. Contractor is responsible for coordination of this activity with the local municipality.

C. Electric Power Service: Contractor to provide connections and extensions of services as required for construction operations including the office trailers. Contractor will be responsible to coordinate and make arrangements with PG&E to provide temporary power to the construction site. Contractor will be responsible for all costs associated with the installation of temporary power and any and all use charges for the duration of the contract. **Contractor shall provide temporary power as required to allow for operation of office trailers, construction power and new modular building.** Temporary power from PG&E is available in the immediate area of the site, contractor shall pursue engineering and installation of temporary power at their own cost.

   a. If using a generator, contractor to abide by all local laws and regulation including CEQA conditions of approval. See plan sheets G - 003/ 004 (also attached as supplement).

D. Internet Service/Data: Temporary hardwired service is not currently available in the immediate area of the site, but contractor may pursue engineering and installation of temporary hardwired service at their own cost. Contractor may need to pursue other options to meet the contractual temporary service requirements (satellite, etc.).

E. Temporary Fencing: Contractor to provide temporary fencing at the perimeter of the project site with adequate protection provided to pedestrians outside of the project site. If there is any exposure to falling objects outside of the project site then the Contractor must provide a covered walkway. Contractor shall comply with FAA Orders and Standards for temporary fencing installed at airside (aircraft parking areas). Contractor shall install fencing to secure FAA Parking areas near ATCT during work at ATCT parking lots.

1.4 SUBMITTALS

A. Site Plan: Show temporary facilities, utility hookups, staging areas, and parking areas for construction personnel and Construction Managers.

B. Erosion- and Sedimentation-Control Plan: Show compliance with requirements of EPA Construction General Permit or authorities having jurisdiction, whichever is more stringent.

C. Fire-Safety Program: Show compliance with requirements of NFPA 241 and authorities having jurisdiction. Indicate Contractor personnel responsible for management of fire prevention program.

1.5 QUALITY ASSURANCE

A. Electric Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.

B. Tests and Inspections: Arrange for authorities having jurisdiction to test and inspect each temporary utility before use. Obtain required certifications and permits.

1.6 PROJECT CONDITIONS

A. Temporary Use of Permanent Facilities: Installer of each permanent service shall assume responsibility for operation, maintenance, and protection of each permanent service during its use as a construction facility before Owner’s acceptance, regardless of previously assigned responsibility.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Temporary Chain-Link Fencing: Minimum 2-inch, 9-gage, galvanized steel, chain-link fence with privacy screening fabric mesh; minimum 6 feet high with galvanized steel pipe posts; minimum 2-3/8-inch- OD line posts and 2-7/8-inch- OD corner and pull posts, with 1-5/8-inch- OD top and bottom rails. Galvanized Steel posts will be required to be driven into the ground for support and stability or portable fencing, if appropriate, with sufficient hold down weight to prevent overturning.

2.2 TEMPORARY FACILITIES FOR PROJECT SITE

A. Field Offices for each site, General: Prefabricated or mobile units with serviceable finishes, temperature controls, and foundations adequate for normal loading.

B. Field Offices: Provide and maintain for the duration of the Work temporary offices on site for use by the Contractor and a separate onsite trailer for use by the Owner's representatives (including Owner, Construction Manager and the Architect).
   1. Offices shall be equipped with secure wireless internet capabilities to allow for onsite users access to email and the internet.
   2. Offices shall be provided with a door and lock with security bar and a window with a minimum size of 4 feet x 3 feet and security screen. Provide and maintain an electric heater and air conditioning along with adequate electric lighting for each office.

C. Storage and Fabrication Sheds: Provide sheds sized, furnished, and equipped to accommodate materials and equipment for construction operations.

D. Temporary Field Fencing: Provide fence size, material and privacy screen fabric mesh to encompass each site, furnish and installed, equipped for entrance of utility trucks (16-foot gates) and man gates for easy access.

E. Network Setup: The network shall have the following requirements:
   1. The internet connection must be separate service and independent of the Contractor's and shall be the fastest speed available in the area with a minimum a 20-Meg upload / 20-Meg download speed. This should be accomplished via a hard-wired connection.
      a. Wired network connections must be provided at
         1) The Office, Planroom, and the Printer/Scanner.
      b. Reasonable access to power for the equipment must be provided.
   2. If it is necessary to "piggyback" off of an existing hard-wired line, the line provided to the Owner's Representative shall be an unfiltered line, with no limitations set by the main line holder, such as access restrictions or DNS port blocking.
   3. In the cases where a hard-wired connection is not available, the wireless connection provided must meet the same speed needs of 20-Meg upload / 20-Meg

download. It shall also be of sufficient bandwidth to meet the needs of the staff.

4. In the case of sites where the internet speeds do not meet the above requirements, a cellular "hot-spot" is to be provided if resulting in a faster connection, along with a local storage device must be provided for the location to save the project data. The local storage device will be connected to the Kitchell network, and backed up during non-business hours to the Kitchell network server.

2.3 EQUIPMENT

A. Fire Extinguishers: Portable, UL rated; with class and extinguishing agent as required by locations and classes of fire exposures.

B. HVAC Equipment: Unless Owner authorizes use of permanent HVAC system, provide vented, self-contained, liquid-propane-gas or fuel-oil heaters with individual space thermostatic control.
   1. Use of gasoline-burning space heaters, open-flame heaters, or salamander-type heating units is prohibited.
   2. Heating Units: Listed and labeled for type of fuel being consumed, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
   3. Permanent HVAC System: If Owner authorizes use of permanent HVAC system for temporary use during construction, provide filter with MERV of 8 at each return air grille in system and remove at end of construction.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required by progress of the Work.

B. Provide each facility ready for use when needed to avoid delay. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

3.2 TEMPORARY UTILITY INSTALLATION FOR PROJECT SITE

A. General: Install temporary service or connect to existing service.
   1. Arrange with utility company, Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.

B. Electrical Power and Lighting:
   1. Contractor will furnish and pay for power during the course of the work to the extent power is not in the building(s) or on the Site. Contractor shall be responsible for providing temporary facilities required on the Site to point of

intended use.

2. Contractor shall furnish, wire for, install and maintain temporary electrical lights wherever it is necessary to provide illumination for the proper performance and/ or observe of the Work: a minimum of 20 foot-candles for rough work and 50 foot-candles for finish work.
3. Contractor shall be responsible for maintaining existing lighting levels in the Project vicinity should temporary outage or service interruptions occur.

C. Sewers and Drainage: Provide temporary utilities to remove effluent lawfully.
   1. Connect temporary sewers to municipal system as directed by authorities having jurisdiction. Coordination is the responsibility of the Contractor.

D. Water Service: Install water service and distribution piping in sizes and pressures adequate for construction and modular passenger terminal.

E. Sanitary Facilities: Provide temporary toilets, wash facilities, and drinking water for use of construction personnel. Comply with authorities having jurisdiction for type, number, location, operation, and maintenance of fixtures and facilities. Provide connection to existing sanitary sewer for temporary passenger terminal modular.

F. Heating and Cooling: Provide temporary heating and cooling required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of low temperatures or high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed.

G. Ventilation and Humidity Control: Provide temporary ventilation required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed. Coordinate ventilation requirements to produce ambient condition required and minimize energy consumption.

H. Electric Power Service: It is the Contractor's responsibility to coordinate with PG&E to obtain the temporary electrical service, including submission of services applications, load calculation, and single line diagrams. The Contractor will also be responsible for payment of the monthly PG&E invoices and all other temporary requirements as outlined within the specification section.

   Contractor shall provide electric power service and distribution system of sufficient size, capacity, and power characteristics required for construction operations including office trailers.
   1. See Section 1.3.C

I. Lighting: Provide temporary lighting with local switching that provides adequate illumination for construction operations, observations, inspections, and traffic

conditions.

1. Install and operate temporary lighting that fulfills security and protection requirements without operating entire system.

3.3 Temporary Controls

A. Noise Control
   1. Contractor acknowledges that adjacent facilities may remain in operation during all or a portion of the Work, and it shall take all reasonable precaution to minimize noise as required by applicable lass and the Contract Documents.
   2. Notices of proposed noisy operations, including without limitation, operation of pneumatic demolition tools, concrete saws, and other equipment, shall be submitted to the County a minimum of forty-eight (48) hours in advance of their performance. Contractor responsible for obtaining all permits required for construction noise outside of the times allowable within the noise ordinance.
   3. Contractor to meet the Conditions of Approval related to Noise Control as defined in the Contract Documents.

B. Noise and Vibration
   1. Equipment and impact tools shall have intake and exhaust mufflers.
   2. Contractor shall cooperate with the County to minimize and /or cease the use of noisy and vibratory equipment if that equipment becomes objectionable by its longevity.
   3. Contractor to meet the Conditions of Approval related to noise and vibration as defined in the Contract Documents.

C. Dust and Dirt
   1. Contractor shall conduct demolition and construction operations to minimize the generation of dust and dirt, and prevent dust and dirt from interfering with the progress of the Work and from accumulating in the Work and adjacent areas including, without limitation, occupied facilities.
   2. Contractor shall periodically water exterior demolition and construction areas to minimize the generation of dust and dirt.
   3. Contractor shall ensure that all hauling equipment and trucks carrying loads of soil and debris shall have their loads sprayed with water or covered with tarpaulins, and as otherwise required by local and state ordinance.
   4. Contractor shall prevent dust and dirt from accumulating on walks, roadways, parking areas, and planting, and from washing into sewer and storm drain lines.
   5. Contractor to meet the Conditions of Approval related to dust and dirt as defined in the Contract Documents.
   6. Comply with FAA Orders and Standards.

3.4 SUPPORT FACILITIES INSTALLATION

A. General: Comply with the following:

1. Provide incombustible construction for offices, shops, and sheds located within construction area or within thirty (30) feet of building lines. Comply with NFPA 241.
2. Maintain support facilities until near Substantial Completion. Remove before Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to Owner.

B. Temporary Roads and Paved Areas: Construct and maintain temporary roads and paved areas adequate for construction operations. Locate temporary roads and paved areas within construction limits indicated on Drawings.
1. Provide dust-control treatment that is nonpolluting and non-tracking. Reapply treatment as required to minimize dust.

C. Temporary Roads and Paved Areas: All areas are currently paved.

D. Traffic Controls: Comply with requirements of authorities having jurisdiction.
1. Protect existing site improvements to remain including curbs, pavement, and utilities.
2. Maintain access for fire-fighting equipment and access to fire hydrants.

E. Parking: Contractor is to provide temporary parking for construction personnel within confines of the designated construction site. If parking within the designated construction site becomes unavailable due to number of Trades, Subcontractors and Vendors, Contractor shall be responsible for coordinating with the County, or local jurisdiction for parking requirements, locations, permits, shuttle services, etc. Contractor is to review and follow all related Conditions of Approval, Laws and Regulations from the Contra Costa County.

F. Dewatering Facilities and Drains: Comply with requirements of authorities having jurisdiction. Maintain Project site, excavations, and construction free of water. (refer to demolition drawings for specifics)
1. Dispose of rainwater in a lawful manner that will not result in flooding Project or adjoining properties nor endanger permanent Work or temporary facilities.

G. Project Identification and Temporary Signs: Provide Project identification and other signs as indicated on drawings or required by the County or the City. Install signs where indicated to inform public and individuals seeking entrance to Project. Unauthorized signs are not permitted.
1. Provide temporary, directional signs for construction personnel and visitors.
2. Maintain and touchup signs so they are legible at all times.

H. Waste Disposal Facilities: Provide waste-collection containers in sizes adequate to handle waste from construction operations. Comply with requirements of authorities having jurisdiction. Comply with Section 01 73 00 "Execution Requirements" for progress cleaning requirements.

I. Lifts and Hoists: Provide facilities necessary for hoisting materials and personnel.
   1. Truck cranes and similar devices used for hoisting materials are considered "tools and equipment" and not temporary facilities.

3.5 SECURITY AND PROTECTION FACILITIES INSTALLATION

A. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction in ways and by methods that comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects.

B. Temporary Erosion and Sedimentation Control: Provide measures to prevent soil erosion and discharge of soil-bearing water runoff and airborne dust to adjacent properties and walkways, according to requirements of authorities having jurisdiction.

C. Stormwater Control: Comply with authorities having jurisdiction. Provide barriers in and around excavations and subgrade construction to prevent flooding by runoff of stormwater from heavy rains.

D. Pest Control: Engage pest-control service to recommend practices to minimize attraction and harboring of rodents, roaches, and other pests and to perform extermination and control procedures at regular intervals so Project will be free of pests and their residues at Substantial Completion. Obtain extended warranty for Owner. Perform control operations lawfully, using environmentally safe materials.

E. Temporary Site Enclosure Fence: All costs associated with the install, monthly fencing rental fees and demobilization of the fencing will be the responsibility of the contractor. Furnish and install any additional site enclosure fence panels in a manner that will prevent people and animals from easily entering site except by entrance gates.
   1. Temporary Fence: As required to enclose entire Project site or portion determined sufficient to accommodate construction operations and protection of the public. Operations include temporary offices, parking, staging areas, actual construction site.

F. Security Enclosure and Lockup: Install substantial temporary enclosure around partially completed areas of construction. Contractor is responsible to ensure that the fencing and all gates are secured and locked prior to leaving the site on a daily basis to prevent unauthorized entrance, vandalism, theft, and similar violations of security.

G. Barricades, Warning Signs, and Lights: Comply with requirements of authorities having jurisdiction for erecting structurally adequate barricades, including warning signs and lighting.

H. Temporary Enclosures: Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities. Provide temporary weather-tight enclosure for building exterior.

1. Where heating or cooling is needed and permanent enclosure is not complete, insulate temporary enclosures.
2. Insulate partitions to provide noise protection to occupied areas.
3. Seal joints and perimeter. Equip partitions with dustproof doors and security locks.
4. Protect air-handling equipment.
5. Weather strip openings.
6. Provide walk-off mats at each entrance through temporary partition.

I. Temporary Fire Protection: Install and maintain temporary fire-protection facilities of types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 241.
1. Smoking is prohibited in all construction areas.
2. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition according to requirements of authorities having jurisdiction.
3. Develop and supervise an overall fire-prevention and -protection program for personnel at Project site. Review needs with local fire department and establish procedures to be followed. Instruct personnel in methods and procedures. Post warnings and information.
4. Provide temporary standpipes and hoses for fire protection. Hang hoses with a warning sign stating that hoses are for fire-protection purposes only and are not to be removed. Match hose size with outlet size and equip with suitable nozzles.

3.6 OPERATION, TERMINATION, AND REMOVAL

A. Supervision: Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.

B. Maintenance: Maintain facilities in good operating condition until removal.
1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.

C. Temporary Facility Changeover: Do not change over from using temporary security and protection facilities to permanent facilities until Substantial Completion.

D. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.
1. Materials and facilities that constitute temporary facilities are property of

Contractor. Owner reserves right to take possession of Project identification signs.

2. At Substantial Completion, clean and renovate permanent facilities used during construction period. Comply with final cleaning requirements specified in Division 01 Section "Closeout Procedures."

-END OF SECTION-

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01 60 00 - PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes administrative and procedural requirements for selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; product substitutions; and comparable products.

B. See Section 01 77 00 "Closeout Procedures" for submitting warranties for Contract closeout.

C. See Divisions 02 through 48 Sections for specific requirements for warranties on products and installations specified to be warranted.

D. See Divisions 02 through 48 Sections for specific requirements for LEED.

1.2 DEFINITIONS

A. Products: Items purchased for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.
   1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published product literature that is current as of date of the Contract Documents.
   2. New Products: Items that have not previously been incorporated into another project or facility, except that products consisting of recycled-content materials are allowed, unless explicitly stated otherwise. Products salvaged or recycled from other projects are not considered new products.
   3. Comparable Product: Product that is demonstrated and approved through submittal process, or where indicated as a product substitution, to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.

B. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Contractor.

C. Basis-of-Design Product Specification: Where a specific manufacturer's product is named and accompanied by the words "basis of design," including make or model number or other designation, to establish the significant qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics for purposes of evaluating comparable products of other named manufacturers.

1.3 SUBMITTALS

A. Substitution Requests: Must comply with the requirements of the Contract and General Conditions.

B. Submit three copies of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
   1. Substitution Request Form: CSI Form 13.1A.
   2. Documentation: Show compliance with requirements for substitutions and the following, as applicable:
      a. Statement indicating why specified material or product cannot be provided.
      b. Coordination information, including a list of changes or modifications needed to other parts of the Work and to construction performed by Owner and separate contractors that will be necessary to accommodate proposed substitution.
      c. Detailed comparison of significant qualities of proposed substitution with those of the Work specified. Significant qualities may include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
      d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
      e. Samples, where applicable or requested.
      f. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners.
      g. Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
      h. Research/evaluation reports evidencing compliance with building code in effect for Project, from a model code organization acceptable to authorities having jurisdiction.
      i. Detailed comparison of Contractor's Construction Schedule using proposed substitution with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating lack of availability or delays in delivery.
      j. Cost information, including a proposal of change, if any, in the Contract Sum.
      k. Contractor's certification that proposed substitution complies with requirements in the Contract Documents and is appropriate for applications indicated.
      l. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.
   3. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within seven (7) days of receipt of a request for substitution. Architect will notify Contractor of acceptance or rejection of

proposed substitution within fourteen (14) days of receipt of request, or seven (7) days of receipt of additional information or documentation, whichever is later.

a. Form of Acceptance: Change Order.
b. Use product specified if Architect cannot make a decision on use of a proposed substitution within time allocated.

C. Comparable Product Requests: Submit three copies of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.

1. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within one week of receipt of a comparable product request. Architect will notify Contractor of approval or rejection of proposed comparable product request within fourteen (14) calendar days of receipt of request, or seven (7) days of receipt of additional information or documentation, whichever is later.
   a. Form of Approval: As specified in Section 01 33 00 "Submittal Procedures."
   b. Use product specified if Architect cannot make a decision on use of a comparable product request within time allocated.

D. Basis-of-Design Product Specification Submittal: Comply with requirements in Section 01 33 00 "Submittal Procedures." Show compliance with requirements.

1.4 QUALITY ASSURANCE

A. Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, product selected shall be compatible with products previously selected, even if previously selected products were also options.

1.5 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft. Comply with manufacturer's written instructions.

B. Delivery and Handling:

1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
3. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
4. Inspect products on delivery to ensure compliance with the Contract Documents and to ensure that products are undamaged and properly protected.

C. Storage:

1. Store products to allow for inspection and measurement of quantity or counting of units.
2. Store materials in a manner that will not endanger Project structure.
3. Store products that are subject to damage by the elements, under cover in a weather tight enclosure above ground, with ventilation adequate to prevent condensation.
4. Store cementitious products and materials on elevated platforms.
5. Store foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.
6. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
7. Protect stored products from damage and liquids from freezing.

1.6 MANUFACTURER'S LABELS AND NAME PLATES

A. Except as otherwise indicated for required labels and operating data, do not permanently attach or imprint manufacturer's or producer's nameplates or trademarks on exposed surfaces of products which will be exposed to view either in occupied spaces or on the exterior of the completed project. Visible, non-required labels and nameplates shall be removed.
   1. Labels: Locate required product labels and stamps on a concealed surface or, where required for observation after installation, on an accessible surface which, in occupied spaces, is not conspicuous.
   2. Equipment Nameplates: Provide a permanent nameplate on each item of service-connected or power-operated equipment. Locate the nameplate on an easily accessible surface which is inconspicuous in occupied spaces. The name plate shall contain the following information as well as other essential operating data:
      a. Name of manufacturer.
      b. Model number.
      c. Serial number.
      d. Capacity.

1.7 PRODUCT WARRANTIES

A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.
   1. Manufacturer's Warranty: Preprinted written warranty published by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.
   2. Special Warranty: Written warranty required by or incorporated into the Contract Documents, either to extend time limit provided by manufacturer's warranty or to provide more rights for Owner.

B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution. Submit a draft for approval before final execution.

1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
2. Specified Form: When specified forms are included with the Specifications, prepare a written document using appropriate form properly executed.
3. Refer to Divisions 2 through 48 Sections for specific content requirements and particular requirements for submitting special warranties.

C. Submittal Time: Comply with requirements in Division 01 Section 01 77 00 "Closeout Procedures."

PART 2 - PRODUCTS

2.1 PRODUCT SELECTION PROCEDURES

A. General Product Requirements: Provide products that comply with the Contract Documents, that are undamaged and, unless otherwise indicated, that are new at time of installation.
1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
3. Owner reserves the right to limit selection to products with warranties not in conflict with requirements of the Contract Documents.
4. Where products are accompanied by the term "as selected," Architect will make selection.
5. Where products are accompanied by the term "match sample," sample to be matched is Architect's.
6. Descriptive, performance, and reference standard requirements in the Specifications establish "salient characteristics" of products.

B. Product Selection Procedures:
1. Product: Where Specifications name a single product and manufacturer, provide the named product that complies with requirements.
2. Manufacturer/Source: Where Specifications name a single manufacturer or source, provide a product by the named manufacturer or source that complies with requirements.
3. Products: Where Specifications include a list of names of both products and manufacturers, provide one of the products listed that complies with requirements.
4. Manufacturers: Where Specifications include a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements.
5. Available Products: Where Specifications include a list of names of both products and manufacturers, provide one of the products listed, or an unnamed product, that complies with requirements. Comply with provisions in the Contract, General Conditions, and Part 2 "Comparable Products" Article for consideration of an unnamed product.

6. Available Manufacturers: Where Specifications include a list of manufacturers, provide a product by one of the manufacturers listed, or an unnamed manufacturer, that complies with requirements. Comply with provisions in the Contract, General Conditions, and Part 2 "Comparable Products" Article for consideration of an unnamed product.
7. Product Options: Where Specifications indicate that sizes, profiles, and dimensional requirements on Drawings are based on a specific product or system, provide the specified product or system. Comply with provisions in the Contract, General Conditions, and Part 2 "Product Substitutions" Article for consideration of an unnamed product or system.
8. Basis-of-Design Product: Where Specifications name a product and include a list of manufacturers, provide the specified product or a comparable product by one of the other named manufacturers. Drawings and Specifications indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with provisions in the Contract, General Conditions, and Part 2 "Comparable Products" Article for consideration of an unnamed product by the other named manufacturers.
9. Visual Matching Specification: Where Specifications require matching an established Sample, select a product that complies with requirements and matches Architect's sample. Architect's decision will be final on whether a proposed product matches.
    a. If no product available within specified category matches and complies with other specified requirements, comply with provisions in the Contract, General Conditions, and Part 2 "Product Substitutions" Article for proposal of product.
10. Visual Selection Specification: Where Specifications include the phrase "as selected from manufacturer's colors, patterns and textures" or a similar phrase, select a product that complies with other specified requirements.
    a. Standard Range: Where Specifications include the phrase "standard range of colors, patterns, textures" or similar phrase, Architect will select color, pattern, density, or texture from manufacturer's product line that does not include premium items.
    b. Full Range: Where Specifications include the phrase "full range of colors, patterns, textures" or similar phrase, Architect will select color, pattern, density, or texture from manufacturer's product line that includes both standard and premium items.

2.2 COMPARABLE PRODUCTS

A. Conditions: Architect will consider Contractor's request for comparable product when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:
    1. Procedures within the General Conditions and Contract are followed.
    2. Evidence that the proposed product does not require extensive revisions to the contract documents that it is consistent with the contract documents and will

produce the indicated results, and that it is compatible with other portions of the Work.

3. Detailed comparison of significant qualities of proposed product with those named in the Specifications. Significant qualities include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
4. Evidence that proposed product provides specified warranty.
5. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners, if requested.
6. Samples, if requested.

PART 3 - EXECUTION (Not Used)

-END OF SECTION-

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01 73 00 - EXECUTION REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes general procedural requirements governing execution of the Work including, but not limited to, the following:
   1. Construction layout.
   2. Field engineering and surveying.
   3. General installation of products.
   4. Cutting and patching.
   5. Progress cleaning.
   6. Starting and adjusting.
   7. Protection of installed construction.
   8. Correction of the Work.

B. See Section 01 78 39 "Project Record Documents" for submitting final property survey with Project Record Documents, recording of Owner-accepted deviations from indicated lines and levels, and final cleaning.

C. Related Requirements:
   1. Division 00 General Conditions and Special Conditions
   2. Section 01 10 00 "Summary" for limits on use of Project site.
   3. Section 01 77 00 "Closeout Procedures" for submitting final property survey with Project Record Documents, recording of Owner-accepted deviations from indicated lines and levels, and final cleaning.

1.2 SUBMITTALS

A. Landfill Receipts: Submit copy of receipts issued by a landfill facility, licensed to accept hazardous materials, for hazardous waste disposal.

B. Certificates: Submit certificate signed by land surveyor certifying that location and elevation of improvements comply with requirements.

C. Survey reports and plots as detailed below.

1.3 QUALITY ASSURANCE

A. Land Surveyor Qualifications: A professional land surveyor who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing land-surveying services of the kind indicated.

B. Cutting and Patching: Comply with requirements for and limitations on cutting and patching of construction elements.
   1. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as

intended or that results in increased maintenance or decreased operational life or safety.

1.4 EXAMINATION

A. Existing Utilities: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework, investigate and verify the existence and location of underground utilities and other construction affecting the Work.
   1. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, and water-service piping; and underground electrical services.
   2. Furnish location data for work related to Project that must be performed by public utilities serving Project site.

B. Acceptance of Conditions: Examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.
   1. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
   2. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
   3. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
   4. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

1.5 PREPARATION

A. Existing Utility Information: Furnish information to local utility that is necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances located in or affected by construction. Coordinate with authorities having jurisdiction.

B. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

C. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.

D. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents, submit a request for information to Architect. Include a detailed description of problem encountered, together with recommendations for changing the Contract Documents.

1.6 CONSTRUCTION LAYOUT

A. Verification: Before proceeding to lay out the Work, verify layout information shown on Drawings, in relation to the property survey and existing benchmarks. If discrepancies are discovered, notify Architect promptly.

B. General: Engage a land surveyor to lay out the Work using accepted surveying practices.
   1. Establish benchmarks and control points to set lines and levels at each story of construction and elsewhere as needed to locate each element of Project.
   2. Establish limits on use of Project site.
   3. Establish dimensions within tolerances indicated. Do not scale Drawings to obtain required dimensions.
   4. Inform installers of lines and levels to which they must comply.
   5. Check the location, level and plumb, of every major element as the Work progresses.
   6. Notify Architect when deviations from required lines and levels exceed allowable tolerances.
   7. Close site surveys with an error of closure equal to or less than the standard established by authorities having jurisdiction.

C. Site Improvements: Locate and lay out site improvements, including pavements, grading, fill and topsoil placement, utility slopes, and invert elevations.

D. Building Lines and Levels: Locate and lay out control lines and levels for structures, building foundations, column grids, and floor levels, including those required for mechanical and electrical work. Transfer survey markings and elevations for use with control lines and levels. Level foundations and piers from two or more locations.

E. Record Log: Maintain a log of layout control work. Record deviations from required lines and levels. Include beginning and ending dates and times of surveys, weather conditions, name and duty of each survey party member, and types of instruments and tapes used. Make the log available for reference by Architect.

1.7 FIELD ENGINEERING

A. Reference Points: Locate existing permanent benchmarks, control points, and similar reference points before beginning the Work. Preserve and protect permanent benchmarks and control points during construction operations.

B. Benchmarks: Establish and maintain a minimum of two permanent benchmarks on Project site, referenced to data established by survey control points. Comply with authorities having jurisdiction for type and size of benchmark.
   1. Record benchmark locations, with horizontal and vertical data, on Project Record Documents.

C. Certified Survey: On completion of foundation walls, major site improvements, and other work requiring field-engineering services, prepare a certified survey showing dimensions, locations, angles, and elevations of construction and sitework.

D. Final Property Survey: Prepare a final property survey showing significant features (real property) for Project. Include on the survey a certification, signed by land surveyor, that principal metes, bounds, lines, and levels of Project are accurately positioned as shown on the survey.
   1. Recording: At Substantial Completion, have the final property survey recorded by or with authorities having jurisdiction as the official "property survey."

1.8 INSTALLATION

A. General: Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.
   1. Make vertical work plumb and make horizontal work level.
   2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
   3. Conceal pipes, ducts, and wiring in finished areas, unless otherwise indicated.

B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.

C. Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Substantial Completion.

D. Conduct construction operations so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.

E. Tools and Equipment: Do not use tools or equipment that produce harmful noise levels.

F. Templates: Obtain and distribute to the parties involved templates for work specified to be factory prepared and field installed. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.

G. Anchors and Fasteners: Provide anchors and fasteners as required to anchor each component securely in place, accurately located and aligned with other portions of the Work.
   1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Architect.
   2. Allow for building movement, including thermal expansion and contraction.
   3. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

H. Joints: Make joints of uniform width. Where joint locations in exposed work are not indicated, arrange joints for the best visual effect. Fit exposed connections together to form hairline joints.

I. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.

1.9 CUTTING AND PATCHING

A. Cutting and Patching, General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.
   1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.

B. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during installation or cutting and patching operations, by methods and with materials so as not to void existing warranties

C. Temporary Support: Provide temporary support of work to be cut.

D. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.

E. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other work. Patch with durable seams that are as invisible as practicable. Provide materials and comply with installation requirements specified in other Sections, where applicable
   1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate physical integrity of installation.
   2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will minimize evidence of patching and refinishing.

F. Cleaning: Clean areas and spaces where cutting and patching are performed. Remove paint, mortar, oils, putty, and similar materials from adjacent finished surfaces.

1.10 PROGRESS CLEANING

A. General: Clean Project site and work areas daily, including common areas. Coordinate progress cleaning for joint-use areas where more than one installer has worked. Enforce requirements strictly. Dispose of materials lawfully.
   1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
   2. Do not hold materials more than seven (7) days during normal weather or three (3) days if the temperature is expected to rise above 80 deg F.

3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.

B. Site: Maintain Project site free of waste materials and debris.

C. Work Areas: Clean areas where work is in progress to the level of cleanliness necessary for proper execution of the Work.
   1. Remove liquid spills promptly.
   2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.

D. Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.

E. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.

F. Exposed Surfaces in Finished Areas: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.

G. Waste Disposal: Burying or burning waste materials on-site will not be permitted. Washing waste materials down sewers or into waterways will not be permitted.

H. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.

I. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.

J. Limiting Exposures: Supervise construction operations to assure that no part of the construction completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

1.11 STARTING AND ADJUSTING

A. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.

B. Adjust operating components for proper operation without binding. Adjust equipment for proper operation.

C. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

D. Manufacturer's Field Service: If a factory-authorized service representative is required to inspect field-assembled components and equipment installation, comply with qualification requirements in Section 01 40 00 "Quality Requirements."

1.12 PROTECTION OF INSTALLED CONSTRUCTION

A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.

B. Comply with manufacturer's written instructions for temperature and relative humidity.

1.13 CORRECTION OF THE WORK

A. Repair or remove and replace defective construction. Restore damaged substrates and finishes. Comply with requirements in Section 01 73 29 "Cutting and Patching."
   1. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment.

B. Restore permanent facilities used during construction to their specified condition.

C. Remove and replace damaged surfaces that are exposed to view if surfaces cannot be repaired without visible evidence of repair.

D. Repair components that do not operate properly. Remove and replace operating components that cannot be repaired.

E. Remove and replace chipped, scratched, and broken glass or reflective surfaces.

-END OF SECTION-

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01 73 29 - CUTTING AND PATCHING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes procedural requirements for cutting and patching.

B. See Divisions 2 through 48 Sections for specific requirements and limitations applicable to cutting and patching individual parts of the Work.

1.2 SUBMITTALS

A. Cutting and Patching Proposal: Submit a proposal describing procedures at least 10 days before the time cutting and patching will be performed, requesting approval to proceed. Include the following information:
   1. Extent: Describe cutting and patching, show how they will be performed, and indicate why they cannot be avoided.
   2. Changes to In-Place Construction: Describe anticipated results. Include changes to structural elements and operating components as well as changes in building's appearance and other significant visual elements.
   3. Products: List products to be used and firms or entities that will perform the Work.
   4. Dates: Indicate when cutting and patching will be performed.
   5. Utility Services and Mechanical/Electrical Systems: List services/systems that cutting and patching procedures will disturb or affect. List services/systems that will be relocated and those that will be temporarily out of service. Indicate how long services/systems will be disrupted.
   6. Structural Elements: Where cutting and patching involve adding reinforcement to structural elements, submit details and engineering calculations showing integration of reinforcement with original structure.
   7. Architect's Approval: Obtain approval of cutting and patching proposal before cutting and patching. Approval does not waive right to later require removal and replacement of unsatisfactory work.

1.3 QUALITY ASSURANCE

A. Structural Elements: Do not cut and patch structural elements in a manner that could change their load-carrying capacity or load-deflection ratio.

B. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that result in increased maintenance or decreased operational life or safety.

C. Miscellaneous Elements: Do not cut and patch miscellaneous elements or related components in a manner that could change their load-carrying capacity, and result in reducing their capacity to perform as intended, or that result in increased maintenance or decreased operational life or safety.

D. Visual Requirements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch construction exposed on the exterior or in occupied spaces in a manner that would, in Architect's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General: Comply with requirements specified in other Sections.

B. In-Place Materials: Use materials identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.
   1. If identical materials are unavailable or cannot be used, use materials that, when installed, will match the visual and functional performance of in-place materials.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine surfaces to be cut and patched and conditions under which cutting and patching are to be performed.
   1. Compatibility: Before patching, verify compatibility with and suitability of substrates, including compatibility with in-place finishes or primers.
   2. Proceed with installation only after unsafe or unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Temporary Support: Provide temporary support of Work to be cut.

B. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.

C. Adjoining Areas: Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.

D. Existing Utility Services and Mechanical/Electrical Systems: Where existing services/systems are required to be removed relocated, or abandoned, bypass such services/systems before cutting to minimize interruption to occupied areas.

3.3 PERFORMANCE

A. General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.
   1. Cut in-place construction to provide for installation of other components or

performance of other construction, and subsequently patch as required to restore surfaces to their original condition.

B. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.
   1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots as small as possible, neatly to size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
   2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
   3. Concrete and Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
   4. Excavating and Backfilling: Comply with requirements in applicable Division 31 Sections where required by cutting and patching operations.
   5. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
   6. Proceed with patching after construction operations requiring cutting are complete.

C. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other Work. Patch with durable seams that are as invisible as possible. Provide materials and comply with installation requirements specified in other Sections.
   1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate integrity of installation.
   2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing.
   3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove in-place floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.
   4. Ceilings: Patch, repair, or re-hang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.
   5. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition.

D. Cleaning: Clean areas and spaces where cutting and patching are performed. Completely remove paint, mortar, oils, putty, and similar materials.

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01 74 19 - CONSTRUCTION WASTE MANAGEMENT

PART 1 - GENERAL

1.1 SUMMARY – WASTE MANAGEMENT GOALS

A. Section includes administrative and procedural requirements for salvaging, recycling and disposing of nonhazardous demolition and construction waste.

B. The Owner has established that this Project shall generate the least amount of waste possible and processes that ensure the generation of as little waste as possible due to error, poor planning, breakage, mishandling, contamination, or other factors shall be employed.

C. Of the inevitable waste that is generated, as many of the waste materials as economically feasible shall be reused, salvaged, or recycled. Waste disposal in landfills shall be minimized.

1.2 DEFINITIONS

A. Construction Waste: Building and site improvement materials and other solid waste resulting from construction, remodeling, renovation, or repair operations. Construction waste includes packaging.

B. Demolition Waste: Building and site improvement materials resulting from demolition or selective demolition operations.

C. Disposal: Removal of off-site waste and subsequent sale, recycling, reuse or deposit in landfill or incinerator acceptable to authorities having jurisdiction.

D. Hazardous: Exhibiting the characteristics of hazardous substances, i.e., ignitability, corrosivity, toxicity or reactivity.

E. Recyclable: The ability of a product or material to be recovered at the end of its life cycleand remanufactured into a new product for reuse by others.

F. Recycle: Recovery of waste from the Project site to another site for subsequent processing in preparation for reuse

G. Recycling: The process of sorting, cleansing, treating and reconstituting solid waste and other discarded materials for the purpose of recycling. Recycling does not include burning, incinerating, or thermally destroying waste.

H. Salvage: To remove a waste material from the Project site for subsequent sale or

reuse in another facility.

I. Salvage and Reuse: Recovery of waste and subsequent incorporation into the Work

1.3 PERFORMANCE REQUIREMENTS

A. Develop and implement a waste management program resulting in an end-of-project rates for salvage/recycling of minimum 65 percent by weight or volume of the total waste generated by the project.

B. Regulations: The Contractor shall be responsible for knowing and complying with regulatory requirements, Federal, State, and Local, pertaining to legal disposal of all construction and demolition waste materials.

C. Coordination: Coordinate the recycling of materials with Owner and Subcontractors as required to conform to the Construction Waste Management Plan.

D. Site Access and Controls: Conduct waste management operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

1.4 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with hauling and disposal regulations of authorities having jurisdiction.

B. Waste Management Meetings: Conduct on-site waste management meetings with all subcontractors. Review and discuss the waste management plan, methods, procedures and each party's roles and responsibilities.

C. Refrigerant Recovery Technician Qualifications: Certified by EPA-approved certification program.

D. Packing and Shipping

1. Shipping: Coordinate the schedule of product delivery to designated prepared areas in order to minimize site storage time and potential damage to stored materials.
2. Packing: Arrange for the return of packing materials, such as wood pallets, where economically feasible.

E. Handling

1. Provide equipment and personnel to handle products by methods to prevent soiling or damage.
2. Promptly inspect shipments to assure products comply with requirements, quantities are correct, and products are undamaged.
3. Promptly return damaged shipments or incorrect orders to manufacturer for

credit or refund.

F. Storage: Store products in accordance with manufactures recommendations and periodically inspect to assure that stored products are undamaged and are maintained under required conditions.

G. Preparation

1. Storage and Protection:
   a. Designate receiving/storage areas for incoming material to be delivered according to installation schedule and to be placed convenient to work area in order to minimize waste due to excessive materials handling and misapplication.
   b. Store and handle materials in a manner as to prevent loss from weather and other damage. Keep materials covered and off the ground, and store in a dry, secure area.
   c. Prevent contact with material that may cause corrosion, discoloration, or staining.
   d. Protect all materials and installations from damage by the activities of other trades.

H. Waste Management

1. Source separated waste: Separate, store, protect, and handle at the site identified recyclable and salvageable waste products in order to prevent contamination of materials and to maximize recyclability and salvageability of identified materials.
2. Comingled Waste: Waste may be commingled at the site and separated at a recycling facility.
3. Return: Set aside and protect missed-delivered and substandard products and materials and return to supplier for credit.
4. Reuse and Salvage: Set aside, sort, and protect separated products and materials for collection, re-use on site by contractor, and salvage by other.
5. Recycling: Arrange for timely pickups from the site or deliveries to recycling facility in order to prevent contamination of recyclable materials.

1.5 WASTE MANAGEMENT PLAN

A. Waste Identification: Indicate anticipated types and quantities of demolition, site-clearing and construction waste generated by the Work. Include estimated quantities and assumptions for estimates

B. The list of these materials is to include, at minimum, the following materials:

1. Cardboard.
2. Clean dimensional wood.
3. Beverage containers.
4. Land clearing debris.
5. Concrete.
6. Bricks.
7. Concrete Masonry Units (CMU).
8. Metals from banding, stud trim, ductwork, piping, rebar, roofing, other trim,

steel, iron, galvanized sheet steel, stainless steel, aluminum, copper, zinc, lead, brass, and bronze.
9. Drywall.
10. Carpet and carpet pads.

2 PRODUCTS – NOT USED

3 EXECUTION

3.3 WASTE MANAGEMENT PLAN IMPLEMENTATION

A. Manager: The Contractor shall designate an on-site party (or parties) responsible for instructing workers and overseeing and documenting results of the Waste Management Plan for the Project.

B. Distribution: The Contractor shall distribute copies of the Waste Management Plan to the Job Site Foreman, each Subcontractor, the Owner, and the Owner's Representative.

C. Instruction and Training: The Contractor shall provide on-site instruction and train workers, subcontractors and suppliers of appropriate separation, handling, and recycling, salvage, reuse, and return methods to be used.

D. Separation facilities: The Contractor shall layout and label a specific area to facilitate separation of materials for potential recycling, salvage, reuse, and return. Recycling and waste bin areas are to be kept neat and clean and clearly marked in order to avoid contamination of materials. Waste may be commingled at the site in a specific label area for pickup by the waste hauler and separated at a recycling facility.

E. Hazardous wastes: Hazardous wastes shall be separated, stored, and disposed of according to local regulations.

F. Contractor shall provide a monthly summary to the LEED Consultant with the following information:

G. The amount (in tons or cubic yards) of material landfilled from the Project, the identity of the landfill, the total amount of tipping fees paid at the landfill, and the total disposal cost. Include manifests, weight tickets, receipt, and invoices.

H. For each material recycled, reused, or salvaged from the Project, the amount (in tons or cubic yards), the date (removed from the jobsite, the receiving party, the transportation cost, the amount of any money paid or received for the recycled or salvaged material, and the net total cost or savings of salvage or recycling each material). Attach manifests, weight tickets, receipts, and invoices.

3.4 RECYCLING DEMOLITION AND CONSTRUCTION WASTE, GENERAL

A. General: Recycle paper and beverage containers used by on-site workers.

B. Recycling Incentives: Revenues, savings, rebates, tax credits, and other incentives received for recycling waste materials shall accrue to Owner.

Preparation of Waste: Prepare and maintain recyclable waste materials according to recycling or reuse facility requirements. Maintain materials free of dirt, adhesives, solvents, petroleum contamination, and other substances deleterious to the recycling process.

C. Procedures: Separate recyclable waste from other waste materials, trash, and debris. Separate recyclable waste by type at Project site to the maximum extent practical according to approved construction waste management plan

D. Provide appropriately marked containers or bins for controlling recyclable waste until removed from Project site. Include list of acceptable and unacceptable materials at each container and bin. Regularly inspect bins for contamination.

E. Stockpile processed materials on-site without intermixing with other materials. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.

F. Stockpile materials away from construction area. Do not store within drip line of remaining trees.

G. Store components off the ground and protect from the weather.

H. Remove recyclable waste from Owner's property per approved Waste Management Plan.

3.5 DISPOSAL OF WASTE

A. General: Except for items or materials to be salvaged, recycled, or otherwise reused, remove waste materials from Project site and legally dispose of them in a landfill or incinerator acceptable to authorities having jurisdiction.

1. Except as otherwise specified, do not allow waste materials that are to be disposed of accumulate on-site.

2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

3.6 INSTALLATION

A. Install product(s) per manufacturer's recommendations to reduce damage to or waste of materials by required replacement.

3.7 TRANSPORTATION

A. Transport materials in covered trucks to prevent contamination of product or littering of surrounding areas.

3.8 GENERAL CLEANING

A. Control accumulation of waste materials and trash. Recycle or dispose of off-site at intervals approved by the Owner and in compliance with waste management procedures.

B. Cleaning materials: Use cleaning materials that are non-hazardous.

3.9 FINAL CLEANING

A. Cleaning Materials: Only non-hazardous cleaning materials shall be used in the final cleanup.

B. Recycle, salvage, and return construction and demolition waste from Project.

C. Arrange for pick-up of salvageable materials in accordance with the Waste Management Plan.

D. Disposal Operations: Promptly and legally transport and dispose of any trash. Do not burn, bury, or otherwise dispose of trash on the Project site.

-END OF SECTION-

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01 74 20 - CLEANING

PART 1 – GENERAL

1.1 Section Includes

A. Cleaning throughout the construction period, and final project cleaning prior to the acceptance tour.

1.2 Related Sections

A. Section 01 50 00 - Temporary Facilities and Controls

1.3 Quality Assurance

A. Inspection: Conduct daily inspection, and more often if necessary, to verify that requirements of cleanliness are being met.

B. Codes and Standards: In addition to the requirements specified herein, comply with pertinent requirements of authorities having jurisdiction.

PART 2 – PRODUCTS

2.1 Cleaning Materials and Equipment

A. Provide required personnel, equipment, and materials needed to maintain the specified standard of cleanliness.

2.2 Compatibility

A. Use cleaning materials and equipment that are compatible with the surfaces being cleaned, as recommended by the manufacturer of the material to be cleaned.

PART 3 – EXECUTION

3.1 Progress Cleaning

A. General:
   1. Retain stored items in an orderly arrangement allowing maximum access, not impeding drainage or traffic, and providing the required protection of materials.
   2. Do not allow the accumulation of scrap, debris, waste material, and other items not required for construction of this work. Debris shall be removed from the site and disposed of in a lawful manner. Disposal receipts or dump tickets shall be furnished to Architect upon request.
   3. At least twice each month, and more often if necessary, remove scrap debris, and waste material from the job site.

4. Provide adequate storage for items awaiting removal from the job site, observing requirements for fire protection and protection of the ecology.

B. Site:

1. Daily, and more often if necessary, inspect the site and pick up all scrap, debris, and waste material. Remove items to the place designated for their storage. Flammable waste shall be kept in sealed metal containers until removed from the site.
2. Weekly, and more often if necessary, inspect, arrangements of materials stored on the site; restack, tidy, or otherwise service arrangements to meet the requirements specified above.
3. Maintain the site in a neat and orderly condition.

C. Structures:
1. Weekly, and more often if necessary, inspect the structures and pick up scrap, debris, and waste material. Remove items to the place designated for their storage.
2. Weekly, and more often if necessary, sweep interior spaces clean.
   a. "Clean", for the purpose of this subparagraph, shall be interpreted as meaning free from dust and other material capable of being removed by use of reasonable effort and a handheld broom, i.e., "broom-clean".
3. As required preparatory to installation of succeeding materials, clean the structures of pertinent portions thereof to the degree of cleanliness recommended by the manufacturer of the succeeding material, using equipment and materials required to achieve the required cleanliness.
4. Following the installation of finish floor materials, clean the finish floor daily, and more often if necessary, and while work is being performed in the space in which finish materials have been installed.
   a. "Clean", for the purpose of this subparagraph, shall be interpreted as meaning free from foreign material that, in the opinion of the Architect, may be injurious to the finish floor material, i.e., "vacuum-clean".

C. General: The General Conditions require general cleaning during construction. Prior to completion of the work, remove from the job site all tools, surplus materials, equipment, scrap, debris, and waste, conduct final progress cleaning as described below.

D. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to the condition expected in a normal, commercial building cleaning and maintenance program. Comply with manufacturer's instructions. Unless otherwise specifically directed by the Architect, water and broom clean paved areas on the site and public paved areas directly adjacent to the site. Remove resultant debris

F. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion.
1. Remove labels that are not permanent labels.

2. Clean transparent materials, including mirrors and glass in doors and windows.

Remove glazing compounds and other substances that are noticeable vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials.

G. Clean exposed exterior and interior hard-surfaced finishes to a dust-free condition, free of stains, films, and similar foreign substances. Restore reflective surfaces to their original condition. Leave concrete floors broom clean. Vacuum carpeted surfaces. Sweep and mop vinyl and rubber surfaces.

H. Structures:
   1. Exterior: In areas affected by the work under this contract, visually inspect exterior surfaces and remove traces of soil, waste material, smudges, and other foreign matter. Remove traces of splashed material from adjacent surfaces. If necessary to achieve a uniform degree of exterior cleanliness, hose down the exterior of the structure.
   2. In the event of stubborn stains not removable with water, the Architect may require light sandblasting or other cleaning at no additional cost to the County.

I. Interior: In areas affected by the work under this contract, visually inspect interior surfaces and remove traces of soil waste material, smudges, and other foreign matter. Remove traces of splashed materials from adjacent surfaces. Remove paint drippings, spots, stains, and dirt from finished surfaces. Use only the cleaning materials and equipment instructed by the manufacturer of the surface material.

J. Glass: Clean glass inside and outside.

K. Polished surfaces: On surfaces requiring the routine application of buffed polish, apply the polish recommended by the manufacturer of the material being polished. Glossy surfaces shall be cleaned and shined as intended by the manufacturer
   1. Wipe surfaces of mechanical and electrical equipment. Remove excess lubrication and other substances. Clean plumbing fixtures to a sanitary condition. Clean light fixtures and lamps.
   2. Clean the site, including landscape development areas, of rubbish, litter, and other foreign substances. Sweep paved areas broom clean; remove stains, spills, and other foreign deposits. Rake grounds that are neither paved nor planted to a smooth, even-textured surface.

L. Pest Control: Engage an experienced, licensed exterminator to make a final inspection and rid the Project of rodents, insects, and other pests.

M. Removal of Protection: Remove temporary protection and facilities installed for protection of the Work during construction.

N. Compliance: Comply with regulations of authorities having jurisdiction and safety standards for cleaning. Do not burn waste materials. Do not bury debris or excess materials on the County's property. Do not discharge volatile, harmful, or dangerous materials into drainage systems. Remove waste materials from the site and dispose of lawfully.

O. Extra Materials: Where extra materials of value remain after completion of associated Work, they become the County's property. Dispose of these materials as directed by the Owner.

P. Timing: Schedule final cleaning as accepted by the Architect to enable the County to accept a completely clean project.

Q. Cleaning During County's Occupancy
   1. Should the County occupy the work or any portion thereof prior to its completion by the Contractor and acceptance by the County, responsibilities for interim and final cleaning of the occupied spaces shall be determined by the Architect in accordance with the General Conditions of the Contract.

- End of Section –

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01 74 20 - CLEANING

PART 1 – GENERAL

1.1 Section Includes

A. Cleaning throughout the construction period, and final project cleaning prior to the acceptance tour.

1.2 Related Sections

A. Section 01 50 00 - Temporary Facilities and Controls

1.3 Quality Assurance

A. Inspection: Conduct daily inspection, and more often if necessary, to verify that requirements of cleanliness are being met.

B. Codes and Standards: In addition to the requirements specified herein, comply with pertinent requirements of authorities having jurisdiction.

PART 2 – PRODUCTS

2.1 Cleaning Materials and Equipment

A. Provide required personnel, equipment, and materials needed to maintain the specified standard of cleanliness.

2.2 Compatibility

A. Use cleaning materials and equipment that are compatible with the surfaces being cleaned, as recommended by the manufacturer of the material to be cleaned.

PART 3 – EXECUTION

3.1 Progress Cleaning

A. General:
   1. Retain stored items in an orderly arrangement allowing maximum access, not impeding drainage or traffic, and providing the required protection of materials.
   2. Do not allow the accumulation of scrap, debris, waste material, and other items not required for construction of this work. Debris shall be removed from the site and disposed of in a lawful manner. Disposal receipts or dump tickets shall be furnished to Architect upon request.
   3. At least twice each month, and more often if necessary, remove scrap debris, and waste material from the job site.

4. Provide adequate storage for items awaiting removal from the job site, observing requirements for fire protection and protection of the ecology.

B. Site:

1. Daily, and more often if necessary, inspect the site and pick up all scrap, debris, and waste material. Remove items to the place designated for their storage. Flammable waste shall be kept in sealed metal containers until removed from the site.
2. Weekly, and more often if necessary, inspect, arrangements of materials stored on the site; restack, tidy, or otherwise service arrangements to meet the requirements specified above.
3. Maintain the site in a neat and orderly condition.

C. Structures:
1. Weekly, and more often if necessary, inspect the structures and pick up scrap, debris, and waste material. Remove items to the place designated for their storage.
2. Weekly, and more often if necessary, sweep interior spaces clean.
   a. "Clean", for the purpose of this subparagraph, shall be interpreted as meaning free from dust and other material capable of being removed by use of reasonable effort and a handheld broom, i.e., "broom-clean".
3. As required preparatory to installation of succeeding materials, clean the structures of pertinent portions thereof to the degree of cleanliness recommended by the manufacturer of the succeeding material, using equipment and materials required to achieve the required cleanliness.
4. Following the installation of finish floor materials, clean the finish floor daily, and more often if necessary, and while work is being performed in the space in which finish materials have been installed.
   a. "Clean", for the purpose of this subparagraph, shall be interpreted as meaning free from foreign material that, in the opinion of the Architect, may be injurious to the finish floor material, i.e., "vacuum-clean".

C. General: The General Conditions require general cleaning during construction. Prior to completion of the work, remove from the job site all tools, surplus materials, equipment, scrap, debris, and waste, conduct final progress cleaning as described below.

D. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to the condition expected in a normal, commercial building cleaning and maintenance program. Comply with manufacturer's instructions. Unless otherwise specifically directed by the Architect, water and broom clean paved areas on the site and public paved areas directly adjacent to the site. Remove resultant debris

F. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion.
1. Remove labels that are not permanent labels.

2. Clean transparent materials, including mirrors and glass in doors and windows.

Remove glazing compounds and other substances that are noticeable vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials.

G. Clean exposed exterior and interior hard-surfaced finishes to a dust-free condition, free of stains, films, and similar foreign substances. Restore reflective surfaces to their original condition. Leave concrete floors broom clean. Vacuum carpeted surfaces. Sweep and mop vinyl and rubber surfaces.

H. Structures:
   1. Exterior: In areas affected by the work under this contract, visually inspect exterior surfaces and remove traces of soil, waste material, smudges, and other foreign matter. Remove traces of splashed material from adjacent surfaces. If necessary to achieve a uniform degree of exterior cleanliness, hose down the exterior of the structure.
   2. In the event of stubborn stains not removable with water, the Architect may require light sandblasting or other cleaning at no additional cost to the County.

I. Interior: In areas affected by the work under this contract, visually inspect interior surfaces and remove traces of soil waste material, smudges, and other foreign matter. Remove traces of splashed materials from adjacent surfaces. Remove paint drippings, spots, stains, and dirt from finished surfaces. Use only the cleaning materials and equipment instructed by the manufacturer of the surface material.

J. Glass: Clean glass inside and outside.

K. Polished surfaces: On surfaces requiring the routine application of buffed polish, apply the polish recommended by the manufacturer of the material being polished. Glossy surfaces shall be cleaned and shined as intended by the manufacturer
   1. Wipe surfaces of mechanical and electrical equipment. Remove excess lubrication and other substances. Clean plumbing fixtures to a sanitary condition. Clean light fixtures and lamps.
   2. Clean the site, including landscape development areas, of rubbish, litter, and other foreign substances. Sweep paved areas broom clean; remove stains, spills, and other foreign deposits. Rake grounds that are neither paved nor planted to a smooth, even-textured surface.

L. Pest Control: Engage an experienced, licensed exterminator to make a final inspection and rid the Project of rodents, insects, and other pests.

M. Removal of Protection: Remove temporary protection and facilities installed for protection of the Work during construction.

N. Compliance: Comply with regulations of authorities having jurisdiction and safety standards for cleaning. Do not burn waste materials. Do not bury debris or excess materials on the County's property. Do not discharge volatile, harmful, or dangerous materials into drainage systems. Remove waste materials from the site and dispose of lawfully.

O. Extra Materials: Where extra materials of value remain after completion of associated Work, they become the County's property. Dispose of these materials as directed by the Owner.

P. Timing: Schedule final cleaning as accepted by the Architect to enable the County to accept a completely clean project.

Q. Cleaning During County's Occupancy
   1. Should the County occupy the work or any portion thereof prior to its completion by the Contractor and acceptance by the County, responsibilities for interim and final cleaning of the occupied spaces shall be determined by the Architect in accordance with the General Conditions of the Contract.

- End of Section –

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01 77 00 - CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:
   1. Inspection procedures.
   2. Final Completion.
   3. Warranties.
   4. Final cleaning.
   5. Repair of work.

B. See Section 01 29 00 "Payment Procedures" for requirements for Applications for Payment for Substantial and Final Completion.

C. See Section 01 78 39 "Project Record Documents" for submitting Record Drawings, Record Specifications, and Record Product Data.

D. See Section 01 78 23 "Operation and Maintenance Data" for operation and maintenance manual requirements.

E. See Section 01 79 00 "Demonstration and Training" for requirements for instructing Owner's personnel.

F. See Divisions 02 through 48 Sections for specific closeout and special cleaning requirements for the Work in those Sections.

1.2 SUBSTANTIAL COMPLETION

A. Preliminary Procedures: Before requesting inspection for determining date of Substantial Completion, complete the following. List items below that are incomplete in request.
   1. Prepare a list of items to be completed and corrected (punch list), the value of items on the list, and reasons why the Work is not complete.
   2. Advise Owner of pending insurance changeover requirements.
   3. Submit specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
   4. Obtain and submit releases permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
   5. Prepare and submit Project Record Documents, operation and maintenance manuals, damage or settlement surveys, property surveys, and similar final record information.
   6. Deliver tools, spare parts, extra materials, and similar items to location designated by Owner. Label with manufacturer's name and model number where applicable.

7. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
8. Complete startup testing of systems.
9. Submit test/adjust/balance records.
10. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
11. Advise Owner of changeover in heat and other utilities.
12. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.
13. Complete final cleaning requirements, including touchup painting.
14. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.
15. Successful completion of Functional Testing for equipment requiring LDD Commissioning.

B. Inspection: Submit a written request for inspection for Substantial Completion. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Architect, that must be completed or corrected before certificate will be issued.
   1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
   2. Results of completed inspection will form the basis of requirements for Final Completion.

1.3 FINAL COMPLETION

A. Preliminary Procedures: Before requesting final inspection for determining date of Final Completion, complete the following:
   1. Submit a final Application for Payment according to Section 01 29 00 "Payment Procedures."
   2. Submit certified copy of Architect's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Architect. The certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
   3. Submit evidence of final, continuing insurance coverage complying with insurance requirements.
   4. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems.

B. Inspection: Submit a written request for final inspection for acceptance. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.

1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

1.4 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

A. Preparation: Submit electronic versions of list (including editable file and PDF file). Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.
   1. Organize list of spaces in sequential order, starting with exterior areas first.
   2. Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems.
   3. Submit list of incomplete items in the following format:
      a. MS Excel electronic file. Architect, though Construction Manager, will retune annotate copy.

1.5 WARRANTIES

A. Submittal Time: Submit written warranties on request of Architect for designated portions of the Work where commencement of warranties other than date of Substantial Completion is indicated.

B. Organize warranty documents into an orderly sequence based on the table of contents of the Project Manual.
   1. Bind warranties and bonds in heavy-duty, 3-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch paper.
   2. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product and the name, address, and telephone number of Installer.
   3. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project name, and name of Contractor.

C. Provide additional copies of each warranty to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.

PART 3 - EXECUTION

3.1 FINAL CLEANING

A. General: Provide final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.

B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.
   1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a portion of Project:
      a. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
      b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
      c. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.
      d. Remove tools, construction equipment, machinery, and surplus material from Project site.
      e. Remove snow and ice to provide safe access to building.
      f. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
      g. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
      h. Sweep concrete floors broom clean in unoccupied spaces.
      i. Vacuum carpet and similar soft surfaces, removing debris and excess nap; shampoo if visible soil or stains remain.
      j. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials. Polish mirrors and glass, taking care not to scratch surfaces.
      k. Remove labels that are not permanent.
      l. Touch up and otherwise repair and restore marred, exposed finishes and surfaces. Replace finishes and surfaces that cannot be satisfactorily repaired or restored or that already show evidence of repair or restoration.
         1) Do not paint over "UL" and similar labels, including mechanical and electrical nameplates.
      m. Wipe surfaces of mechanical and electrical equipment and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
      n. Replace parts subject to unusual operating conditions.

o. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
p. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
q. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency. Replace burned-out bulbs, and those noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.
r. Leave Project clean and ready for occupancy.

C. Comply with safety standards for cleaning. Do not burn waste materials. Do not bury debris or excess materials on Owner's property. Do not discharge volatile, harmful, or dangerous materials into drainage systems. Remove waste materials from Project site and dispose of lawfully.

-END OF SECTION-

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01 78 23 - OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:
   1. Emergency manuals.
   2. Operation manuals for systems, subsystems, and equipment.
   3. Maintenance manuals for the care and maintenance of products, materials, and finishes systems and equipment.

B. See Divisions 02 through 48 Sections for specific operation and maintenance manual requirements for the Work in those Sections.

1.2 SUBMITTALS

A. Manual: Submit one copy of each manual in final form at least fifteen (15) days before final inspection. At discretion of Architect, initial submittals may be as PDF files with both hard copies and PDF files of final version. Architect will return copy with comments within fifteen (15) days after final inspection.
   1. Correct or modify each manual to comply with Architect's comments. Submit three (3) copies of each corrected manual within fifteen (15) days of receipt of Architect's comments.

PART 2 - PRODUCTS

2.1 MANUALS, GENERAL

A. Organization: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain a title page, table of contents, and manual contents.

B. Title Page: Enclose title page in transparent plastic sleeve. Include the following information:
   1. Subject matter included in manual.
   2. Name and address of Project.
   3. Name and address of Owner.
   4. Date of submittal.
   5. Name, address, and telephone number of Contractor.
   6. Name and address of Architect.
   7. Cross-reference to related systems in other operation and maintenance manuals.

C. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.

D. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder.
   1. Binders: Heavy-duty, 3-ring, vinyl-covered, loose-leaf binders, in thickness necessary to accommodate contents, sized to hold 8-1/2-by-11-inch (215-by-280-mm) paper; with clear plastic sleeve on spine to hold label describing contents and with pockets inside covers to hold folded oversize sheets.
      a. Identify each binder on front and spine, with printed title "OPERATION AND MAINTENANCE MANUAL," Project title or name, and subject matter of contents. Indicate volume number for multiple-volume sets.
   2. Dividers: Heavy-paper dividers with plastic-covered tabs for each section. Mark each tab to indicate contents. Include typed list of products and major components of equipment included in the section on each divider, cross-referenced to Specification Section number and title of Project Manual.
   3. Protective Plastic Sleeves: Transparent plastic sleeves designed to enclose diagnostic software diskettes for computerized electronic equipment.
   4. Drawings: Attach reinforced, punched binder tabs on drawings and bind with text.
      a. If oversize drawings are necessary, fold drawings to same size as text pages and use as foldouts.
      b. If drawings are too large to be used as foldouts, fold and place drawings in labeled envelopes and bind envelopes in rear of manual. At appropriate locations in manual, insert typewritten pages indicating drawing titles, descriptions of contents, and drawing locations.

2.2 EMERGENCY MANUALS

A. Content: Organize manual into a separate section for type of emergency, emergency instructions, and emergency procedures.

B. Type of Emergency: Where applicable for each type of emergency indicated below, include instructions and procedures for each system, subsystem, piece of equipment, and component for fire, gas leak, water leak, power failure, water outage, equipment failure, and chemical release or spill.

C. Emergency Instructions: Describe and explain warnings, trouble indications, error messages, and similar codes and signals. Include responsibilities of Owner's operating personnel for notification of Installer, supplier, and manufacturer to maintain warranties.

D. Emergency Procedures: Include instructions on stopping, shutdown instructions for each type of emergency, operating instructions for conditions outside normal operating limits, and required sequences for electric or electronic systems.

2.3 OPERATION MANUALS

A. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and equipment descriptions, operating standards, operating procedures, operating logs, wiring and control diagrams, and license requirements.

B. Descriptions: Include the following:
1. Product name and model number.
2. Manufacturer's name.
3. Equipment identification with serial number of each component.
4. Equipment function.
5. Operating characteristics.
6. Limiting conditions.
7. Performance curves.
8. Engineering data and tests.
9. Complete nomenclature and number of replacement parts.

C. Operating Procedures: Include start-up, break-in, and control procedures; stopping and normal shutdown instructions; routine, normal, seasonal, and weekend operating instructions; and required sequences for electric or electronic systems.

D. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.

E. Piped Systems: Diagram piping as installed, and identify color-coding where required for identification.

2.4 PRODUCT MAINTENANCE MANUAL

A. Content: Organize manual into a separate section for each product, material, and finish. Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, as described below.

B. Source Information: List each product included in manual identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual.

C. Product Information: Include the following, as applicable:
1. Product name and model number.
2. Manufacturer's name.
3. Color, pattern, and texture.
4. Material and chemical composition.
5. Reordering information for specially manufactured products.

D. Maintenance Procedures: Include manufacturer's written recommendations and inspection procedures, types of cleaning agents, methods of cleaning, schedule for cleaning and maintenance, and repair instructions.

E. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.

F. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.

2.5 SYSTEMS AND EQUIPMENT MAINTENANCE MANUAL

A. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranty and bond information, as described below.

B. Source Information: List each system, subsystem, and piece of equipment included in manual identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual.

C. Manufacturers' Maintenance Documentation: Manufacturers' maintenance documentation including maintenance instructions, drawings and diagrams for maintenance, nomenclature of parts and components, and recommended spare parts for each component part or piece of equipment:

D. Maintenance Procedures: Include test and inspection instructions, troubleshooting guide, disassembly instructions, and adjusting instructions, and demonstration and training videotape if available, that detail essential maintenance procedures:

E. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.

F. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.

G. Maintenance Service Contracts: Include copies of maintenance agreements with name and telephone number of service agent.

H. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.

PART 3 - EXECUTION

3.1 MANUAL PREPARATION

A. Emergency Manual: Assemble a complete set of emergency information indicating procedures for use by emergency personnel and by Owner's operating personnel for types of emergencies indicated.

B. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.

C. Operation and Maintenance Manuals: Assemble a complete set of operation and maintenance data indicating operation and maintenance of each system, subsystem, and piece of equipment not part of a system.

D. Manufacturers' Data: Where manuals contain manufacturers' standard printed data, include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.

E. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with information contained in Record Drawings to ensure correct illustration of completed installation.
   1. Do not use original Project Record Documents as part of operation and maintenance manuals.

F. Comply with Section 01 77 00 "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

-END OF SECTION-

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01 78 36 - WARRANTIES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes administrative and procedural requirements for preparing warranties of products and installation.

B. All Contract Documents should be reviewed for applicable provisions related to the provisions in this document, including without limitation:
1. General Conditions, including, without limitation, Warranty/Guarantee Information;
2. Special Conditions.

1.2 SUBMITTALS

A. Binders: Contractor shall use commercial quality, 8-1/2 by 11 inch, three-side rings, with durable plastic covers; two inch maximum ring size.

B. Cover: Contractor shall identify each binder with typed or printed title "WARRANTIES" and shall list title of Project.

C. Table of Contents: Contractor shall provide title of Project; name, address, and telephone number of Contractor and equipment supplier, and name of responsible principal. Contractor shall identify each item with the number and title of the specific Specification, document, provision, or section in which the name of the product or work item is specified.

D. Contractor shall separate each warranty with index tab sheets keyed to the Table of Contents listing, providing full information and using separate typed sheets as necessary. Contractor shall list each applicable and/or responsible Subcontractor(s), supplier(s), and/or manufacturer(s), with name, address, and telephone number of each responsible principal(s).

1.3 PREPARATION:

A. Contractor shall obtain warranties, executed in duplicate by each applicable and/or responsible subcontractor(s), supplier(s), and manufacturer(s), within ten (10) days after completion of the applicable item or work. Except for items put into use with City's permission, Contractor shall leave date of beginning of time of warranty until the date of completion is determined.

B. Contractor shall verify that documents are in proper form, contain full information, and are notarized, when required.

C. Contractor shall co-execute submittals when required.

D. Contractor shall retain warranties until time specified for submittal.

E. Manufacturers' Data: Where manuals contain manufacturers' standard printed data, include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.

F. Comply with Section 01 77 00 "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

-END OF SECTION-

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01 78 39 - PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes administrative and procedural requirements for Project Record Documents, including the following:
   1. Record Drawings.
   2. Record Specifications.

B. See Section 01 78 23 "Operation and Maintenance Data" for operation and maintenance manual requirements.

C. See Divisions 02 through 48 Sections for specific requirements for Project Record Documents of the Work in those Sections.

1.2 SUBMITTALS

A. Record Drawings: Comply with the following:
   1. Submit copies of Record Drawings as follows:
      a. Initial Submittal: Submit one copy of marked-up Record Prints for review. Architect will initial and date each sheet and mark whether general scope of changes, additional information recorded, and quality of drafting are acceptable. Architect will return prints for organizing into sets, printing, binding, and final submittal.
      b. Final Submittal: Submit one set of the marked-up Record Prints, and the following:
         1) PDF file of complete set of record drawings.
         2) Record CAD Drawing Files and Plots.

B. Record Specifications: Submit copy of Project's Specifications, including addenda and contract modifications.

PART 2 - PRODUCTS

2.1 RECORD DRAWINGS

A. Record Prints (Progress): Maintain one set of blue- or black-line white prints of the Contract Drawings and Shop Drawings.
   1. Preparation: Mark Record Prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to prepare the marked-up Record Prints.
      a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.

b. Record data as soon as possible after obtaining it. Record and check the markup before enclosing concealed installations.

2. Mark the Contract Drawings or Shop Drawings, whichever is most capable of showing actual physical conditions, completely and accurately. If Shop Drawings are marked, show cross-reference on the Contract Drawings.
3. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
4. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, RFI numbers and similar identification, where applicable. **Clearly mark revisions made to original documents – listing reference documents is not sufficient.**

B. Record Prints (Final): Immediately before inspection for Certificate of Substantial Completion, review marked-up progress Record Prints with Architect. When authorized, prepare a full set of corrected copies of the Contract Drawings and Shop Drawings.
1. Incorporate changes and additional information previously marked on Record Prints. Erase, redraw, and add details and notations where applicable.
2. Refer instances of uncertainty to Architect for resolution.

C. Format: Identify and date each Record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.
1. Record Prints: Organize Record Prints and newly prepared Record Drawings into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets. Provide PDF file of full set of record documents.
2. Record CAD Drawings: Organize CAD information into separate electronic files that correspond to each sheet of the Contract Drawings. Name each file with the sheet identification. Include identification in each CAD file.
3. Identification: As follows:
   a. Project name.
   b. Date.
   c. Designation "PROJECT RECORD DRAWINGS."
   d. Name of Architect.
   e. Name of Contractor.

2.2 RECORD SPECIFICATIONS

A. Preparation: Mark Specifications to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications.
1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
2. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.
3. Record the name of manufacturer, supplier, Installer, and other information necessary to provide a record of selections made.
4. Note related Change Orders, RFIs and Record Drawings where applicable

(including revisions made not just referenced document number).

2.3 MISCELLANEOUS RECORD SUBMITTALS

A. Assemble miscellaneous records required by other Specification Sections for miscellaneous record keeping and submittal in connection with actual performance of the Work. Bind or file miscellaneous records and identify each, ready for continued use and reference. Miscellaneous records include, but are not limited to, the following:
1. Field records on underground construction and similar work.
2. Surveys showing locations and elevations of underground lines.
3. Invert elevations of drainage piping.
4. Surveys establishing building lines and levels.
5. Authorized measurements using unit prices or allowances.
6. Records of plant treatment.
7. Ambient and substrate condition tests.
8. Certifications received in lieu of labels on bulk products.
9. Batch mixing and bulk delivery records.
10. Testing and qualification of trade persons.
11. Documented qualification of installation firms.
12. Load and performance testing.
13. Inspections and certifications by governing authorities.
14. Final inspection and correction procedures

PART 3 - EXECUTION

3.1 RECORDING AND MAINTENANCE

A. Recording: Maintain one copy of each submittal during the construction period for Project Record Document purposes. Post changes and modifications to Project Record Documents as they occur; do not wait until the end of Project.

B. Maintenance of Record Documents and Samples: Store Record Documents and Samples in the field office apart from the Contract Documents used for construction. Do not use Project Record Documents for construction purposes. Maintain Record Documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to Project Record Documents for Architect's reference during normal working hours.

-END OF SECTION-

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01 79 00 - DEMONSTRATION AND TRAINING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes administrative and procedural requirements for instructing Owner's personnel, including the following:
   1. Demonstration of operation of systems, subsystems, and equipment.
   2. Training in operation and maintenance of systems, subsystems, and equipment.
   3. Demonstration and training DVD’s/digital storage device.

B. See Divisions 02 through 48 for specific requirements for demonstration and training for products in those Sections.

1.2 SUBMITTALS

A. Instruction Program: Submit two (2) copies of outline of instructional program for demonstration and training, including a schedule of proposed dates, times, length of instruction time, and instructors' names for each training module. Include learning objective and outline for each training module.

B. Demonstration and Training DVD’s/digital storage device: Submit two (2) copies within seven (7) days of end of each training module.

1.3 QUALITY ASSURANCE

A. Facilitator Qualifications: A firm or individual experienced in training or educating maintenance personnel in a training program similar in content and extent to that indicated for this Project, and whose work has resulted in training or education with a record of successful learning performance.

B. Instructor Qualifications: A factory-authorized service representative, complying with requirements in Section 01 40 00 "Quality Requirements," experienced in operation and maintenance procedures and training.

C. Pre-instruction Conference: Conduct conference at Project site. Review methods and procedures related to demonstration and training.

D. Coordinate content of training modules with content of approved emergency, operation, and maintenance manuals. Do not submit instruction program until operation and maintenance data has been reviewed and approved by Architect.

PART 2 - PRODUCTS

2.1 INSTRUCTION PROGRAM

A. Program Structure: Develop an instruction program that includes individual training modules for each system and equipment not part of a system, as required by individual Specification Sections, and as follows:
   1. Building Energy Management System.

B. Training Modules: Develop a learning objective and teaching outline for each module. Include a description of specific skills and knowledge that participant is expected to master. For each module, include instruction for the following:
   1. Basis of System Design, Operational Requirements, and Criteria: Include system and equipment descriptions, operating standards, regulatory requirements, equipment function, operating characteristics, limiting conditions, and performance curves.
   2. Documentation: Review emergency, operations, and maintenance manuals; Project Record Documents; identification systems; warranties and bonds; and maintenance service agreements.
   3. Emergencies: Include instructions on stopping; shutdown instructions; operating instructions for conditions outside normal operating limits; instructions on meaning of warnings, trouble indications, and error messages; and required sequences for electric or electronic systems.
   4. Operations: Include startup, break-in, control, and safety procedures; stopping and normal shutdown instructions; routine, normal, seasonal, and weekend operating instructions; operating procedures for emergencies and equipment failure; and required sequences for electric or electronic systems.
   5. Adjustments: Include alignments and checking, noise, vibration, economy, and efficiency adjustments.
   6. Troubleshooting: Include diagnostic instructions and test and inspection procedures.
   7. Maintenance: Include inspection procedures, types of cleaning agents, methods of cleaning, procedures for preventive and routine maintenance, and instruction on use of special tools.
   8. Repairs: Include diagnosis, repair, and disassembly instructions; instructions for identifying parts; and review of spare parts needed for operation and maintenance.

PART 3 - EXECUTION

3.1 INSTRUCTION

A. Facilitator: Engage a qualified facilitator to prepare instruction program and training modules, to coordinate instructors, and to coordinate between Contractor and Owner for number of participants, instruction times, and location.

B. Engage qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.

1. Owner will furnish an instructor to describe Owner's operational philosophy.

C. Scheduling: Provide instruction at mutually agreed on times. For equipment that requires seasonal operation, provide similar instruction at start of each season.
   1. Schedule training with Owner, through Construction Manager, with at least seven days' advance notice.

D. Evaluation: At conclusion of each training module, assess and document each participant's mastery of module by use of a demonstration performance-based test.

3.2 DEMONSTRATION AND TRAINING VIDEOTAPES

A. General: Engage a qualified commercial photographer to record demonstration and training videos. Record each training module separately. Include classroom instructions and demonstrations, board diagrams, and other visual aids, but not student practice.
   1. At beginning of each training module, record each chart containing learning objective and lesson outline.

B. Media Format: Provide high-quality Digital Videos Discs (DVD's) or digital storage device (per the preference of the Owner).

C. Narration: Describe scenes on video by audio narration by microphone while video is recorded. Include description of items being viewed. Describe vantage point, indicating location, direction (by compass point), and elevation or story of construction.

-END OF SECTION-

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SPECIFICATION 01 91 00
COMMISSIONING

PART 1 GENERAL

1.01 WORK INCLUDED

A. Work included in this section: Oversight, coordination, and documentation of the following:

1. Commissioning of selected systems and equipment specified under Division 23 HVAC Systems

2. Commissioning of selected systems and equipment specified under Division 26 Electrical Systems

3. Commissioning of systems and equipment specified under Section 25 00 00 Building Automation Systems

1.02 GENERAL

A. Building Commissioning is a quality assurance process that has as its goal that all systems perform interactively and according to design intent under the full range of expected operating conditions. The Contractor shall ensure that all systems are fully commissioned and that commissioning is fully documented as specified in this Section.

B. Commissioning Team: The Commissioning Team for the construction and post-construction period shall include:

1. Contractor Members

a. Commissioning Coordinator; see paragraph 1.02C.

b. Division 23, 25 and 26 project managers plus key subcontractors where appropriate, including but not limited to those responsible for:

1) 23 05 93 Testing, Adjusting and Balancing

2) 25 00 00 Building Automation System

2. Owner Members

a. Owner's Representative

b. Owner's Commissioning Provider

c. Owner plant operator/engineer (during the functional testing and training phases only)

d. Architectural/Engineering (A/E) Design team members

C. Commissioning Coordinator

1. The Contractor shall procure and provide the services of the Commissioning Coordinator.

2. Qualifications

    a. Cumulative of two or more years' experience in one or more of the following for projects of similar size and complexity

        1) Building mechanical system commissioning

        2) Building mechanical-electrical-plumbing system coordination services for a general contractor

        3) Building mechanical system construction project management

        4) Building mechanical system testing, adjusting, and balancing project management

    b. Experience with project management software such as MS Project or equal

    c. Either an employee of or direct subcontractor to the Contractor

    d. May serve other roles on the project such as MEP Coordinator

3. Services to be provided: See Paragraph 3.01.

1.03 SUBMITTALS

A. Commissioning Coordinator Qualifications: Prior to any commissioning work taking place, submit Commissioning Coordinator's resume listing applicable experience for review and approval by the Owner's Representative.

B. Equipment submittals and shop drawings: See Divisions 23, 25 and 26.

C. Commissioning Reports

1. Where electronic format of reports is called for, provide report in word searchable format (e.g. Adobe Acrobat, Microsoft Word). Scans of paper copies are acceptable only with approval of Owner's Representative.

2. Pre-functional Tests

    a. See Divisions 23, and 26 for checklists.

    b. Compile after all equipment pre-functional forms have been completed and submit electronic copy to Owner's Representative for review and approval.

3. Start-up and Factory Tests

    a. See Divisions 23, and 26 for requirements.

    b. Compile after all equipment has been started and submit electronic copy to Owner's Representative for review and approval.

4. Test and Balance Reports

    a. See Section 23 05 93 Testing, Adjusting and Balancing for content and quantity of reports.

b. Include only those reports developed after spot checks and associated rebalancing have been completed.

5. Functional Tests

   a. See Divisions 23, 25 and 26 for tests and documentation format.

   b. Compile after all tests have been completed and submit electronic copy to Owner's Representative for review and approval.

6. Demonstration Tests

   a. Tests will be a subset of Functional Tests and will be identified one day prior to the Tests by the Owner's Representative. See Divisions 23, 25 and 26 for expected time required.

   b. Compile after all tests have been completed and submit electronic copy to Owner's Representative for review and approval.

7. Trend Reviews

   a. Data to be provided to Owner's Representative in electronic format specified in Section 250000 Building Automation Systems.

8. Final Report

   a. Include the following completed documentation:

      1) System/Equipment Matrix

      2) Start-up and Factory Tests

      3) Test and Balance Reports

      4) Pre-functional test documentation

      5) Functional test documentation

   b. Format and Procedure

      1) Submit electronic draft copy for review and comment by Owner's Representative.

      2) Make changes noted on returned electronic copy and compile final electronic word searchable draft.

      3) Provide Owner's Representative approved Final Report in the following format

         a) One electronic copy on CD in format

         b) One electronic copy copied onto the Operator's Workstation server

9. Operations and Maintenance Manuals: See Divisions 23, 25 and 26.

10. Training manuals: See Divisions 23, 25 and 26.

11. Training Logs; see Paragraph 3.01A.9

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 COMMISSIONING COORDINATION

A. Commissioning Coordinator shall:

1. Prepare schedule of commissioning activities specified in Divisions 23, 25 and 26 including:

a. Submission of equipment submittals and shop drawings

b. Equipment start-up and pre-functional tests

c. Factory start-up and inspection of equipment

d. Test and balance

e. Functional tests

f. Demonstration tests

g. BAS trend review initiation and data distribution

h. Submission of operations and maintenance manuals

i. Development and submission of record drawings

j. Training of Owner personnel

k. Preparation of Final Commissioning Report

2. Prepare a system and equipment commissioning matrix with a line item for each piece of equipment and each subsystem specified to be commissioned under Divisions 23, 25 and 26. The System/Equipment matrix shall include for each line item.

a. Equipment tag or name

b. Service

c. Location

d. Responsible subcontractor

e. The due date and actual completion date for the following (where applicable)

1) Submittals

2) Shop drawings

3) Factory test

4) Equipment set

5) Preliminary operations and maintenance manuals indicating start-up procedures

6) Pre-start verification

7) Equipment start-up

8) Pre-functional test

9) Test and balance

10) Functional performance test

11) Operations and maintenance manuals

12) Record drawings

13) Training

3. Complete the commissioning matrix as activities are completed, and distribute to Commissioning Team at least one day prior to each Team meeting or when requested by Owner's Representative.

4. Schedule and chair meetings of Commissioning Team

   a. Commissioning Team shall be notified of all meeting times and locations at least two weeks prior to the meeting.

   b. Contractor Members of Commissioning Team shall attend all scheduled meetings; Owner Members of Commissioning Team shall be invited to all meetings and attend where they feel their attendance is beneficial or where required to witness demonstration tests and training.

   c. Prior to start of construction until 30 days prior to start-up of any equipment:

      1) One scoping meeting shall occur prior to any Division 23, 25 and 26 submissions of equipment submittals or shop drawings. Meeting shall include a discussion of preliminary commissioning schedule and roles of each Team member.

      2) Bi-monthly progress meetings; more frequent if required in the judgment of the Commissioning Coordinator; less frequent if requested by the Commissioning Coordinator and approved by the Owner's Representative.

   d. 30 days prior to start-up of any equipment through start of functional testing: Bi-weekly progress meetings; more frequent if required in the judgment of the Commissioning Coordinator; less frequent if requested by the Commissioning Coordinator and approved by the Owner's Representative.

   e. During functional testing until their completion: Weekly progress meetings; more frequent if required in the judgment of the Commissioning Coordinator; less frequent if requested by the Commissioning Coordinator and approved by the Owner's Representative.

f. After functional testing until all commissioning documentation is complete: Meetings as required in the judgment of the Commissioning Coordinator.

5. Supervise pre-functional and functional testing performed by Contractor's Members of Commissioning Team.

   a. Coordinate tests among Team Members and schedule tests so that required work for each trade is complete prior to tests being performed.

   b. Ensure that tests are successfully completed by reviewing test forms for completeness and positive response, and ensuring forms have been signed by the Team Member who performed the work; the Commissioning Coordinator is not required to perform or witness any pre-functional or functional tests.

   c. Compile test documentation and submit to the Owner's Representative for review and approval.

   d. Coordinate and ensure resolution of punchlists from Owner's Representative.

6. Supervise and witness demonstration tests performed by Contractor's Members of Commissioning Team, also witnessed by Owner Members of the Commissioning Team.

   a. Compile test documentation and submit to the Owner's Representative for review and approval.

   b. Coordinate and ensure resolution of punchlists from the Owner's Representative.

   c. Coordinate retesting where required until tests are successfully completed.

7. Coordinate BAS post-construction and post-occupancy trend reviews with Section 250000 Building Automation Systems Contractor.

   a. Ensure trends are initiated as specified in Section 25 00 00 Building Automation Systems.

   b. Ensure data is transmitted in required format to Owner's Representative.

   c. Coordinate and ensure resolution of trend review punchlists from the Owner's Representative.

   d. Coordinate retesting where required until tests are successfully completed.

8. Maintain a master deficiency and resolution log developed from punchlists, including status and date of resolution of each deficiency. Provide the Owner's Representative with regular progress reports.

9. Coordinate and confirm completion of training of Owner personnel as specified under Divisions 23, 25 and 26. Each training session shall have a Training Log created and verified by the CxC that includes the following:

   a. Topics trained

   b. Specification sections covered by training

   c. Electronic word searchable copies of training materials

d. Date of training

e. Duration of training

f. Name, title, affiliation and signature of trainer

g. Name, title affiliation and signature of all trainees

10. Compile information required for the Final Commissioning Report, to be finalized by the Commissioning Provider.

3.02 REMEDIAL WORK

A. Remedial work shall be performed at no additional cost to the Owner.

B. Remedial work shall include re-performing any commissioning or other tests related to remedial work once remediation is complete at no additional cost to the Owner.

C. Contractor shall compensate Owner's Representatives on a time and material basis at standard billing rates for any additional time required to witness additional demonstration tests or to review additional BAS trends beyond the initial tests (see Paragraphs 3.01A.6.c and 3.01A.7.d), at no additional cost to the Owner.

3.03 SYSTEM ACCEPTANCE

A. Specified Division 23, 25 and 26 systems shall be considered commissioned and substantially complete when the following have been submitted and approved by Owner's Representative:

1. Final Commissioning Report

2. Post-construction trend review

3. Other completion documentation as defined in Divisions 23, 25 and 26, including Owner's Representative sign-off that training has been completed

4. All remedial action associated with punchlists developed by the Owner's Representative

B. Remedial action required to address deficiencies identified by post-occupancy trend reviews shall be covered by the system warranty at no additional cost to the Owner.

Sample Equipment Matrix

Equipment Commissioning Scheduling Matrix																						
Equipment		Service	Location	Sub-contracor	Factory Test		Set Equipment		Preliminary O&M Manuals for Start-up Procedures		Write Pre-start, start-up, and functional test procedures		Pre-start Verification		Equipment Start-up		Functional Performance Test		Training and Submit O&M Manuals and As-builts		Owner Acceptance	
Tag	Description				Target	Complete	Target	Complete	Target	Complete	Target	Complete	Target	Complete	Target	Complete	Target	Complete	Target	Complete	Target	Complete

END OF SECTION

SECTION 02 25 00

EXISTING CONDITIONS – HAZARDOUS MATERIAL ASSESSMENT

TABLE OF CONTENTS

SECTION 02 25 00

SCHEDULE FOR EXISTING CONDITIONS

PART 1 - GENERAL

1.1 SUMMARY

A. This Document discloses Reference Documents that are available to the bidders regarding the hazardous materials investigations utilized in preparation of the Contract Documents.

1.2 HAZARDOUS MATERIALS REPORT(S)

The Bidder's attention is directed to the fact that the following limited non-destructive hazardous materials investigation was performed for the building:

- "Summary Report: Limited Hazardous Materials Survey, 2415 University Avenue, East Palo Alto, CA 94303" Prepared by SCA Environmental, Inc. July 2020.

A copy of the hazardous materials report for the building can be obtained from the Owner for review.

1.3 HAZARD SUMMARY

A. Asbestos Hazards: Certain existing building components or materials, which may be impacted by the Work of this Project, are known or assumed to contain asbestos.

For a list of asbestos-containing materials (ACM, >1%), asbestos-containing construction materials (ACCM, >0.1%), Trace asbestos materials, assumed asbestos-containing materials, and non-asbestos-containing materials in the buildings and at the site, refer to the Material Matrix Reports attached to this section. Additional suspect materials identified should be assumed asbestos-containing until such time as sampling can be performed to verify asbestos content.

B. Lead Hazards: Certain existing painted or coated surfaces to be impacted by the Work of this Project are known or suspected and assumed to contain lead.

Treat all similar paints and substrates in kind. Note that most building paints contain some lead content. Assume all paints and coatings, including glaze on ceramic tiles, contain >1000 ppm and require demolition dust control procedures for compliance with Cal/OSHA's Construction Lead Standard under 8 CCR 1532.1.

Characterize debris from coated materials for possible disposal as hazardous waste. Intact painted elements may be disposed as non-hazardous waste complying with dust controls and personal protective procedures per Cal/OSHA regulation 8 CCR 1532.1 and California DPH regulation 17 CCR Sections 35001 through 36100.

The following materials were not all tested but, the Contractor, for the purposes of this Contract, shall assume, and manage, them as lead containing.

a. Plumbing components, such as pipes, fittings and solders.
b. Roof flashings.
c. Mastic and adhesives.

It has not been verified that any paints, coatings, dusts, or materials are “lead free” or below detection therefore all “trigger 1” construction activities, such as demolition of painted surfaces, manual scraping or sanding of painted surfaces, or any work impacting painted surfaces and primed structural steel shall be completed using dust controls and personal protective measures in compliance with the Cal/OSHA Construction Lead Standard, 8 CCR 1532.1.

C. Other Hazards:

1. PCB-containing Fluorescent Light Ballasts: Fluorescent fixtures shall be treated as having a mix of PCB and non-PCB ballasts, requiring disposal of impacted suspect units as hazardous waste.

2. Mercury-Containing Fluorescent Light Tubes/Bulbs: Fluorescent lamps on-site shall be treated as having mercury content requiring removal and recycling by this contract’s demolition requirements.

1.4 USE OF DATA

A. Environmental consultation was obtained only for the use of the Owner and its Consultants for planning and design stages of this Project. The above-mentioned data are not, as a whole, part of the Contract Documents, but the sampling data contained therein can be relied upon by the Contractor to characterize general site conditions, although quantities, friability and other factors may have changed or been altered since the time of inspection.

B. All statements, findings, and interpretations in the above-mentioned report are those of the Survey or Abatement Consultant. The Owner makes no representations, either expressed or implied, as to the completeness or adequacy of the above-mentioned reports. Bidders are advised that the limited testing of components allow for generalizations in describing the extent of hazardous materials. Specific components or materials, should be checked against the referenced sampling data and the Contract Documents, or be tested at affected locations, prior to disturbance of such components.

C. Bidders shall visit the site and acquaint themselves with the existing conditions.

1.5 PRE-BID VISIT TO WORK SITE

A. Prior to bidding, Bidders may make their own investigations to satisfy themselves as to the Site and building conditions.

1.6 ASBESTOS SAMPLE LOCATION DIAGRAM

Drawing provided herein and listed below refer to sample locations only and are not intended to provide locations where hazardous materials are present. Sample location diagram include those completed by SCA during the building materials survey and included in the July 2020 survey report. Refer to Section 1.7 for information regarding locations of identified hazardous materials.

Figures
Figure 1-4: Sample Location Diagrams

1.7 MATERIALS MATRIX REPORT (TABLE 1)

The Materials Matrix Report provided herein as listed below inventories the suspect materials that may be present requiring abatement and /or control procedures:

Table 1: Materials Matrix Report – County of SM East Palo Alto Government Center

END OF SECTION 02 25 00

Table 1: Materials Matrix Report County of SM East Palo Alto Government Center

Material ID	Material Description	Previous Sample Results	Sub-sample # A	B	C	D	E	F	G	H	I	J	K	L	Asbestos Positive? Yes. No. Trace. Assumed	UNITS (LF, SF, EA)
ASBESTOS																
WLSH-3	Wall drywall (-) w/tape (-) and joint compound (+)		2% CH	3% CH	3% CH	2% CH	3% CH	2% CH	3% CH							SF
GASKET-7	Black gasket between flanges of hot water supply and return pipes		60% CH													EA
CAULK-13	Off-white/brown caulking between exterior metal wall panels		10% CH	10% CH	10% CH											LF
CONC-14	Gray concrete floor with compound in locations (2% CH)		ND	2% CH	ND											SF
WLSH-16	Wall drywall (-) w/tape (-) and joint compound (+)		3% CH	3% CH	3% CH											SF
BBMAS-17	Brown mastic (-) under 4" Brown vinyl baseboard -asbestos found in underlying joint compound (+) associated with drywall only		ND	4% CH	3% CH											LF
CLSH-18	Ceiling drywall (-) w/tape (-) and joint compound (+)		2% CH	2% CH	2% CH											SF
12FLVCT/M-20	12"x12" Light blue w/white streaks vinyl floor tile (-) w/black mastic (+)		8% CH												YES	SF
BBMAS-22	Brown mastic (-) under 4"/6" Brown vinyl baseboard -asbestos found in underlying joint compound (+) associated with drywall only		ND	ND	2% CH											LF
CLSH-25	Ceiling drywall (-) w/tape (-) and joint compound (+)		ND	2% CH	ND	2% CH	3% CH	3% CH								SF
WLSH-29	Wall drywall (-) w/tape (-), joint compound (+) and texture (+)		ND	3% CH	ND											SF
12FLVCT/M-37	12"x12" Tan w/white streaks and black fissures vinyl floor tile (+) w/black mastic (+)		6-15% CH	6-15% C	6-15% CH											SF
WL-54	White painted (-) off-white canvas covering (-) w/yellow glue (-) and white compound (+)		3% CH	NA	NA											SF
CLTL-AAA	Older ceiling tiles reported as <1% in 1987. Although not identified in 2015 and 2020 surveys, assume any older ceiling tile encountered as asbestos-containing as many may have been painted, etc.	<1% CH													TRACE	SF
STSFP-4	Beige sprayed-on structural fireproofing on metal roof truss and decking (<0.09% Tremolite/Actinolite) [SEE NOTE 1 BELOW]	<1% CH, <1% AM	ND	ND	ND	<0.09% AC/TR	<0.09% AC/TR	ND	ND	ND	ND	ND		ND		SF
ASSUMED ASBESTOS (Destructive Testing Required to Confirm)																
FIREDOOR-AAA	Fire-rated core in fire doors															EA
FORMICA-AAA	Off-white/gray Formica counter top w/assoc glue															SF
FILL-AAA	Engineered fill and/or surcharged soils (6" per as-built plans) and gravel (4") below concrete slab															CY
PIDHW-AAA	Insulation on domestic hot water (DHW) pipes and fittings concealed behind walls or above ceilings															LF
FLCER-AAA	12"x12" Brown ceramic floor tile w/assoc grout and mortar														ASSUMED	SF
TRANSITE-AAA	Transite associated with underground utilities															LF
ASPHALT-45	Surface asphalt (-) in parking lot and driveways with underlying asphalt layers (Assumed) and baserock (Assumed). Note that only surface was sampled. Coring and multilayered analysis is required to determine asbestos content before disturbance.		ND	ND	ND											SF
NON-ASBESTOS																
CONC-1	Gray concrete floor		ND	ND	ND											SF
CONC-2	Gray concrete wall		ND	ND	ND											SF
PICW-5	Yellow fiberglass insulation (-) w/off-white canvas jacket (-) on chilled water return and supply pipes and fittings		ND	ND												LF
PIHW-6	Yellow fiberglass insulation (-) w/off-white canvas jacket (-) on hot water return and supply pipes and fittings		ND	ND												LF
RFROLL-8	Off-white membrane roofing over off-white backing on parapet walls		ND	ND	ND											SF
PENMAS-9	Off-white painted black roofing penetration tars/mastic		ND	ND	ND											LF
RFPAD-10	Gray roof stepping pads		ND	ND	ND											SF
RFPTCH-11	Black roofing patch		ND	ND												SF
RFMAS-12	Black roofing mastic on black rubber pads supports for pipes		ND	ND	ND											SF
CONC-15	Gray concrete wall		ND	ND	ND											SF
CARMAS-19	Yellow carpet glue under various colored carpets		ND	ND	ND											SF
12FLVCT/M-21	12"x12" Purple w/tan specks vinyl floor tile (-) w/gray glue (-) and leveling compound (-)		ND													SF
CLLI-23	2'x4' Fiberglass laid-in ceiling tile w/off-white covering and fissures		ND	ND	ND											SF
CLSP-24	12"x12" Off-white splined ceiling tiles w/fissures		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND		SF
SINK-26	Stainless steel sink w/gray undercoating		ND													EA
12FLVCT/M-27	12"x12" Beige w/red and white specks vinyl floor tile (-) w/yellow glue (-)		ND	ND												SF
DEBRIS-28	Debris in walker ducts		ND	ND												SF
BBMAS-30	4"/6" Red/tan/ivory/black vinyl baseboard w/off-white glue		ND	ND	ND											LF
CLLI-31	2'x4' Off-white laid-in ceiling tile w/2'x2' pattern, fissures and pinholes		ND	ND	ND											SF
FLVCS-32	Tan/brown wood-look vinyl floor sheeting (-) w/yellow glue (-)		ND	ND	ND										NO	SF
12FLVCT/M-33	12"x12" Beige/green/blue vinyl floor tiles (-) in checkerboard pattern w/yellow glue (-)		ND	ND	ND											SF
SINK-34	Stainless steel sink w/off-white undercoating		ND													EA
FLVCS-35	Light blue w/gray and white specks vinyl floor sheeting (-) w/yellow glue (-)		ND													SF
HDUTP-36	Off-white canvas tape around seams of VAV boxes		ND	ND												LF
9FLVCT/M-38	9"x9" Red brick pattern vinyl floor tile (-) w/yellow glue (-) over 12FLVCT/M-37		ND													SF
12FLVCT/M-39	12"x12" Purple w/gray and blue streaks vinyl floor tile (-) w/yellow glue (-)		ND	ND	ND											SF
FLCER-40	1"x1" Beige ceramic floor tile (-) w/black grout (-) and yellow glue (-)		ND													SF
12FLVCT/M-41	12"x12" Off-white w/black specks vinyl floor tile (-) w/yellow glue (-)		ND	ND												SF
12FLVCT/M-42	12"x12" Light gray w/white streaks and 12"x12" blue w/gray streaks vinyl floor tiles (-) w/yellow glue (-)		ND	ND												SF
CLLI-43	2'x2' Off-white laid-in ceiling tile w/fissures		ND	ND	ND											SF
CONC-44	Gray concrete sidewalk around perimeter of building		ND	ND	ND											SF
FL-50	Core of: 2"x2" Gray/blue/green ceramic floor tile (-) w/gray grout (-) and mortar (-), black felt vapor barrier (-) and gray concrete slab (-) (3.5 inches thick)		ND	ND	ND											SF
WLCER-51	6"x6" Off-white/blue/green ceramic wall tile (-) w/off-white grout (-) and off-white/gray mortar (-)		ND	ND	ND											SF
RFAG-52	Tar and gravel roofing felts w/silver foil (-) w/black tars/mastic (-) over off-white/tan lightweight concrete (-)		ND	ND	ND											SF
RFINS-53	Off-white/tan zonolite roofing insulation (-) below roofing felts (-)		ND	ND	ND											SF
WLMAS-55	Off-white fiberglass-reinforced panels (FRP) w/tan glue (-)		ND	ND	ND											SF
WL-NNN	Brown painted exterior metal panels															SF
WLSH-NNN	Drywall wall partitions (No tape or joint compound)															SF
HVAC-NNN	Fiberglass insulation around HVAC ducts															LF
CL-NNN	Off-white fiberglass ceiling light panels in honeycomb pattern														NOT SUSPECT	SF
WL-NNN	Moveable partition wall w/vinyl and faux wood															SF
VAPBAR-NNN	No vapor barrier or waterproofing membrane below floor finishes/topping slab															SF
PCBs															PPM	
CAULK-13	Off-white/brown caulking between exterior metal wall panels														<0.50	LF
PCBs	Possible PCB-containing Ballasts, assumed >50 ppm														>50	EA
LEAD															PPM	
OW-1	Off-white paint on drywall walls														9.2	SF
BR-2	Brown paint on exterior metal panels														30	SF
RD-3	Red paint on metal base of chiller														150	SF
VENT-4	Lead sleeve on vent pipes														62000	SF
OE-5	Orange paint on hand rails														3100	SF
12FLVCT/M-20	12"x12" Light blue w/white streaks vinyl floor tile w/black mastic														<5.0	SF
12FLVCT/M-21	12"x12" Purple w/tan specks vinyl floor tile w/gray glue														6.9	SF
12FLVCT/M-27	12"x12" Beige w/red and white specks vinyl floor tile w/yellow glue														<5.0	SF
FLVCS-32	Tan/brown wood-look vinyl floor sheeting w/yellow glue														<5.0	SF
12FLVCT/M-33	12"x12" Beige/green/blue vinyl floor tiles in checkerboard pattern w/yellow glue														<5.0	SF
FLVCS-35	Light blue w/gray and white specks vinyl floor sheeting w/yellow glue														<5.0	SF
12FLVCT/M-37	12"x12" Tan w/white streaks and black fissures vinyl floor tile w/black mastic														<5.0	SF
9FLVCT/M-38	9"x9" Red brick pattern vinyl floor tile w/yellow glue over 12FLVCT/M-37														<5.0	SF
12FLVCT/M-39	12"x12" Purple w/gray and blue streaks vinyl floor tile w/yellow glue														<5.0	SF
FLCER-40	1"x1" Beige ceramic floor tile w/black grout and yellow glue														<5.0	SF
12FLVCT/M-41	12"x12" Off-white w/black specks vinyl floor tile w/yellow glue														6.7	SF
12FLVCT/M-42	12"x12" Light gray w/white streaks and 12"x12" blue w/gray streaks vinyl floor tiles w/yellow glue (assumed >600ppm)														5.5	SF
WLCER-51	6"x6" Off-white/blue/green ceramic wall tile w/assoc grout and mortar														9.8	SF
FLCER-AAA	12"x12" Brown ceramic floor tile w/assoc grout and mortar														>600	SF
Lead in paints	Lead Containing Paints / Coatings (assumed >600ppm)														>600	SF
Lead on steel	Lead Containing Coatings on Structural Steel (assumed >600ppm)														>600	SF
Other Hazardous Materials																
Mercury	Fluorescent Light Tubes														PRESENT	EA
Mold	Potentially Moldy Conditions														NOT PRESENT	---

Material ID	First Floor						Second Floor												Third Floor											Stairs			Elev	Roof					Ext	
	Police Dept	RR	Elev Rm	Lobby	Library	Community Rm	Probation	City Hall	Elect Rm	Stor1	Stor2	Hallway	Jan	RR	American Water	Rent Control	Break Rm	Community Learning	Family Health Nursing	Community Health Center	Stor	Conf Rm	Human Services Agency	Telecom	Lounge	Elect Rm	Jan	RR	Hallway	W Stairs	E Stairs	Ctr Stairs	Elev	Roof	Mech Rm Roof	E Stairs Roof	W Stairs Roof	Mech Rm	Exterior	TOTAL (+/-15%)
WLSH-3	6270	1280	320	2650	4100	3000	4500	3050	560	400	280	3040	320	1280	900	520	760	760	3000		280	800	10620	280	520	560	320	1280	3040			2160						3540		60390
GASKET-7																																						5		5
CAULK-13																																		1560					9550	11110
CONC-14																														1200										1200
WLSH-16																														3360										3360
BBMAS-17																														280										280
CLSH-18																														250										250
12FLVCT/M-20																			45																					45
BBMAS-22	200								70	50	35						110	110	430							70														1075
CLSH-25	625		100						300	150				435					45				930			300	100	435												3420
WLSH-29																				5360																				5360
12FLVCT/M-37	425									150	60	2300			540	235	730	730															50							5220
WL-54								300											120													2160								2580
CLTL-AAA																																								PNQ
STSFP-4	1800	435	100	1400	1000	600	1000	1500	300	150	60	2100	100	435	250			250	400	500		250	3200	60	145	300	100	435	2100	250	250	625						300		20395
FIREDOOR-AAA	7	2	1	1	1	2		4	2	1	1	3	1		1	1	1	3	1	2	1	2	4	1	1		1	4									5	5		59
FORMICA-AAA					30		30												30	50					20															160
FILL-AAA	875	165	40	520	2950	1100																																		5650
PIDHW-AAA	250	100			250	250	250						100	100			100	200	200	250			100		100		100	100												2450
FLCER-AAA				1220																																				1220
TRANSITE-AAA																																							PNQ	PNQ
ASPHALT-45																																							20285	20285
CONC-1	2360	435	100	1400	7940	2960	7940	3600	300	150	60	2300	100	435	540	235	730	730	1870	2115	85	600	10940	60	145	300	100	435	2300		900	750						1375		54290
CONC-2																																						325		325
PICW-5																																						150		150
PIHW-6																																						150		150
RFROLL-8																																		1050						1050
PENMAS-9																																		200	100					300
RFPAD-10																																		500						500
RFPTCH-11																																		50						50
RFMAS-12																																		1000						1000
CONC-15																														500										500
CARMAS-19					7760	1480	7790	3600							540	235	550		1725	1970		600	7480						2300											36030
12FLVCT/M-21																			100																					100
CLLI-23	1735			180	7940												730	730	1450	2115																				14880
CLSP-24				1220				1000				2300							375																					4895
SINK-26																			1						1															2
12FLVCT/M-27																				145	85																			230
DEBRIS-28																				650																				650
BBMAS-30	405				590	250		450							100	65				700	35	100	1410	35	65		40		380											4625
CLLI-31								2600			60				540	235					85	600	10010	60	145				1140											15475
FLVCS-32																							3500						1140											4640
12FLVCT/M-33																								60	145				2300											2505
SINK-34					1																				1															2
FLVCS-35							150																																	150
HDUTP-36	200	50		200	500	200	500	350		50	50	200	50	50	150	150	150	150	200	200	50	75	200	50	50		50	50	200											4125
9FLVCT/M-38																	80																							80
12FLVCT/M-39	1735																																							1735
FLCER-40	200																																							200
12FLVCT/M-41				180	180																																			360
12FLVCT/M-42						1480																																		1480
CLLI-43						2960																																		2960
CONC-44																																							2865	2865
FL-50		435												435														400												1270
WLCER-51		1280												1280														1280												3840
RFAG-52																																		15090	1375	250	250			16965
RFINS-53																																		15090	1375	250	250			16965
WLMAS-55	400																															1800								2200
WL-NNN																																		3150					19080	22230
WLSH-NNN	2450				2760		2900	320											1480	240																				10150
HVAC-NNN	350	50		200	500	350	500	350				200		50	150	75	100	100	250	250	50	75	250	50	50			50	200											4200
CL-NNN												735																												735
WL-NNN						620																																		620
VAPBAR-NNN	200	435																																						635
CAULK-13																																		1560					9550	11110
PCBs	47	2	2	28	124	48	143	56	3	1	2	53	1		9	6	12	12	35	41	2	10	104	2	4	3	1	4	18	16	12	12	3					17		833
OW-1	PNQ	PNQ	PNQ	PNQ	PNQ	PNQ	PNQ	PNQ	PNQ	PNQ	PNQ	PNQ	PNQ	PNQ	PNQ	PNQ	PNQ	PNQ	PNQ	PNQ	PNQ	PNQ	PNQ	PNQ	PNQ	PNQ	PNQ	PNQ	PNQ	PNQ	PNQ	PNQ	PNQ	PNQ	PNQ	PNQ	PNQ	PNQ		PNQ
BR-2																																		PNQ					PNQ	PNQ
RD-3																																							PNQ	PNQ
VENT-4																																		10						10
OE-5																														PNQ	PNQ									PNQ
12FLVCT/M-20																			45																					45
12FLVCT/M-21																			100																					100
12FLVCT/M-27																				145	85																			230
FLVCS-32																							3500						1140											4640
12FLVCT/M-33																								60	145				2300											2505
FLVCS-35							150																																	150
12FLVCT/M-37	425									150	60	2300			540	235	730	730																						5170
9FLVCT/M-38																	80																							80
12FLVCT/M-39	1735																																							1735
FLCER-40	200																																							200
12FLVCT/M-41				180	180																																			360
12FLVCT/M-42						1480																																		1480
WLCER-51		1280												1280														1280												3840
FLCER-AAA				1220																																				1220
Lead in paints																																						PNQ		PNQ
Lead on steel																																						PNQ		PNQ
Mercury	94	4	4	56	248	96	286	112	6	2	4	106	2		18	12	24	24	70	82	4	20	208	4	8	6	2	8	36	32	24	24	6					34		1666
Mold																																								NA

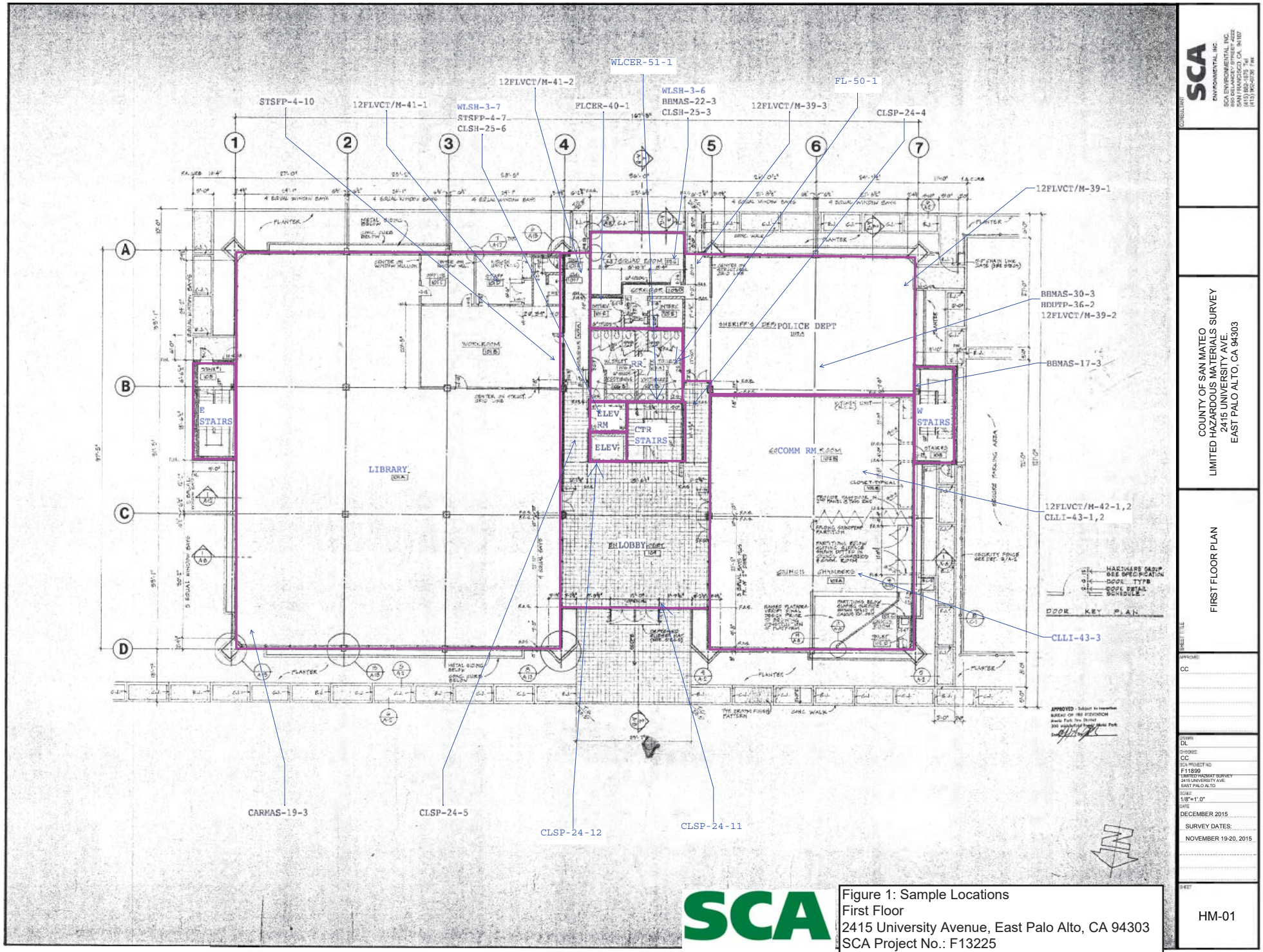
Notes:

NOTE 1: <1% CH reported in 3rd floor and <1% CH/<1% AM reported in boiler room samples collected in 1987. SCA collected samples in these areas and throughout the building and could not reproduce these results.

We speculate the Amosite was most likely present as contamination from insulation previously present in the area. We recommend that prior to abatement in the boiler room, add't testing by TEM be performed due to the difficulty wetting and elevated fiber levels associated with Amosite.

As asbestos content can vary in surfacing materials, we recommend all fireproofing be treated as asbestos-containing, with impacts following Class I removal activities with a neg pressure enclosure.

PNQ = Present, not quantified; CH = Chrysotile; ND = Not detected; NA = Not analyzed; TR=Tremolite; AC=Actinolite; AM=Amosite



SCA ENVIRONMENTAL, INC.

Figure 1: Sample Locations
First Floor
2415 University Avenue, East Palo Alto, CA 94303
SCA Project No.: F13225
Sampled December 2015 and June 2020

SCA ENVIRONMENTAL, INC.
COUNTY OF SAN MATEO
LIMITED HAZARDOUS MATERIALS SURVEY
2415 UNIVERSITY AVE.
EAST PALO ALTO, CA 94303

FIRST FLOOR PLAN

CC
DL
CC
F11899
LIMITED HAZMAT SURVEY
2415 UNIVERSITY AVE.
EAST PALO ALTO
1/8"=1'-0"
DECEMBER 2015
SURVEY DATES:
NOVEMBER 19-20, 2015

HM-01

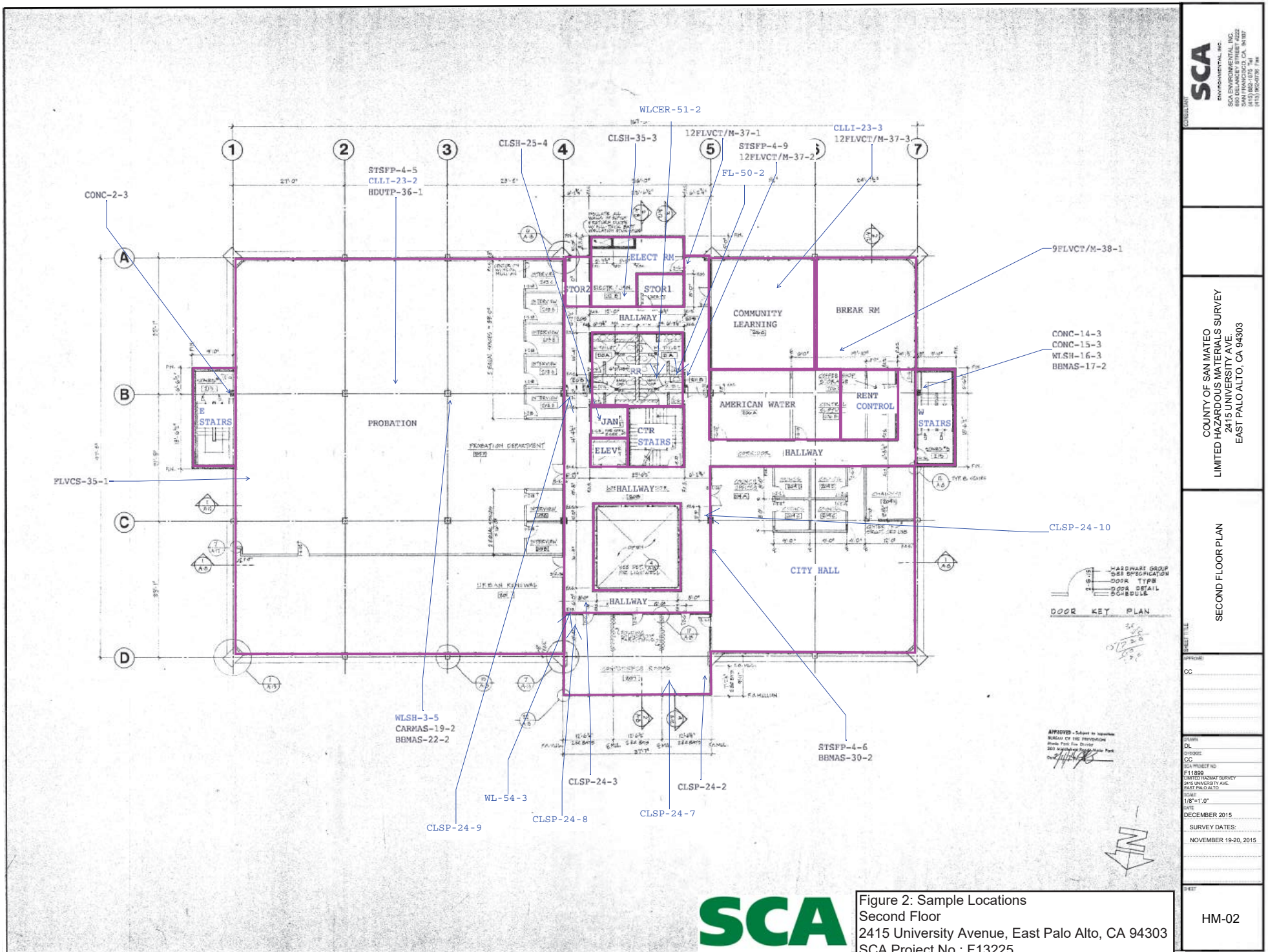
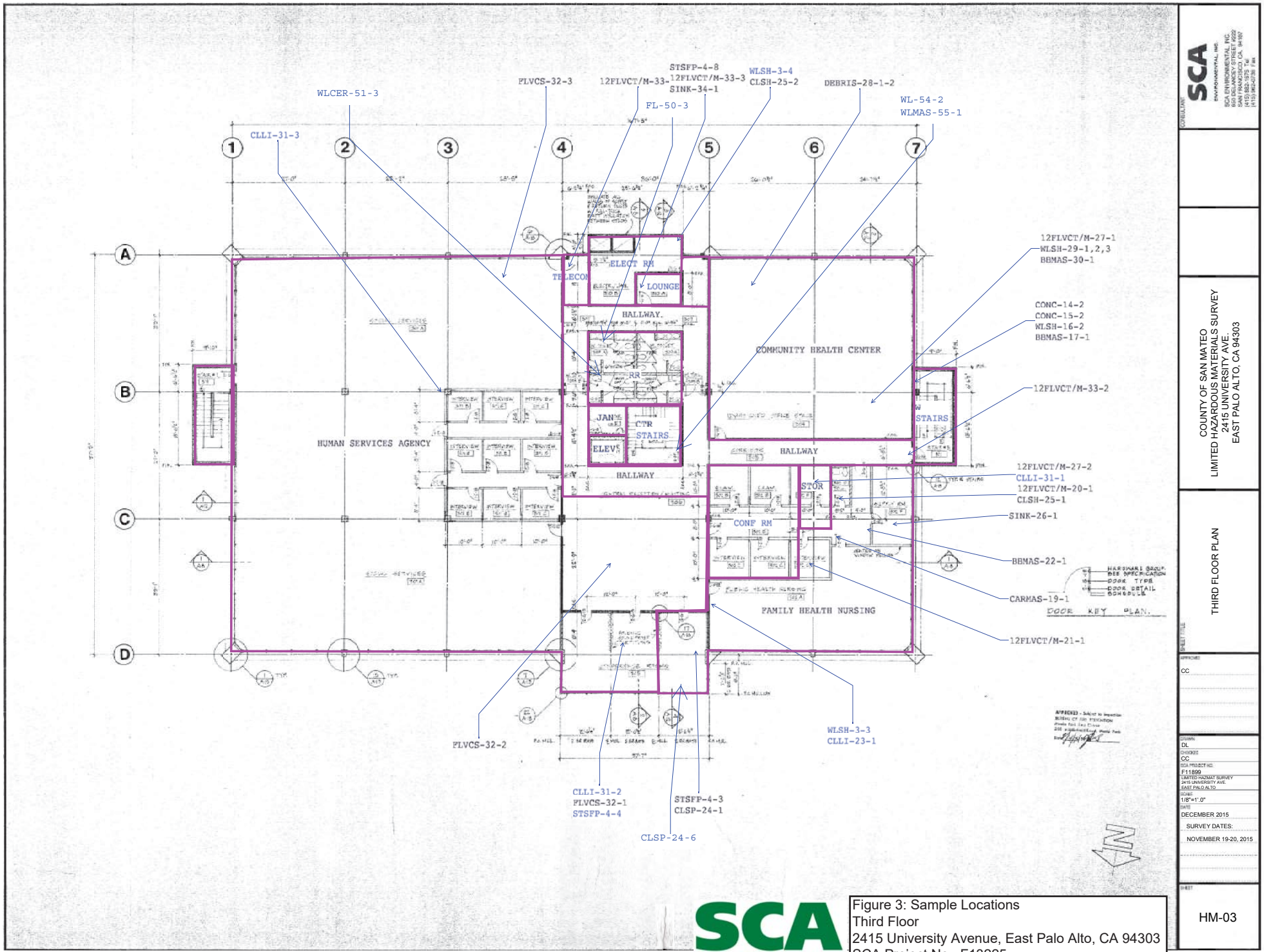


Figure 2: Sample Locations
Second Floor
2415 University Avenue, East Palo Alto, CA 94303
SCA Project No.: F13225
Sampled December 2015 and June 2020



SCA ENVIRONMENTAL, INC.

Figure 3: Sample Locations
Third Floor
2415 University Avenue, East Palo Alto, CA 94303
SCA Project No.: F13225
Sampled December 2015 and June 2020

CONSULTANT
SCA ENVIRONMENTAL, INC.
654 G STREET, SUITE 2
SAN FRANCISCO, CA. 94107
(415) 882-1975 Tel
(415) 882-0736 Fax

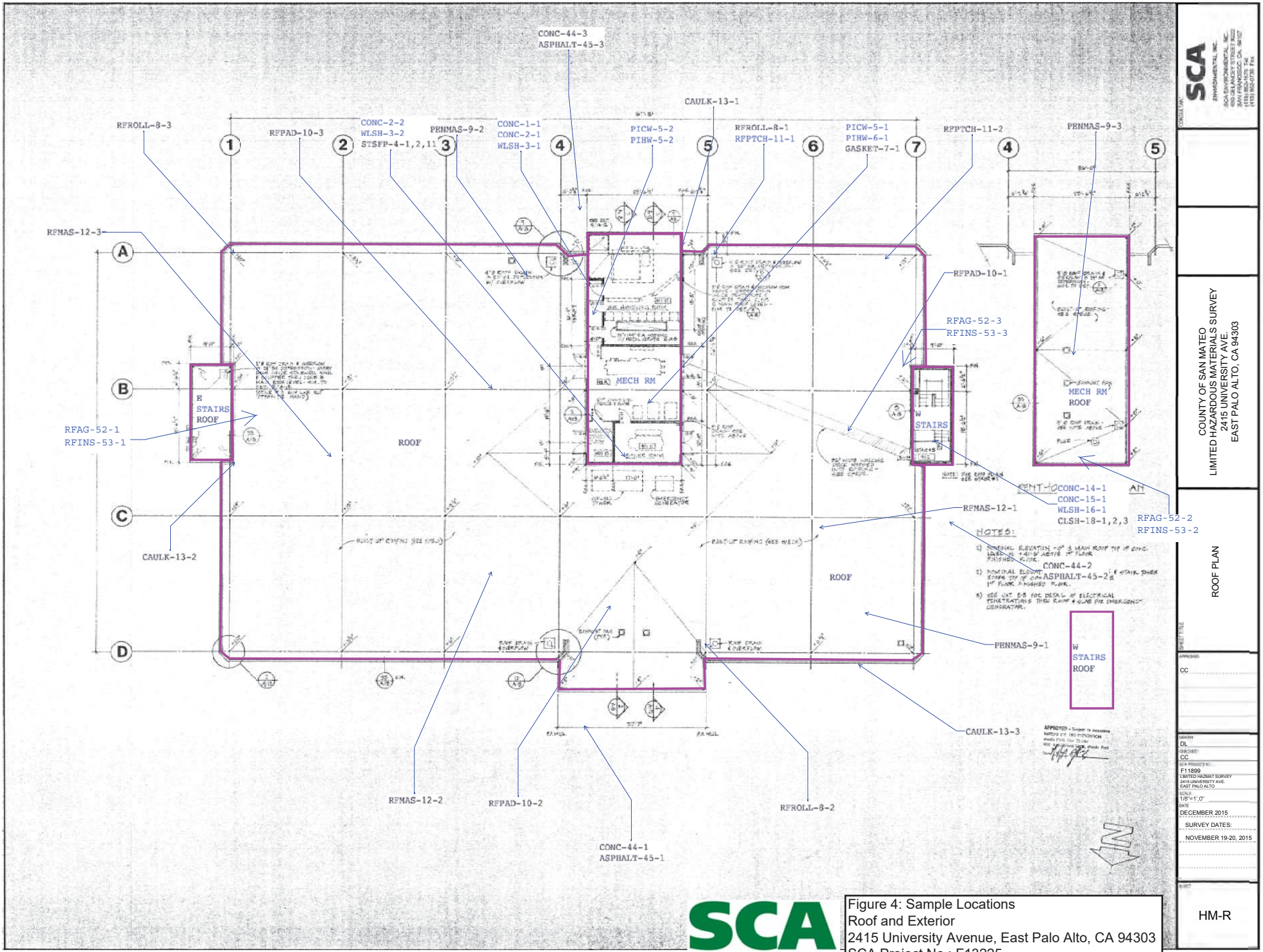
COUNTY OF SAN MATEO
LIMITED HAZARDOUS MATERIALS SURVEY
2415 UNIVERSITY AVE.
EAST PALO ALTO, CA 94303

SHEET TITLE
THIRD FLOOR PLAN

APPROVED
CC

DRAWN
DL
CHECKED
CC
SCA PROJECT NO.
F11899
LIMITED HAZMAT SURVEY
2415 UNIVERSITY AVE.
EAST PALO ALTO
SCALE
1/8"=1'-0"
DATE
DECEMBER 2015
SURVEY DATES:
NOVEMBER 19-20, 2015

SHEET
HM-03



SCA ENVIRONMENTAL, INC.

Figure 4: Sample Locations
Roof and Exterior
2415 University Avenue, East Palo Alto, CA 94303
SCA Project No.: F13225
Sampled December 2015 and June 2020

SCA
ENVIRONMENTAL, INC.

COUNTY OF SAN MATEO
LIMITED HAZARDOUS MATERIALS SURVEY
2415 UNIVERSITY AVE.
EAST PALO ALTO, CA 94303

ROOF PLAN

APPROVED: CC
DRAWN: DL
CHECKED: CC
SCA PROJECT #: F11899
LIMITED HAZMAT SURVEY
2415 UNIVERSITY AVE.
EAST PALO ALTO
SCALE: 1/8"=1'-0"
DATE: DECEMBER 2015
SURVEY DATES:
NOVEMBER 19-20, 2015

HM-R

SECTION 02 26 00

HAZARDOUS MATERIALS ABATEMENT WORK PLAN

TABLE OF CONTENTS

HAZARDOUS MATERIALS ABATEMENT WORK PLAN

Project:	Building Renovations 2415 University Avenue East Palo Alto, CA 94303	**Issued:**	July 2020

The work covered by this work plan includes the removal, handling and disposal of various hazardous materials in accordance with the Contract Documents and applicable federal, state and local regulations at the above designated site. A copy of this Abatement Work Plan is to be posted on-site during the abatement work.

I. Summary of Work (as designated)

X	Removal and disposal of asbestos-containing materials (ACM) and asbestos-containing building/construction materials (ACBM / ACCM) as part of the demolition and renovation activities.
X	Scraping of loose and peeling paints as required for disposal of intact painted elements as non-hazardous waste, including associated dust controls and personal protective procedures in compliance with Cal/OSHA's Construction Lead Standard, 8 CCR 1532.1 and CDPH regulation 17 CCR Sections 35001 through 36100.
X	Spot abatement and disposal of wastes for primers and lead-containing paints on structural steel elements prior to torching, cutting, etc., including dust controls and personal protective procedures in compliance with Cal/OSHA's Construction Lead Standard, 8 CCR 1532.1, CDPH regulation 17 CCR Sections 35001 through 36100 and the EPA's RR&P rules, as applicable. Warning - Surfaces or building materials scheduled for torch cutting or other "hot" work may have previously been coated with lead containing paints. Spot removal of paints may not be sufficient to completely control lead fume release. The contractor is required to: (1) use the appropriate equipment and work practices to prevent lead releases and possible exposures to hospital patients, visitors, and staff; (2) protect or clean surfaces so that dislodgeable lead contamination (i.e. contamination which can be identified by wipe sampling) is not left behind, and take appropriate measures to protect their employees against lead exposures.
X	Preparation and disposal of wastes for repainting, including dust controls and personal protective procedures for manual scraping or sanding and other "trigger 1" work activities in compliance with Cal/OSHA's Construction Lead Standard, 8 CCR 1532.1, CDPH regulation 17 CCR Sections 35001 through 36100 and the EPA's RR&P rules, as applicable.
X	Removal and disposal of lead-containing paints/coatings, including dust controls and personal protective procedures in compliance with Cal/OSHA's Construction Lead Standard, 8 CCR 1532.1 and CDPH regulation 17 CCR Sections 35001 through 36100.
X	Removal and disposal of PCB-containing ballasts, as designated.

X	Removal and recycling of mercury-containing lamps, as designated.
X	For Controlled Renovation Projects: Use of controlled renovation procedures for drilling, coring and anchoring through asbestos-containing materials in accordance with 8 CCR 1529.
X	Free silica is expected to be released during concrete cutting, coring, drilling, etc. Contractors are required to comply with the current CalOSHA regulations for free silica effective since 2017 for their workers and others in the building.

I. SUBMITTALS:

Pre-job Submittals (as designated):

X	BAAQMD Notification (10-working days in advance as needed if disturbance / removal quantity of friable asbestos **for the entire project** exceeds 100 SF/LF);
X	Cal/OSHA Asbestos Abatement Notification per 8 CCR 1529 (twenty-four (24) hours in advance);
X	Cal/OSHA Lead Hazard Notification per 8 CCR 1532.1 (twenty-four (24) hours in advance);
X	copy of current Contractors' State Licensing Board (CSLB) License, including C-22 License for Asbestos Abatement;
X	copy of Cal/OSHA Asbestos Registration Certificate;
X	proof of all required permits or variances;
X	abatement work schedule;
X	abatement work plan(s);
X	copies of workers' asbestos training certificates, including the Competent Person;
X	copies of workers' lead awareness training certificates;
	Copies of CDPH Certified Lead Worker's and Supervisor's training certificates;
X	copies of workers' annual medical exam and respirator approval;
X	copies of workers' 12-month respirator fit testing records;
X	copies of workers' blood lead test within past 90 days;
X	Safety Data Sheets (SDSs) for all products and materials proposed for use at the site;
X	emergency phone and pager listing;
X	Independent on-site third-party DOP testing of HEPA-filtered negative pressure units and vacuum cleaners;
X	proposed location of locked dumpster; and
X	rotameter calibrations within past 6 months.
X	Completed sample manifest for the Owner's review that lists correct EPA #, Generator information, and disposal facility information

Periodic Submittals (as designated):

X	personal air monitoring (daily);
X	updated worker documentation (as needed);
X	boundary access logs (daily);
X	negative pressure records (daily); and
X	copies of updated notification to regulatory agencies (as needed).

Project Close-out Submittals (as designated within 2 weeks of completion):

X	Certificate of Completion;
X	receipt and weight tickets from landfill operator or recycler (as applicable);
X	copies of completed uniform waste manifests, including hazardous and non-hazardous waste;
X	waste profiling data (TCLP, WET and SW846, as applicable);
X	filter change logs for all filtration units, water filtration units (as applicable) and respirators;
X	foreman's daily job reports;
X	employee and visitor entry/exit logs for all containments;
X	manometer printouts for all applicable containments;
X	air sample results for all personnel, work areas and air filtration units; and
X	A detailed list describing the presence, locations and quantity of ACM and PACM remaining in the work area, per 1529 CCR Section (K)(3)(c)

II. SCHEDULE

Start Date:	Refer to Contract Documents.
End Date:	Refer to Contract Documents.
Maximum Abatement Shifts:	Work shall be completed within the timeframe identified in the Contract Documents.
Time frame:	Monday-Friday, weekend or night work may be permitted with Owner approval, unless otherwise indicated in the Contract Documents.

TBD=to be determined

III. CONTACTS:

Contact	*Individual*	*Phone #*	*Cell #*	*Email*
County of San Mateo	Chris Bandy	650-208-1909	650-208-1909	cbandy@smcgov.org
SCA's Project Manager	Tucker Kalman, QSD/P, CAC, CDPH	415-723-0962	415-723-0962	tkalman@sca-enviro.com
Abatement Contractor	TBD	TBD	TBD	TBD

TBD=to be determined

Note: Contact the Owner's Project Manager only in an emergency.

IV. SECURITY

Arrange site security with the Owner at the beginning of the job. Please note the following:

1. Abatement contractor employees and equipment will be required to enter the building at entrance ways designated by the Owner. No employee may enter the building at any other point than the designated entryway(s).

2. Abatement contractor's equipment will be stored and secured in an area agreed upon by the Owner and the Contractor.

3. The Abatement contractor will be responsible for providing temporary security at building penetrations created by the demolition and abatement.

4. Refer to the Contract documents for additional site security requirements for the project.

V. SPECIAL CONDITIONS

1. Asbestos Abatement and Lead Hazard Abatement Project Designs shall be completed by the Owner's designated Environmental Consultant only. Designers shall be EPA-accredited Asbestos Project Designers only.

2. The minimum negative pressure level for this project is –0.02" w.g. at all locations. The Abatement contractor is responsible for maintaining this level during all work activities, including bagout and until satisfactory reoccupancy air results have been received and notice of passing reoccupancy testing is provided by the Environmental Consultant.

3. Whenever possible, the intakes to HEPA-filter equipped negative pressure units ("hogs") shall be placed in close proximity to potentially dust generating activities such as concrete breaking or chipping to capture dust releases, if applicable to the project. Such intakes, where feasible, shall have a local exhaust shroud/enclosure to optimize dust collection and minimize aerosolized silica dust.

4. Negative pressure recording: The Abatement contractor is responsible for recording negative pressure as follows:
   a. Negative pressure will be recorded throughout the entire project, including inspections, reoccupancy testing, and at all times until the Consultant provides a final reoccupancy notice.
   b. At least one spare manometer must be kept on site at all times.
   a. A printout of recordings must be transmitted to the Environmental Consultant by the Abatement Contractor <u>each day</u>.

5. Waste will be removed from the work areas each night and disposed of in approved waste receptacles in the designated loading areas. Waste receptacles will be properly labeled and locked each night.

<u>Asbestos Sampling:</u>

1. PCM Analysis: Analysis of PCM samples shall follow the procedures outlined in NIOSH method 7400 and within these Contract Documents.

2. TEM Analysis: The U. S. Environmental Protection Agency passed regulations for schools under the Asbestos Hazard Emergency Response Act (AHERA), which are found in 40 CFR Part 763 "Asbestos Containing Materials in Schools". This regulation states that all

abatement work shall be evaluated upon completion by collecting air samples using aggressive sampling techniques and that such samples shall be analyzed using Transmission Electron Microscopy (TEM). TEM analysis turnaround times shall be 24 hours, unless otherwise indicated.

3. The sampling and analytical criteria in the AHERA regulation for schools shall be viewed as the preferred method for determining that any asbestos abatement project in any work area(s) has achieved a satisfactory level of cleanliness. The Environmental Consultant shall collect air samples from all work areas using aggressive sampling and TEM analysis, unless otherwise noted. The Owner reserves the right to determine the quantity of reoccupancy air samples to be collected for each subzone. Sample results in excess of 70 asbestos structures per square millimeter of filter area (equivalent to 0.018 s/cc, corrected for a 1,500 [1,200 - 1,800] liter sample volume as appropriate) will require cleaning, inspection, and resampling of the affected area at the Hazardous Materials Contractor 's expense. Z-testing shall NOT be used as a means for comparing the interior levels against those of the exterior for the purpose of clearing the Work Area.

4. The Owner shall pay the Environmental Consultant's costs of the final round of visual inspections, air sampling, and PCM and/or TEM analyses that will meet the asbestos abatement specification. All rounds of visual inspections, air sampling, and PCM and/or TEM analyses that fail to meet the contract criteria shall be borne by the Hazardous Materials Contractor. For the purpose of this paragraph, visual inspection includes the area isolation inspection, pre-encapsulation inspection, and final area clean-up inspection.

5. During all asbestos-related work, perimeter sample results will be collected by the designated Environmental Consultant (Industrial Hygienist). These samples will be analyzed by Phase Contrast Microscopy (PCM). Sample results that are in excess of the background level or 0.01 fibers per cubic centimeter (f/cc) Project Action Level may be forwarded for analysis by Transmission Electron Microscopy (TEM) with a 12-hour turnaround specified. Handling, shipping, and analysis charges (including the Environmental Consultants time and expenses) will be paid for by the Hazardous Materials Contractor. Any sample results in excess of 0.018 structures/cc will require cleaning, inspection, and resampling of the affected area at the Hazardous Materials Contractor 's expense.

Lead Sampling:

1. During all lead hazard-related work, such as demolition, torching and welding activities, etc., as applicable, perimeter air sample and/or lead wipe sample results may be collected by the Environmental Consultant (Industrial Hygienist). These samples will be analyzed by flame atomic absorption or ICP/MS. Wipe sample results which are in excess of the of 40 micrograms per square foot for adjoining zones on two consecutive samplings (or two consecutive days) or for adjoining floor areas on any occasion will require isolation and clean-up of the affected areas. Air sampling results in excess of 1.5 micrograms per cubic meter will require isolation of the work area and amendment of work procedures and/or clean-up of the affected areas. Resampling of the affected areas and handling, shipping, and analysis charges (including the Environmental Consultant's time and expenses) for additional

sampling required to show background levels below these construction lead standards shall be borne by the Hazardous Materials Contractor.

Submittals:

1. All pre-construction submittals shall be forwarded to the Owner and the Owner's designated Environmental Consultant prior to the start of abatement as designated in the Contract Documents and herein. Documents shall be provided at least **10 business days prior to** commencement of work activities.

2. Failure by the Hazardous Materials Contractor to fulfill the submittal requirements as specified in the Contract Documents and herein shall be the basis for withholding final payment until such submittal requirements are satisfied.

Waste Manifests:

1. The Hazardous Materials Contractor shall coordinate the inspection and signing of all waste manifests with the Owner and its Environmental Consultant, while on-site. Failure to complete the manifests or callbacks after completion of the project will be back charged to the Hazardous Materials Contractor.

   Waste Manifests shall contain the following information:

Generator's Name	TBD
Generator Address	TBD
Generator ID#	TBD

Additional Liquidated Damages:

1. The Hazardous Materials Contractor shall pay for all Environmental Consultant costs for delays in completion of work beyond the authorized schedule established as stated in the contract documents. Such charges shall include Consultant's observations and inspections, daily air monitoring, equipment, transportation and analysis charges. Such charges shall include Consultant's observations and inspections, daily air monitoring, equipment, transportation and PCM analysis charges, estimated at $1500 per 8-hour shift, excluding TEM analyses. Such costs are in addition to liquidated damages for failure to complete the tasks in accordance with the schedules established in the Contract Documents. See the Liquidated Damages Section in the contract documents for further requirements.

VI. SUMMARY OF SURVEY RESULT AND CONDITIONS

Asbestos:

For a list of ACM and ACBM / ACCM, refer to the Materials Matrix Report attached to Section 00 31 26: Hazardous Materials Existing Conditions. Additional suspect materials identified should be assumed asbestos-containing until such time as sampling can be performed to verify asbestos content.

Lead:

All paints, vinyl flooring, and ceramic tiles are assumed to contain lead and shall be treated as such. Contractors shall comply with the Cal/OSHA lead in construction regulation (8 CCR 1532.1) for all work

activities, and all coated surfaces shall be considered to contain some lead.

Treat all similar paints and substrates in kind. Note that most building paints contain some lead content, and require demolition dust control procedures for compliance with Cal/OSHA's Construction Lead Standard under 8 CCR 1532.1, as well as the Welding, Cutting, and Heating of Coated Metals under 8 CCR 1537.

Characterize debris from coated materials, ceramic floor tiles, vinyl flooring, etc. for possible disposal as hazardous waste. Intact painted elements may be disposed as non-hazardous waste complying with dust controls and personal protective procedures per Cal/OSHA regulation 8 CCR 1532.1 and CDPH regulation 17 CCR Sections 35001 through 36100, if both the total and leachable lead contents of the waste streams are below 1000 mg/kg and 5 mg/liter (WET and TCLP tests).

VII. SCOPE OF WORK: PRE-RENOVATION ABATEMENT

The Contractor will be responsible for quantifying all hazardous materials requiring abatement for bidding purposes. Materials listed below include identified hazardous materials within the areas requiring abatement and disposal.

Asbestos Abatement:

Task 1

Abatement Materials	**Vinyl Floor Tiles & Associated Mastics and leveling compounds**					
Method:	X	Full Isolation or Mini-Containments		Glovebag		Glovebag-Cutout
Material	***Activity Class***	***Material I.D.***	***% Asbestos***		***Est. Quantity requiring abatement*** *(Field verify)*	
Vinyl Floor tiles with asbestos containing mastics	2	12FLVCT/M-20 12FLVCT/M-37	See Section 00 31 26		See Section 00 31 26 and Contract Documents	
Grey compound on concrete floor	2	CONC-14	See Section 00 31 26		See Section 00 31 26 and Contract Documents	
Decon System:	X	Shower		Central		Bucket
Floor:		# Layers Poly		Drop Cloths		Scaffold
Walls:	1	# of Polyethylene Layers		Splash Guards		
Criticals:	1	# of Polyethylene Layers		Plywood Barriers		

Other Comments: Abate the floor tiles and associated mastics and leveling compounds per Cal/OSHA 8 CCR 1529 Work Class II procedures, minimum, with negative pressurization of the zone(s). Remove the mastics using an approved "low odor" mastic remover with greater than 140°F flash point. Dispose of waste as friable asbestos waste. Characterize and dispose of rags and solvent residues as a separate hazardous waste stream. For areas where concrete floor will be exposed and polished, mastic should be 100% removed.

See Task 10 below for further details on “minor” procedures for coring, anchoring, etc.

Task 2

Abatement Materials	**Thermal System Insulation (TSI)**							
Method:	X	Full Isolation or Mini-Containments		Glovebag	X	Glovebag-Cutout		
Material	***Activity Class***	***Material I.D.***		***% Asbestos***		***Est. Quantity requiring abatement*** *(Field verify)*		
Piping insulation and hard packed elbows assumed present inside of wall cavities	1	PIDHW-AAA		See Section 00 31 26		See Section 00 31 26 and Contract Documents		
Decon System:	X	Shower	___	Central		___	Hudson sprayer	
Floor:	2	# Layers Poly		Drop Cloths			Scaffold	
Walls:	1	# of Polyethylene Layers			Splash Guards			
Criticals:	2	# of Polyethylene Layers			Plywood Barriers			

Other Comments:
Set-up secondary containment for all glovebag Removal areas, or set-up full isolation containment. Abate pipe insulation within a full isolation containment per Cal/OSHA 8 CCR 1529 Work Class 1 procedures, minimum with negative pressurization for the zone(s). For hard packed elbows, set-up glovebags and abate using wet methods. Double bag the waste and dispose as friable asbestos waste.

Areas with evidence of damaged TSI will require HEPA-vacuuming of the access to this debris as well as vacuuming of all piping, ductwork and substrate materials within a minimum five (5) ft. radius of all such contamination.

Task 3

Abatement Material	**Structural Fireproofing**											
Method:	X	Full Isolation or Mini-Containments		Glovebag		Glovebag-Cutout						
Material	***Activity Class***	***Material I.D.***		***% Asbestos***		***Est. Quantity requiring abatement*** *(Field verify)*						
Structural Fireproofing and Overspray	1	STSFP-4		See Section 00 31 26		See Section 00 31 26 and Contract Documents						
Decon System:	X	Shower if >25 SF		Central		X	Hudson sprayer or bucket decon if <25 SF					
Floor:	1	# of Polyethylene Layers				Scaffold						
Walls:	1	# of Polyethylene Layers				Splash Guards						
Criticals:	2	# of Polyethylene Layers				Plywood Barriers						

For fireproofing: Remove materials using full isolation or mini-containment procedures, satisfying the requirements of Cal/OSHA 8 CCR 1529 Work Class 1 procedures. Use wet methods for dust controls. Dispose of materials as friable asbestos waste. Remove substrates as required to access materials and overspray. Treat all enclosing substrates or materials, such as laid-in ceiling tiles, as asbestos-contaminated and dispose in double goosenecked, labeled bags as friable asbestos waste.

A licensed Abatement Contractor using glovebag and mobile mini-containment methods or full isolation methods, depending on the quantities impacted, shall complete corings greater than 2" diameter, which cannot be properly controlled using a wetted sponge.

If a mobile containment is used, clean-up and reseal the phone booth-type containment and airlock entry between uses.

Any overspray present under flooring, on piping or HVAC ducts, or within wall cavities that require demolition shall also be removed.

See Task 9 below for further details on "minor" procedures for coring, anchoring, etc.

Task 4

Abatement Material:	**Drywall with asbestos-containing joint compounds**			
Method:	X Full Isolation or Mini-Containments	___ Glovebag	___ Glovebag-Cutout	
Material	***Activity Class***	***Sample I.D.***	***% Asbestos***	***Est. Quantity requiring abatement*** *(refer to contract documents and field verify)*
Drywall with asbestos-containing joint compounds and associated baseboards and wall coverings	2	WLSH-3 WLSH-16 BBMAS-17 BBMAS-22 CLSH-18 CLSH-25 WL-54	See Section 00 31 26	See Section 00 31 26 and Contract Documents
Decon System:	X Shower	___ Central	X Hudson sprayer or bucket decon	
Floor:	1 # Layers Poly	___ Drop Cloths	___ Scaffold	
Walls:	___ # of Polyethylene Layers	X Splash Guards		
Criticals:	1 # of Polyethylene Layers	__ Plywood Barriers		

Other comments: Complete all work using full isolation abatement methods per Cal/OSHA 8 CCR 1529 Work Class II procedures, minimum, with negative pressurization of all zone(s). HEPA vacuum the contained area prior to final re-occupancy air sampling.

Waste Disposal:

The Contractor shall perform additional point counting of drywall system waste to determine if the composite result of the overall waste stream is <1.0%. If <1.0%, the drywall waste stream will be considered "trace" composite asbestos waste (e.g., non-hazardous waste, <1.0%). If the composite result is at or >1%, the drywall shall be disposed of as friable asbestos waste. Results of such testing shall be forwarded to the Owner and Environmental Consultant within 24 hours of collection.

See Task 8 below for further details on “minor” procedures for coring, anchoring, etc.

Task 5

Abatement Material:	**Drywall with asbestos-containing joint compounds and texture**			
Method:	X Full Isolation or Mini-Containments	___ Glovebag	___ Glovebag-Cutout	
Material	***Activity Class***	***Sample I.D.***	***% Asbestos***	***Est. Quantity requiring abatement*** *(refer to contract documents and field verify)*
Drywall with asbestos-containing joint compounds and texture	1	WLSH-29	See Section 00 31 26	See Section 00 31 26 and Contract Documents

Decon System:	X Shower	___ Central	X Hudson sprayer or bucket decon
Floor:	1 # Layers Poly	___ Drop Cloths	___ Scaffold
Walls:	___ # of Polyethylene Layers	X Splash Guards	
Criticals:	1 # of Polyethylene Layers	__ Plywood Barriers	

Other Comments: **For ACM wall texturing:** Remove materials using full isolation or mini-containment procedures, satisfying the requirements of Cal/OSHA 8 CCR 1529 Work Class 1 procedures. Use wet methods for dust controls. Dispose of materials as friable asbestos waste. Remove substrates as required to access materials and overspray. Treat all enclosing substrates or materials, such as laid-in ceiling tiles, as asbestos-contaminated and dispose in double goosenecked, labeled bags as friable asbestos waste.

Removal of larger wall or ceiling segments, particularly demolition of elements that may impact friable plaster finishes (see Demolition Plans), shall be completed under full isolation or mini-/mobile containment procedures by a licensed Abatement Contractor. The Asbestos Contractor using glovebag and mobile mini-containment methods or full isolation methods, depending on the quantities impacted, shall complete corings greater than two (2) inch diameter, which cannot be properly controlled using a wetted sponge.

If a mobile containment is used, clean-up and reseal the phone booth-type containment and airlock entry between uses.

See Task 8 below for further details on “minor” procedures for coring, anchoring, etc.

Task 6

Abatement Material:	**Older Ceiling Tiles**			
Method:	**X Full Isolation or Mini-Containments**	**Glovebag**	**Glovebag-Cutout**	
Material	***Activity Class***	***Sample I.D.***	***% Asbestos***	***Est. Quantity requiring abatement*** *(refer to contract documents and field verify)*
Older ceiling tiles	2	CLTL-AAA	See Section 00 31 26	See Section 00 31 26 and Contract Documents

Decon System:	Shower	Central	X Hudson sprayer or bucket decon
Floor:	1 # Layers Poly	Drop Cloths	Scaffold
Walls:	# of Polyethylene Layers	X Splash Guards	
Criticals:	1 # of Polyethylene Layers	Plywood Barriers	

Other comments:

Remove all of the ceiling tiles and any associated mastic inside of a negatively pressurized containment.

Dispose in double goosenecked, labeled bags as friable asbestos waste.

Task 7

Abatement Materials	**Miscellaneous Items**								
Method:	X	Cordon Area		Glovebag		Glovebag-Cutout			
Material	***Activity Class***	***Material I.D.***		***% Asbestos***		***Est. Quantity requiring abatement*** *(Field verify)*			
Formica Countertops	2	FORMICA-AAA		See Section 00 31 26		See Section 00 31 26 and Contract Documents			
Firedoors	2	FIREDOOR-AAA		See Section 00 31 26		See Section 00 31 26 and Contract Documents			
Caulk between exterior metal wall panels	2	CAULK-13		See Section 00 31 26		See Section 00 31 26 and Contract Documents			
Gaskets between flanges of hot water supply and return pipes	2	GASKET-7		See Section 00 31 26		See Section 00 31 26 and Contract Documents			
Decon System:		Shower			Central		X	Bucket	
Floor:		# Layers Poly	X		Drop Cloths			Scaffold	
Walls:		# of Polyethylene Layers			Splash Guards				
Criticals:	1	# of Polyethylene Layers			Plywood Barriers				

Other Comments: Remove items intact without disturbance. Double wrap and dispose of as friable asbestos waste. HEPA-vacuum surrounding area and drop cloths before final visual clearances.

Where removal will result in RACM, complete abatement within a full isolation containment per Cal/OSHA 8 CCR 1529 Work Class 2 procedures, minimum, with negative pressurization of the zone(s).

Controlled Renovation Procedures

Task 8

Controlled Renovations	**Controlled Renovations through Drywall**									
Method:	X	Cordon Area		Glovebag		Glovebag-Cutout				
Material	***Activity Class***	***Material I.D.***	***% Asbestos***	***Est. Quantity requiring abatement*** *(Field verify)*						
Wall and ceiling drywall with joint compound	2	WLSH-3 WLSH-16 CLSH-18 CLSH-25	See Section 00 31 26	See Section 00 31 26 and Contract Documents						
Wall and ceiling drywall with texture	1	WLSH-29	See Section 00 31 26	See Section 00 31 26 and Contract Documents						
Decon System:		Shower		Central	X	Hudson sprayer or bucket decon				
Floor:		# Layers Poly	X	Drop Cloths		Scaffold				
Walls:		# of Polyethylene Layers		Splash Guards						
Criticals:		# of Polyethylene Layers		Plywood Barriers						

Shoot/drill anchors through a wetted sponge, where feasible, following installation of polyethylene drop cloths on floor or other surfaces. Cordon off the room/area and cut holes for devices using drop cloths on the ground and wet methods. For areas impacting drywall, remove the drywall avoiding the joint compounds, where feasible. Continually wet the controlled renovation area during the process and wet wipe & HEPA vacuum the area immediately following completion of the controlled renovation procedures.

Minor procedures impacting drywall with asbestos joint compound or drywall with asbestos texture (i.e., <2" in diameter), may be completed using drop cloths and wet sponges for drilling or shooting anchors. All debris shall be immediately wet wiped or HEPA vacuumed to avoid dispersion of asbestos fibers.

Waste Disposal:

1. For Drywall and associated joint compounds, the Contractor is required to point count all drywall and joint compound materials without ACM skim coat to determine if they may be disposed of as "trace" composite asbestos waste (e.g., non-hazardous waste, <1%).
   - **Disposal as friable waste in lieu of point counting will NOT be permitted under the contract.**
   - Point counting to document composite waste stream of drywall and joint compound will be the responsibility of the Contractor.
2. For drywall with texture compound, dispose of as friable asbestos waste.

Using a Hilti-brand rotohammer drill equipped with a local exhaust hood connected to a HEPA-filtered vacuum cleaner is considered a viable and preferred alternative.

Task 9

Controlled Renovations	**Controlled Renovation Procedures through Structural Fireproofing and overspray**											
Method:	X	Full Isolation or Mini-Containment		Glovebag		Glovebag-Cutout						
Material	***Activity Class***		***Material I.D.***		***% Asbestos***		***Est. Quantity requiring abatement*** *(Field verify)*					
Structural Fireproofing and Overspray	1		STSFP-4		See Section 00 31 26		See Section 00 31 26 and Contract Documents					
Decon System:		Shower		Central	X	Hudson sprayer or bucket decon						
Floor:	1	# Layers Poly		___	Drop Cloths		Scaffold					
Walls:	1	# of Polyethylene Layers			Splash Guards							
Criticals:	1	# of Polyethylene Layers			Plywood Barriers							

Other Comments: **For Friable Asbestos Materials:** Core or anchor through adjoining non-ACM materials, where feasible. If not feasible, cordon off the area and set-up negative pressurization of the controlled renovation activity using glovebag or mini-containment methods per 8 CCR 1529. Do not drill or core openly through friable ACM. Wet the materials throughout the controlled renovations. Do not allow ACM on cores to fall into the ceiling plenum or space below. Following the controlled renovation activities, clean-up the mini-containment using wet methods and a HEPA vacuum. Gooseneck and dispose of the glovebags and waste in double goosenecked bags as friable asbestos waste.

Using a Hilti-brand rotohammer drill equipped with a local exhaust hood connected to a HEPA-filtered vacuum cleaner is considered a viable and preferred alternative.

Task 10

Controlled Renovations	**Controlled Renovations through Vinyl Flooring with Related Mastics**							
Method:		X	Cordon Area		Glovebag		Glovebag-Cutout	
Material	***Activity Class***	***Material I.D.***		***% Asbestos***		***Est. Quantity requiring abatement*** *(Field verify)*		
Vinyl Floor tiles with asbestos containing mastics	2	12FLVCT/M-20 12FLVCT/M-37		See Section 00 31 26		See Section 00 31 26 and Contract Documents		
Grey compound on concrete floor	2	CONC-14		See Section 00 31 26		See Section 00 31 26 and Contract Documents		
Decon System:		Shower		Central	X	Hudson sprayer or bucket decon		
Floor:		# Layers Poly	X	Drop Cloths		Scaffold		
Walls:		# of Polyethylene Layers		Splash Guards				
Criticals:		# of Polyethylene Layers		Plywood Barriers				

Other Comments: **For Vinyl Floor Tiles, mastics and leveling compounds:** Cordon off the room or area and provide a local exhaust ventilation system. Remove the impacted flooring before drilling through the substrate. Where feasible, use water to dislodge the tile. Where tile removal is not feasible or fracturing of the tiles will occur, saturate the tile with shave cream and core through the tiles. Frequently wipe up all chips and debris and dispose as Category 1 non-friable waste. Wet wipe with a clean sponge and HEPA vacuum the area upon completion of coring. Do not let cores with intact ACM debris to fall into the ceiling plenum or space below.

Using a Hilti-brand rotohammer drill equipped with a local exhaust hood connected to a HEPA-filtered vacuum cleaner is considered a viable and preferred alternative.

Lead Hazards Construction Work:
Task 9

Abatement Material:	Removal of loose and peeling lead-containing paints, removal of lead-containing vinyl flooring and ceramic tiles (>50 ppm)					
Sample I.D.	***Color***	***Area***	***Lead Content***			***Activity Class***
Paints/Coatings-Varies	All	All	See Section 00 31 26			See Section 00 31 26 and Contract Documents
Vinyl Flooring	All	All	See Section 00 31 26			See Section 00 31 26 and Contract Documents
Decon System:		Shower		Central	X	Bucket
Required Methods:		Full Containment	X	Manual Methods w/Drop Cloths	X	Loose & Peeling Paints Only

Other Comments: **For Stabilization of Loose & Peeling Paints:** Manually scrape and stabilize loose and peeling paints prior to demolition of painted substrates using drop cloths, wet methods, and HEPA vacuums for dust control in compliance with Cal/OSHA regulation 8 CCR 1532.1. Avoid dry sweeping.

For Mechanical Sanding: Work areas requiring mechanical sanding or stripping of painted surfaces with any lead content shall be fully contained with polyethylene dust barriers, establishing negative pressure of the zone, and using HEPA-filtered tools and other dust control procedures as outlined under 8 CCR 1532.1.

For Demolition of Painted Substrates: Demolition of painted substrates required for renovation work shall be completed using wet methods. Loose paints, HEPA vacuum canister wastes, and fine dust shall be characterized and disposed as potential hazardous waste. Respiratory protection shall be upgraded per 8 CCR 1532.1 requirements for mechanical sanding or mechanical equipment without HEPA vacuum or water misting attachments.

For vinyl flooring & ceramic tiles with lead: Debris shall be characterized for lead content prior to disposal. For non-asbestos-containing flooring with lead content >50 ppm, remove flooring and tiles prior to demolition of the building and characterize waste for lead content prior to proper disposal accordingly. HEPA vacuums for dust control in compliance with Cal/OSHA regulation 8 CCR 1532.1. Avoid dry sweeping.

For Disposal & Cleanup: Intact painted substrates may be disposed of as non-hazardous waste as confirmed by the Contractor's waste characterization testing. Characterize and dispose of loose and peeling paint debris, chemical strippers, rags, vinyl flooring, etc. as potential hazardous waste.

Other Items:
Task 12

PCB Ballasts:	X	Remove and dispose of PCB ballasts throughout the buildings as required by the renovation and demolition plans. Any ballast not otherwise labeled by the manufacturer as non-PCB is considered as PCB containing. Quantity— field verify quantity.
Mercury Lamp Recycling	X	Remove and recycle fluorescent lamps throughout the buildings as required by the renovation and demolition plans. Quantity— field verify quantity.

VIII. MONITORING AND REOCCUPANCY TESTING

Asbestos Reoccupancy Testing Requirements (includes estimated # of samples):

Vinyl flooring, mastics and leveling compound	___ Visual Only	___ PCM/zone	1-5 TEM/zone
TSI Piping Insulation	___ Visual Only	___ PCM/zone	1-5 TEM/zone
Fireproofing	___ Visual Only	___ PCM/zone	1-5 TEM/zone
Wall and Ceiling Sheetrock	___ Visual Only	___ PCM/zone	1-5 TEM/zone
Miscellaneous Materials	X Visual Only	___ PCM/zone	___ TEM/zone
Controlled Renovation – Friable ACM	X Visual Only	___ PCM/zone	___ TEM/zone
Controlled Renovation – Misc. Wall or Ceiling Materials	X Visual Only	___ PCM/zone	___ TEM/zone
Controlled Renovation – Vinyl Flooring with Related Mastics & Leveling Compound	X Visual Only	___ PCM/zone	___ TEM/zone

Lead Reoccupancy Testing Requirements (includes estimated # of samples):

Stabilization of Paints and demolition of intact painted elements	X Visual Only post abatement

IX. SIGNATURES

Consultant's Signature: Dan Leung, CIH, CSP, CAC (07-4175), CDPH	Date: 7/20/20
Consultant's Signature: Tucker Kalman, QSP/D, CAC (15-5384), CDPH	Date: 7/20/20
Contractor's Signature	Date:

SECTION 02 41 19

SELECTIVE STRUCTURE DEMOLITION

PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes selective demolition and removal of portions of the existing building, as indicated and as required to perform the work.

1.02 DEFINITIONS

A. Remove: Remove and legally dispose of items except those indicated to be salvaged or to remain the Owner's property.

B. Remove and Salvage: Items indicated to be removed and salvaged remain the Owner's property. Remove, clean, and pack or crate items to protect against damage. Identify contents of containers and bring to Owner's designated storage area within the building.

C. Remove and Reinstall: Remove items indicated; clean, service, and otherwise prepare them for reuse; store and protect against damage. Reinstall items in locations indicated.

D. Existing to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by the Architect, items may be removed to a suitable, protected storage location during selective demolition and then reinstalled in their original locations.

1.03 MATERIALS OWNERSHIP

A. Except for items or materials indicated to be reused, salvaged, reinstalled, or otherwise indicated to remain the Owner's property, demolished materials shall become the Contractor's property and shall be removed from the Project site.

1.04 SUBMITTALS

A. Proposed dust control measures.

B. Proposed noise control measures.

C. Schedule of selective demolition activities indicating the following:

1. Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity.

2. Interruption of utility services.

3. Coordination for cutoff, capping, and continuation of utility services.

4. Detailed sequence of selective demolition and removal work to ensure uninterrupted use of the existing occupied areas of the building.

5. Coordination of Owner’s continuing occupancy of portions of existing building and of Owner’s partial occupancy of completed work.

6. Locations of temporary partitions and means of egress.

D. Inventory of items to be removed and salvaged, if any.

E. Inventory of items to be removed by Owner, if any.

F. Photographs or video, sufficiently detailed, of existing conditions, of adjoining construction and site improvements that might be misconstrued as damage caused by selective demolition operations.

G. Record drawings at Project closeout. Identify and accurately locate capped utilities and other subsurface structural, electrical, or mechanical conditions.

1.05 QUALITY ASSURANCE

A. Demolition Firm Qualifications: Engage an experienced firm that has successfully completed selective demolition work like that required for this Project.

B. Regulatory Requirements: Comply with hauling and disposal regulations of authorities having jurisdiction. Comply with noise and dust regulations of authorities having jurisdiction.

C. Pre-Demolition Conference: Conduct conference at the Project site. Review methods and procedures related to building demolition including, but not limited to, the following:

1. Inspect and discuss condition of building to be demolished.

2. Review structural load limitations of existing structure.

3. Review and finalize schedule and verify availability of equipment, personnel, and facilities required.

4. Review areas where existing construction is to remain and requires protection.

5. Review methods for removing materials from the site.

6. Review staging area for materials on the site.

D. The Project shall achieve a 65-percent waste diversion rate, including demolition materials, in accordance with CALGreen requirements.

1.06 PROJECT CONDITIONS

A. Owner assumes no responsibility for actual condition of buildings to be selectively demolished. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.

B. Hazardous Materials: It is expected that asbestos or other hazardous materials will be encountered in the demolition work. Refer to Haz Mat Report in the Appendix.

C. Storage or sale of removed items or materials on-site will not be permitted.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that utilities not to be re-used have been disconnected and capped.

B. Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.

C. Inventory and record the condition of items to be removed and reinstalled and items to be removed and salvaged.

D. When unanticipated mechanical, electrical, or structural elements that conflict with the intended function or design are encountered, investigate and measure the nature and extent of the conflict. Promptly submit a written report to the Architect.

E. Survey the condition of the building to determine whether removing any element might result in structural deficiency or unplanned collapse of any portion of the structure or adjacent structures during selective demolition.

F. Perform surveys as the demolition work progresses to detect hazards resulting from selective demolition activities.

3.02 UTILITY SERVICES

A. Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.

B. Utility Requirements: Locate, identify, disconnect, and seal or cap off indicated utility services serving building to be selectively demolished.

1. Arrange to shut off indicated utilities with utility companies.

2. Where utility services are required to be removed, relocated, or abandoned, provide bypass connections to maintain continuity of service to other parts of the building before proceeding with selective demolition.

3. Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal the remaining portion of pipe or conduit after bypassing.

3.03 PREPARATION

A. Drain, purge, or otherwise remove, collect, and dispose of chemicals, gases, explosives, acids, flammables, or other dangerous materials before proceeding with selective demolition operations.

B. Conduct demolition operations and remove debris to ensure minimum interference with streets, walks, and other adjacent occupied and used facilities.

1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by governing regulations.

C. Conduct demolition operations to prevent injury to people and damage to adjacent buildings and facilities to remain. Ensure safe passage of people around selective demolition area.

1. Protect walls, ceilings, floors and other existing finish work that are to remain and are exposed during selective demolition operations.

D. Provide and maintain interior and exterior shoring, bracing, or structural support to preserve stability and prevent movement, settlement, or collapse of building to be selectively demolished.

1. Strengthen or add new supports when required during progress of selective demolition.

3.04 POLLUTION CONTROLS

A. Use water mist, temporary enclosures, and other suitable methods to limit the spread of dust and dirt. Comply with governing environmental protection regulations.

1. Do not use water when it may damage existing construction or create hazardous or objectionable conditions.

B. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

1. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level.

C. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before start of selective demolition.

3.05 SELECTIVE DEMOLITION

A. Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete work within limitations of governing regulations and as follows:

1. Proceed with selective demolition systematically. Complete selective demolition work above each floor or tier before disturbing supporting members on lower levels.

2. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. To minimize disturbance of adjacent surfaces, use hand or small power tools designed for sawing or grinding, not hammering and chopping. Temporarily cover openings to remain.

3. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.

4. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain portable fire-suppression devices during flame-cutting operations.

5. Maintain adequate ventilation when using cutting torches.

6. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.

7. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.

8. Locate selective demolition equipment throughout the structure and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.

9. Dispose of demolished items and materials promptly. On-site storage of removed items is prohibited.

10. Return elements of construction and surfaces to remain to condition existing before start of selective demolition operations.

B. Salvaged Items:

1. Sort and organize salvaged materials as they are removed from the structure.

2. Pack, crate or band materials to keep them contained and organized.

3. Store items in a secure and weather protected area until removed from the site or transferred to Owner.

4. Transport items to Owner’s storage area designated by the Owner.

5. Protect items from damage during transport and storage.

C. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition activities. When permitted by the Architect, items may be removed to a suitable, protected storage location during demolition and cleaned and reinstalled in their original locations after demolition operations are complete.

D. Demolish concrete and masonry in small sections. Cut concrete and masonry at junctures with construction to remain, using power-driven masonry saw or hand tools; do not use power-driven impact tools.

E. Remove air-conditioning equipment without releasing refrigerants.

3.06 DISPOSAL OF DEMOLISHED MATERIALS

A. General: Except for items or materials indicated to be recycled, reused, salvaged, reinstalled or otherwise indicated to remain Owner's property, remove demolished materials from the Project site and legally dispose of them.

1. Do not allow demolished materials to accumulate on site.

2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

3. Remove debris from elevated portions of building by chute, hoist or other device that will convey debris to grade level in a controlled descent.

3.07 CLEANING

A. Sweep the building broom clean on completion of selective demolition operation.

B. Change filters on air-handling equipment on completion of selective demolition operations.

END OF SECTION

SECTION 02 82 33

REMOVAL AND DISPOSAL OF ASBESTOS CONTAINING MATERIALS

TABLE OF CONTENTS

SECTION 02 82 33

REMOVAL AND DISPOSAL OF ASBESTOS CONTAINING MATERIALS

PART 1 – GENERAL

1.1 SUMMARY

A. Section Includes: Minimum requirements for hazardous materials handling, control, and abatement activities, as applicable, including, but not necessarily limited to:

1. Hazardous materials controls.
2. Handling and disposal of asbestos-containing building materials (ACBM).
3. Handling and disposal of asbestos contaminated materials.
4. Demolition associated with access to hazardous materials.
5. Criteria for abatement zone reoccupancy testing.
6. Criteria for reoccupancy testing.

B. Related Sections:

1. Section 02 26 00 –Existing Conditions – Hazardous Materials Conditions
2. Section 01 33 00 - Submittals.
3. Section 02 80 01 – Hazardous Materials Abatement Workplan
4. Section 02 83 33 – Removal and Disposal of Material Containing Lead.

1.2 REFERENCES

A. American Society for Testing and Materials (ASTM):

1. E84: "Test Method for Surface Burning Characteristics of Building Materials."
2. E119: “Standard Method for Fire Tests of Building Construction and Materials.”
3. E849: Safety and Health Requirements Relating to Occupational Exposure to Asbestos.”

B. American National Standards Institute (ANSI):

1. Z9.2: “Fundamentals Governing the Design and Operation of Local Exhaust Systems.”
2. Z41.1: “Men’s Safety Toe Footwear.”

3. Z86.1: “Commodity Specification for Air.”

4. Z87.1: “Practice for Occupational and Educational Eye and Face Protection.”

5. Z88.2: “Practices for Respiratory Protection.”

6. Z88.6: “Respiratory Protection - Respiratory Use Physical Qualifications for Personnel.”

7. Z89.1: “Requirements for Industrial Head Protection.”

C. National Fire Protection Association (NFPA):

1. Standard 10: “Fire Extinguishers.”

2. Standard 70: “National Electric Code.”

3. Standard 90A: “Fire Rating of Sprayed-On Fireproofing.”

4. Standard 701: "Small Scale Fire Test for Flame Resistant Textiles and Films."

D. California Department of Industrial Relations, Division of Occupational Safety and Health (Cal/OSHA):

1. Title 8 California Code of Regulations (8 CCR) Section 5144 - Respiratory Protection.

2. Title 8 California Code of Regulations (8 CCR), Article 4, Section 1529 - Asbestos Standard for the Construction Industry.

3. Title 8 California Code of Regulations (8 CCR) Sections 3203 and 1509 - Injury and Illness Prevention Program.

4. Title 8 California Code of Regulations (8 CCR), Article 110, Section 5208 - Asbestos Standard for General Industry.

5. Title 8 California Code of Regulations (8 CCR), Article 2.5, Section 341.6 for employer registration when disturbing more than one hundred square feet (100 SF) of ACCM.

E. California Air Resources Board (CARB)

1. Title 17, Section 93105. Asbestos Airborne Toxic Control Measure for Construction, Grading, Quarrying, and Surface Mining Operations.

1.3 DEFINITIONS

A. Asbestos Work Class: Activities for removing asbestos materials by categories are as follows:

1. Work Class I: Activity involving removal of TSI and surfacing asbestos-containing materials (ACM) or friable presumed asbestos-containing materials (PACM).

2. Work Class II: Activity involving removal of asbestos-containing materials (ACM) not in Work Class I. Excavation/grading of soil is a Class II activity.

3. Work Class III: Repair and maintenance operations where TSI or surfacing is likely to be disturbed, which fits within one standard glovebag or waste container under sixty (60) inches.

4. Work Class IV: Maintenance and custodial activities during which employees contact but do not disturb PACM or ACM and activities to clean-up dust, waste and debris resulting from Work Class I, II, and III activities.

B. Abatement: Primary work involving the removal, containment, control or treatment of hazardous materials.

C. Asbestos: A generic name given to a number of naturally occurring hydrated mineral silicates that possess a unique crystalline structure, are incombustible in air, and are separate into fibers. Asbestos includes any material that contains greater than 0.1 percent by weight in the asbestiform varieties of chrysotile (serpentine); crocidolite (riebecklite); amosite (cummingtonite-grunerite); anthophyllite; tremolite; and actinolite. For the purposes of determining respiratory protection and worker protection both the asbestiform and non-asbestiform varieties of the above materials and any of these materials that have been chemically treated or altered shall be considered asbestos.

D. Asbestos-Containing Material (ACM): Any material which contains more than one percent (>1%) asbestos by weight for the purposes of abatement, waste disposal and fiber controls specified under this Contract.

E. Asbestos Containing Building or Construction Material (ACBM or ACCM): Any material which contains more than one tenth of one percent (>0.1%) asbestos by weight requiring personal protection, dust controls, Contractor registration, and worker training in compliance with Cal/OSHA regulation 8 CCR 1529. For waste disposal purposes, ACBM and ACCM greater than 0.1% by weight and less than 1% by weight is classified as non-hazardous waste, although it is a regulated material under Cal/OSHA.

F. Hazardous Materials Control: Incidental work procedures for control of releases of project-related hazardous materials, including containment, enclosure, wetting, controlled renovations and demolition procedures, and removal and disposal.

G. Hazardous Waste:

1. Waste material, including asbestos, loose and peeling lead-based paints, and any other material which requires management, handling transport, treatment, storage or disposal according to the requirements of the Federal Resource, Conservation and Recovery Act (RCRA) and associated regulation 42 U.S.C. 6901 et seq. and 40 CFR Part 260 et seq.) or the California Hazardous Waste Control Law and associated regulations (Health and Safety Code 25000 et seq. and 22 CCR 66260 et seq.).

2. References to hazardous material or contaminated material incorporate definitions of hazardous pollutants, hazardous contaminants, hazardous material, hazardous substance, hazardous waste, toxic pollutants and toxic substance applicable in accordance with Federal, State, regional and local statutes, laws, regulations and policies.

H. Presumed Asbestos Containing Material (PACM): Thermal system insulation and surfacing material found in buildings constructed no later than 1980.

I. Naturally Occurring Asbestos (NOA): Soil or rocks containing >0.25% asbestos that has not been modified by a manufacturing process. CalOSHA classifies base rock as NOA; whereas asphalt or concrete as non-NOA. NOA that contains >1% is also a CalOSHA Class II ACM.

1.4 SUBMITTALS

A. Asbestos:

1. Submit the following, in accordance with Section 01 33 00 – Submittals and Section 02 80 01 – Hazardous Materials Abatement Workplan, prior to Commencement of the Abatement Work:

a. Proof of current Asbestos Contractor's licenses (CSLB) including C-22 license for asbestos abatement.

b. Valid and current BAAQMD notification for the Project.

c. Cal/OSHA 24-hour Temporary Worksite Notification for Asbestos and Methylenedianiline-Related Work per 8 CCR 1529 for disturbances exceeding one hundred square feet (>100 SF) or friable asbestos abatement activities.

d. Worker documentation, including:

1). Current AHERA training certifications - supervisor/competent persons.

2). Current AHERA training certifications - workers.

3). Respiratory fit test records within the past 12 months minimum, or in compliance with 8 CCR 5144.

4). Medical examination approvals for respirator use within the past 12 months, or in compliance with 8 CCR 5144.

e. Written asbestos abatement work plan and schedule as part of the Contractor’s Hazardous Materials Management Plan (HMMP) to be submitted in accordance with Section 01 35 43.13 – Environmental Procedures for Hazardous Materials.

f. Material Safety Data Sheets (MSDS) for chemicals used. Note that after June 1, 2015, the Hazard Communication Standard (HCS) requires chemical manufacturers, distributors, or importers to provide Safety Data Sheets (SDSs) (formerly known as

Material Safety Data Sheets or MSDSs) to communicate the hazards of hazardous chemical products.

g. Emergency phone number and pager listing.

h. DOP testing of negative pressure units and HEPA-filtered vacuums.

i. Rotameter calibration data within past six (6) months.

j. Negative Exposure Assessment, as warranted, where personal protective equipment differs from minimal requirements established by Cal/OSHA's Construction Industry Standards.

k. Overall scope and schedule of all hazardous materials management including but not limited to:

1) Description of all hazardous materials work to be performed or managed, and intended control procedures.

(2) Schedule of all hazardous materials work.

(3) Description of personal protective equipment and methods as well as intended compliance monitoring.

l. Name, phone number, pager number of Contractor's designated Hazardous Materials Supervisor.

m. Name, address and phone number of the Contractor's landfill;

2. Submit the following, in accordance with Section 01 33 00 - Submittals, within five (5) calendar days of the request by the Owner or within five (5) calendar days of completion of the abatement or hazard control work.

a. Contractor daily personal air-monitoring data.

b. Updated worker documentation, as needed.

c. Daily boundary access logs.

d. Daily negative pressure records, as applicable.

e. Copies of updated schedules and notices to regulatory agencies, as needed.

f. Receipt and weight tickets from landfill operator or incinerator, as applicable.

g. Copies of completed uniform waste manifests.

h. Certification of Completion.

3. Submit the following, in accordance with Section 01 33 00 – Submittals and per 1529 CCR Section (K)(3)(c), within ten (10) calendar days of completion of the abatement or hazard control work.

    a. A detailed list describing the presence, location and quantity of ACM and PACM remaining in the work area.

1.5 QUALITY ASSURANCE

A. Qualifications:

1. Asbestos Abatement Work: Only qualified persons shall engage in asbestos abatement activities. Work involving asbestos-containing materials exceeding 100 square feet (SF) or 100 linear feet (LF) shall be completed by a Contractor holding a valid asbestos handling license issued by the California Contractors State Licensing Board (CSLB) and a valid current Certificate of Registration for Asbestos-Related Work as issued by the California Department of Industrial Relations - Division of Occupational Safety and Health (Cal/OSHA). Work shall be completed under the on-site supervision of a Competent Person as defined by OSHA Regulation 29 CFR Part 1926.1101 (8 CCR 1529 in California). All abatement workers shall have AHERA training with annual 8-hour refresher training, current medical exams for the use of respiratory protection, and current fit test of appropriate respirators.

B. Regulatory Requirements: The Contractor shall be alerted to and familiar with the following laws and regulations regarding the hazards, control measures, management, characterizing, transport and disposal of hazardous wastes:

1. Asbestos Abatement Work: All labor, materials, facilities, equipment, services, employees and training, and testing necessary to perform the work required for asbestos abatement and disposal of waste shall be in accordance with these Specifications and the most current regulations, including but not limited to:

    a. Environmental Protection Agency NESHAP and AHERA regulations (40 CFR Part 763, as applicable).

    b. Occupational Safety and Health Administration (inclusive of OSHA 29 CFR 1926.1101)

    c. California Department of Occupational Safety and Health (inclusive of Cal/OSHA 8 CCR 1529)

    d. Bay Area Air Quality Management District (BAAQMD), Regulation 11, Rule 2.

    e. Other applicable federal, state, and local governmental regulations pertaining to asbestos-containing materials (ACM) and asbestos waste.

C. Meetings:

1. Pre-Construction or Pre-Abatement Meeting:

a. Prior to any abatement work, the Contractor is to attend a pre-construction meeting to be attended by representatives of the Owner, the Owner's Consultants, the Contractor, the Hazardous Materials Abatement Subcontractor, and other Subcontractors whose work may be affected. The meeting agenda shall include the following considerations:

1). Review of the Specifications and Plans in detail related to the abatement and hazards work. All conflicts and ambiguities, if any, shall be discussed.

2). Review the project conditions, schedule, construction sequencing, abatement application requirements, and quality of completed work.

3). Review in detail the means of protecting adjoining areas, protect of Contractor's, Subcontractor's, Owner's workers, and completed work during the abatement activities.

4). Pre-job submittals requirements.

5). Site security requirements.

2. Weekly Meetings: At the Owner's option, abatement projects extending over one week in length may require attendance of the Contractor at a weekly progress meeting. The purpose of this meeting is to review abatement and project scheduling, coordination with other trades, security and site-specific requirements.

1.6 PROJECT CONDITIONS

A. Contractor shall pay all costs associated with the compliance with applicable hazardous materials regulations or requirements incurred by the Contractor or its subcontractors for this Project.

B. Take precautions necessary to protect the health and safety of construction workers, site visitors, the Owner personnel, outside consultants, the public and others from exposure to hazardous materials.

C. Take precautions necessary to insure all surrounding properties or adjacent occupied areas are protected from any contamination from all hazardous materials from this Project Site.

D. Review the information in the environmental and hazardous material investigation reports and make such information available to appropriate subcontractors and building occupants.

F. Minimize generation and migration of hazardous and contaminated materials, waste, dust, fumes and debris.

G. Prevent contamination or further contamination of any material or area by hazardous or contaminated material, waste, dust, fumes or debris.

H. Avoid mixing or concentrating removed, or demolished materials so as to increase the cost of disposing of such materials required to be disposed as hazardous or contaminated wastes.

I. Contractor shall retain, and the Owner will not indemnify against, any liability of Contractor resulting from the activities or duties which are the responsibility of Contractor under the terms of the Contract, including but not limited to present or future liability arising from the arrangement of transportation or disposal of any hazardous or contaminated material, whether on or off-site.

J. Pursuant to 29 CFR 1926.1101, the Contractor shall be deemed to exercise general supervisory authority over the work covered by the standard, even though the General Contractor is not qualified to serve as the asbestos "Competent Person," as defined by the standard. As supervisor of the entire Project, the General Contractor shall ascertain whether any subcontractor is in compliance with the standard and shall require such contractor to come into compliance with the standard when necessary.

K. Contractors shall schedule and coordinate abatement activities to time limitations indicated in the Contract Documents.

1.7 QUALIFICATIONS

A. Hazardous Materials Supervisor: Assign a qualified person directly responsible under the Contractor's Superintendent having the necessary training to be knowledgeable in the identification, control, and management of the hazardous materials on-site. The Hazardous Materials Supervisor is responsible for the following:

1. Enforcing safe work and hygiene practices in compliance with the Site-Specific Hazardous Materials Management Plan (HMMP).

2. Advising subcontractors of potential hazards and minimum general requirements of the HMMP.

3. Coordinating subcontractor's work regarding hazardous material procedures and controls.

4. Establishing and maintaining restricted work areas.

5. Requiring proper use of personal protective equipment.

6. Communicating approved modified safety requirements to site personnel.

7. Notification and coordinating signing of waste manifests with the Owner.

B. Hazardous Materials Handlers: Only qualified persons shall engage in hazardous material-related work. Contractor and subcontractor personnel, who come into contact with, are exposed to, disturb, operate equipment or otherwise handle hazardous or contaminated material, or debris shall have appropriate hazard communication and required training, personal and medical monitoring, and shall be certified to wear appropriate personal protective equipment as required by the applicable laws and regulations. Special qualifications which may be required depending on the Contractor's means and methods include, but are not limited to, the following:

1. Asbestos-Related Work Involving Asbestos-Containing Materials exceeding 100 square feet:

   a) Valid asbestos handling license issued by the California State Contractors Licensing Board and a valid current Certificate of Registration for Asbestos-Related Work as issued by the California Department of Industrial Relations - Division of Occupational Safety and Health (Cal/OSHA).

   b) Work shall be completed under the on-site supervision of a Competent Person as defined by OSHA Regulation 29 CFR Part 1926.1101 (8 CCR 1529 in California).

   c) All abatement workers shall have AHERA training with annual 8-hour refresher training, current medical exams for the use of respiratory protection, and current fit tests of appropriate respirators.

C. Hazardous Materials Haulers:

1. Possess during the hauling of hazardous material, applicable federal, state, and local vehicle insurance requirements, valid driver's license, vehicle registration and licenses, and a current Class 1 Certification of Compliance from the California Highway Patrol affixed to each vehicle or container

2. Possess a Hazardous Substance Removal Certification granted by the State of California Department of Toxic Substances Control (510-540-3802) and other required certifications and insurance.

3. Contractor shall be responsible for informing drivers of hauling vehicles about:

   a) The nature of the material hauled.

   b) Any recommended or required routes to and from the site.

   c) Applicable city street use regulations and requirements, and State of California Department of Transportation (Caltrans) codes, regulations and requirements.

   d) The Owner's requirements for proper handling and transportation of hazardous waste.

   e) The legal maximum loads for each vehicle.

1.8 REGULATORY REQUIREMENTS

A. Hazardous and contaminated materials and hazardous waste shall be handled according to applicable laws and regulations in effect at the time of disturbance, transport or disposal of said hazardous materials or waste and requirements of the Contract Documents. In the event of conflict, the more stringent requirement shall apply.

B. The Owner is the generator, as defined in 22 CCR Section 66260.10 and 40 CFR Part 261, of any hazardous waste, and will be responsible for that hazardous waste to the extent required by law.

C. Contractor is alerted to and shall familiarize itself to the following laws and regulations regarding the generation, management, characterization and disposal of hazardous waste:

1. Resources Conservation and Recovery Act, 42 U.S.C. Section 6901 et seq. and regulations 40 CFR Part 260 et seq.

2. California Health and Safety Code, Division 20 and regulations, and 22 CCR Section 66000 et seq.

3. For asbestos hazards: Comply with the applicable requirements of the Cal/OSHA Construction Asbestos Standard, 8 CCR Section 1529, and the BAAQMD regulations.

1.9 HAZARDOUS MATERIALS USED TO PERFORM THE WORK

A. General: Minimize the use of hazardous materials to perform the work. Where materials, which contain hazardous substances or mixtures, are used to perform the work, material usage shall be in strict adherence to Cal/OSHA's safety requirements and the manufacturer's warnings and application instructions listed on the Material Safety Data Sheet provided by the product manufacturer and on the product container label.

1. Contractor will be responsible for coordinating the exchange of MSDS (SDS after June 1, 2015) or other hazard communication information between subcontractors at the site.

2. Contractor will notify the Owner when a specific product or equipment, or their intended usage, may be unsafe prior to ordering the product or equipment or prior to the product or equipment being incorporated in the Work.

B. Prohibited Material: The following materials and chemicals are specifically prohibited from use on this project unless otherwise accepted in writing by the Owner.

1. Material with a stated ACGIH threshold limit value of less than 25 parts per million.

2. Ethylene glycol monomethyl ether.

3. Dipropylene glycol methyl ether.

4. Ethylene glycol.

5. Formaldehyde.

6. Methylene chloride.

7. Isocyanates.

8. Chemicals with a flash point of less than 140 degrees Fahrenheit.

1.10 TIME LIMITATION AND DELAY CHARGES

A. Complete all asbestos or other hazard work specified in this Section in no more than the allotted calendar days or work shifts as outlined in the Abatement Work Plan or as otherwise specified in the Contract Documents.

1. In the event of failure to complete the Work of this Section within the specified time, the Contractor shall pay liquidated damages in the amount of one thousand dollar ($1,000.00) per calendar day for each day of delay in completion of work beyond the number of days specified in the Contract Documents. The specified amount of liquidated damages represents the Owner's estimate of costs which include, but are not limited to, those of the Owner and the Owner's Consultants for observations and inspections, daily air monitoring, equipment, transportation, and analysis charges which would be incurred by the Owner after the number of calendar days specified for completion of the Work of this Section.

PART 2 – PRODUCTS

2.1 ASBESTOS WORK - MATERIALS AND EQUIPMENT

A. Protective Devices:

1. Temporary wash stations or showers, disposable clothing, respirators, gloves, hard hats, and other required items.

2. Respirators shall protect against asbestos and other appropriate dusts, fumes and mists as approved by:

a. the Mine Safety and Health Administration (MSHA).

b. the National Institute for Occupational Safety and Health (NIOSH) under provisions of 30 CFR Part 11.

B. Waste Receptacles: Conform to federal and State regulations, with 6-mil minimum thickness or glovebags or waste bags.

C. Sealants and Polyethylene Sheeting:

1. Polyethylene sheeting shall be flame-retardant and approved and listed by the State Fire Marshal in accordance with Section 13121 and/or 13144.1 of the California Health and Safety Code.

a. Thickness and Size: six (6) mil thick minimum, unless otherwise specified, sized to minimize the frequency of joints.

b. Flammability: Comply with NFPA Standard 701 with a flame spread rating of no greater than five (<5) and a smoke development rating of no more than seventy (<70) when tested in accordance with ASTM E84 procedures.

2. Sealing Tape shall conform to the following:

a. 2-inches or wider, capable of sealing joints of adjacent sheets of polyethylene and attaching polyethylene sheet to finished or unfinished surfaces or similar materials.

b. Tape shall be capable of adhering under dry and wet conditions, including use of amended water.

3. Preservation Sealing Tape: Type specifically designed for adhering to critical or sensitive surfaces without damage to surface; 3M or equal.

4. Spray adhesives shall not contain methylene chloride or methyl chloroform (1,1,1-trichloroethane) compounds.

5. Fire resistant sealants shall be compatible with concrete, metals, wood, cable jacketing and other materials capable of preventing fire, smoke, water and toxic fumes from penetrating through sealants.

a. Sealants shall be asbestos free and shall have a flame spread, smoke and fuel contribution of zero.

b. Sealants shall be ASTM -and UL-rated for three (3) hours for standard method of fire test for firestop systems.

6. Lagging sealer for enclosing and sealing raw exposed edges of piping, fitting, equipment and duct insulation (as applicable) shall meet the requirements of NFPA 90A.

D. Surfactants and Encapsulants:

1. Wetting agents or surfactants shall be effective and compatible with the ACM and ACBM being wetted.

2. Bridging or penetrating type encapsulants shall have the following characteristics:

a. Water based. Do not utilize an organic solvent in which the solid parts of the encapsulant are suspended.

b. Non-flammable with no methylene chloride.

c. U.L. listed encapsulants, in full-scale ASTM E119 fire test, compatible with W.R. Grace "Retroguard, RG-1" fireproofing with "Spatterkote" Type SKII" bonding treatment for structural and decking widths exceeding twenty four (24) inches.

d. Compatible with replacement materials, especially mastics, fireproofing, and adhesives.

E. Mastic Removers shall conform to the following:

1. Non-flammable solvent or gel, with a flash point above one hundred and forty degrees Fahrenheit (>140 deg. F.).

2. Low odor.

3. Solvent waste shall not result in the generation of hazardous waste as described under 22 CCR, Division 4.

4. Removers shall not contain methylene chloride, halogenated hydrocarbons, or any of the following glycol ethers:

Common Name	Abbrev.	CAS#	Chemical Name
ethylene glycol methyl ether	EGME	109-86-4	2-methoxyethanol
ethylene glycol methyl ether acetate	EGMEA	110-49-6	2-methoxyethyl acetate
ethylene glycol ethyl ether	EGEE	110-80-5	2-ethoxyethanol
ethylene glycol ethyl ether acetate	EGEEA	111-15-9	2-ethoxyethyl acetate
ethylene glycol dimethyl ether	EGDME	110-71-4	1,2-dimethoxyethane
ethylene glycol diethyl ether	EGDEE	629-14-1	1,2-diethoxyethane
diethylene glycol	DEG	111-46-6	2,2'-dihydroxyethyl ether
diethylene glycol methyl ether	DEGME	111-77-3	2-(2-methoxyethoxy) ethanol
diethylene glycol ethyl ether	DEGEE	111-90-0	2-(2-ethoxyethoxy) ethanol
diethylene glycol dimethyl ether	DEGDME	111-90-6	bis(2-methoxyethoxy) ether
triethylene glycol dimethyl ether	TEGDME	112-49-2	2,5,8,11-tetraoxadodecane
dipropylene glycol	DPG	110-98-5	2,2-dihydroxyisopropyl ether

F. Vacuums and Negative Pressure Units (NPUs) used for clean-up of materials and detail shall be HEPA-filtered. Provide DOP testing on-site for all units, unless otherwise noted in the Contract Documents.

2.2 OTHER HAZARDOUS MATERIALS - MATERIAL AND EQUIPMENT

A. Waste Containers:

1. Provide sealable metal drums, 55-gallon capacity, with sealable lids. Label the drums in accordance with EPA and DTSC requirements, including the Generator I.D. or location identification and manifest number. Drums shall be air and water tight.

PART 3 – EXECUTION

3.1 EXAMINATION

A. Review the hazardous material report(s) to familiarize oneself with hazardous material locations and conditions, and previous abatement by others, as applicable.

B. Review site conditions to verify quantities, work zones, available utilities, security, etc.

3.2 PREPARATION

A. Minimum Protective Procedures for Asbestos Work:

1. Protection of Visitors and Other Site Personnel: Cordon off the abatement area(s) with appropriate signs, and provide temporary tunneling or scaffolding, as applicable.

2. Respiratory Protection: Comply with Cal/OSHA Regulation 8 CCR Section 1529 and ANSI Standard Z88.2, "Practices for Respiratory Protection." Use respirators approved by the National Institute for Occupational Safety and Health (NIOSH).

3. Provide site security to assure that no member of the public is able to gain access to the asbestos work area at any time. Maintain access and egress routes at all times.

4. Provide worker training, respiratory protection, and medical examinations to meet applicable regulations.

5. Provide temporary lighting and power to work areas, including installation of ground fault interrupters.

6. Fully ground all equipment within the work zone and decontamination assemblies.

7. Establish negative pressure in work area(s) as required under 8 CCR Section 1529. Note that where approved by the Owner, negative pressure units may be removed overnight from unoccupied building where site security and equipment are at risk. Under such conditions, the Contractor shall be responsible for sealing all openings and the decontamination assembly before completion of the day's work and reestablishing negative pressurization of the zone before abatement commences.

8. Construct enclosure system(s) for worker and equipment decontamination.

9. Provide workers with sufficient sets of protective full-body clothing to be worn in the designated work area and whenever a potential exposure to airborne asbestos or potential safety hazards exists. Such clothing shall include but not be limited to: full-body coveralls, headgear, eye protection, and gloves. Disposable-type protective clothing, headgear, and footwear may be provided.

   a. Full-Body Clothing: Assure that workers wear hoods covering their hair in the designated work areas at all times. Do not wear protective clothing in lieu of street

clothing outside the work area. Leave non-disposable-type protective clothing and footwear in the wash room until the end of the asbestos abatement work. An acceptable alternative to disposal is proper storage in a sealed and labeled container so that containers would be opened and clothing reused only in an asbestos work area.

b. Eye protection: Provide eye protection to be worm as required by applicable safety regulations. Wear eye protection at all times within the asbestos work areas during all phases of work: preparation, removal, clean-up, encapsulation, waste handling, and similar operations. When appropriate, based on regulatory mandates, a full facepiece respirator may be worn to satisfy this requirement. Equipment shall conform to ANSI Z87.1. Use of contact lenses with respiratory protection is prohibited.

c. Head Protection: Provide hard hats or other head protection as required by applicable safety regulations, conforming to ANSI Z89.1, Class A or B.

d. Foot Protection: Provide nonskid footwear to all abatement workers, conforming to ANSI Z41.1, Class 75.

B. Site Protective Controls:

1. Protect against unnecessary disturbances or damages to sensitive finishes or furnishings that will remain within the facility.

2. Locate temporary scaffolding and containment barriers, as required, and proceed with the construction or demolition, allowing for continued operation of any adjacent occupied areas, as applicable.

3. Protect existing furnishings and building finishes from water, lead dusts, or chemical strippers.

4. Evaluation will review possible contamination resulting from:

a. Failure to adequately cordon off or contain work area dusts, clean-up debris, and use approved work practices, such as wet wiping and HEPA vacuuming.

b. Failure or breaches in the work area isolation containment.

c. Failure or rupture in the negative pressurization/HEPA filtration system.

d. Incomplete decontamination of personnel or equipment removed from the work area(s).

3.3 ASBESTOS ABATEMENT PROCEDURES

A. Notifications:

1. Notify, in writing, the BAAQMD ten (10) working days prior to commencement of any non-emergency asbestos project involving more than two hundred sixty linear feet (>260 LF) or more than one hundred sixty square feet (>160 SF) or more than 35 cubic feet of RACM.

2. Notify Cal/OSHA twenty four (24) hours in advance of any disturbances of any amount of friable or non-friable asbestos-containing materials or prior to performing asbestos-related work.

B. Procedures:

1. Thermal System Insulation (TSI):

a. Remove TSI as indicated on the Contract Drawings using full isolation or glovebag procedures per Cal/OSHA Regulation 8 CCR 1529, Work Class I, minimum.

b. Glovebag cut-out procedures may be used for services scheduled for demolition, as applicable.

c. Use wet methods and HEPA vacuums, setting up critical barriers for quantities greater than 25 LF

d. Seal HVAC systems and install drop cloths below and over nearby objects.

e. Ventilate away from the workers, using a HEPA filtration system.

f. Provide a full decontamination system with shower for abatement quantities exceeding twenty five linear feet (>25 LF) or as otherwise directed by the Contract Documents.

g. HEPA vacuum the entire contained area prior to reoccupancy air testing.

h. Glovebag abatement work, where applicable, requires two workers minimum and smoke testing of all bags prior to abatement.

i. Dispose of TSI in double goosenecked labeled bags or double wrap cut-out sections in 6-mil polyethylene sheeting and properly labeled as friable asbestos waste.

2. Vinyl Floor Tiles and Mastics:

a. Remove the flooring and mastics as indicated on the Contract Drawings using full isolation procedures, satisfying the requirements of Cal/OSHA Regulation 8 CCR 1529, Work Class II.

b. Set-up critical barriers and splash guards and establish negative pressurization.

c. Remove the tiles using wet methods to minimize breakage and airborne fiber releases.

d. Remove the mastic using a mastic remover.

e. HEPA vacuum the contained area following abatement for reoccupancy testing; minimize use of encapsulant on substrates to be retiled.

f. Provide a full decontamination system with shower for areas exceeding twenty five square feet (>25 SF).

g. Dispose of tiles and mastic as Category 1 non-friable waste.

3. Asbestos Plasters and Sprayed-on Surfacing Materials:

a. Remove ACM as indicated on the Contract Drawings using full isolation or mini-containment procedures per Cal/OSHA Regulation 8 CCR 1529, Work Class I, minimum.

b. Use wet methods and HEPA vacuums.

c. Set-up critical barriers for quantities greater than twenty five square feet (>25 SF).

d. Seal HVAC systems and install drop cloths below and over nearby objects. Ventilate away from the workers, using a HEPA filtration system.

e. Provide a full decontamination system with shower for abatement quantities exceeding 25 LF or as otherwise directed by the Contract Documents.

f. HEPA vacuum the entire contained area prior to clearance air testing.

g. Dispose of ACM in double goosenecked bags properly labeled as friable asbestos waste.

4. Caulking:

a. Remove the caulking as indicated by the Contract Drawings.

b. Cordon off the work area, installing critical barriers at the windows, doors, and other penetrations, as applicable.

c. Remove ACM using wet methods per Cal/OSHA's Regulation 8 CCR 1529, Work Class II.

d. Set-up drop cloths on the ground and nearby objects to contain falling materials on the ground or public access areas surrounding the work area.

e. HEPA vacuum the sills and frames following abatement.

f. Provide a full decontamination system with shower for areas exceeding 100 SF.

g. Dispose of caulking as Category 2 non-friable waste.

5. Trace Asbestos Materials (Except Sheetrock Wallboard and Joint Compounds with Skimcoat):

    a. Remove composite materials as indicated on the Contract Drawings using full isolation or mini-containment procedures within occupied building per Cal/OSHA Regulation 8 CCR 1529, Work Class II.

    b. Use wet methods and HEPA vacuums, setting up critical barriers for occupied areas.

    c. Set-up critical barriers for occupied areas.

    d. For building demolition projects, cordon off the area and use dust control methods to minimize airborne fiber releases.

    e. HEPA vacuum the entire contained area prior to reoccupancy testing for renovation projects.

    f. Dispose of composite materials as “trace” (less than one percent (<1%)) asbestos waste, unless otherwise contaminated with other asbestos or hazardous wastes.

6. Contaminated Non-Asbestos Materials:

    a. Remove contaminated non-ACM substrates or underlying ceiling tiles, etc.

    b. Use wet methods and HEPA-filtered vacuums to decontaminate, where feasible. Allow inspection of the decontaminated materials by the Owner’s Environmental Consultant prior to removal from the work area.

    c. Contaminated waste shall be disposed in double goosenecked bags or burrito- wrapped as friable asbestos waste.

    d. Minimize excess waste quantities, where feasible.

7. Other: Remove and dispose in compliance with Cal/OSHA requirements under 8 CCR 1529 and AHERA requirements under 40 CFR Part 763.

C. Special Techniques and Procedures

1. Isolate HVAC system(s) to prevent contamination and fiber dispersal to other areas of the building.

    a. Openings to ducts, fans, louvers, and plenums shall be sealed with two layers of polyethylene sheeting prior to the start of removal.

    b. Provide caulked, rigid panels at the discretion of the Owner.

    c. Repair any damage to ductwork, grilles, dampers, louvers, or HVAC equipment at the completion of the abatement work.

d. Secure systems and equipment using OSHA lock-out and tag-out procedures, as applicable.

2. Ensure that all electrical power terminating in the work area, including but not limited to outlets and lights are disconnected and cannot be reenergized during the course of the work.

   a. Ensure that all power lines which transit the work area and are necessary for the continued operation of services in areas outside the work area are identified and protected adequately in order not to pose a hazard to workers during the course of work.

   b. Provide temporary power and lighting, and ensure safe installation of temporary sources and equipment per applicable electrical code requirements, and provide safety lighting and ground fault interrupter circuits as power source of electrical equipment.

   c. Secure systems and equipment using OSHA lock-out and tag-out procedures, as applicable.

3. Construct critical barriers and decontamination enclosure systems, as applicable. Erect polyethylene sheeting to protect walls, windows, flooring, and fixed equipment, as applicable.

4. Provide differential air pressure systems for each work area in accordance with Appendix J of the EPA's "Guidance for Controlling Asbestos-Containing Materials in Buildings," EPA 560/5-85-024.

   a. Establish negative pressurization within all Asbestos Work Class 1 areas, exhausting air to the exterior, unless otherwise approved by the Owner.

   b. Do not locate outlets near or adjacent to other building intake vents or louvers or at the entrances to the building.

   c. Do not exhaust air into the building's interior spaces or within fifty (50) feet of the building's supply air intakes without on-site DOP testing of all NPUs to show a filter efficiency of ninety nine and ninety seven hundreds percent (99.97%) minimum.

   d. Provide a minimum work area differential air pressure of twenty five hundredths inches water gauge (-0.025 inch w.g.) and four (4) air changes per hour at all times for Asbestos Work Class 1 areas or as otherwise designated by the Contract Documents.

5. Remove ACM employing full isolation, glovebag, and glovebag with mini-containment procedures as designated by material quantities and work class under Cal/OSHA regulation 8 CCR Section 1529.

   a. Glovebag cut-out methods may be used for systems scheduled for demolition as outlined in the Demolition Plans.

b. Use wet cleaning methods, HEPA vacuuming, and proper work practices.

c. Mini-containments may not be required for glovebag TSI removal in unoccupied zones provided the bag is evacuated with a HEPA-filtered vacuum prior to the removal of the element being stripped or unless otherwise indicated in the Contract Documents. All areas requiring aggressive reoccupancy air sampling will require mini-containments or full containments and pre-cleaning throughout the isolated area using HEPA vacuums and wet methods.

6. As applicable to abatement of surfacing materials and non-glovebag thermal system insulation removal projects or for other work completed within full isolation containments, remove visible accumulations of asbestos material, debris, and dust from within the work area and its decontamination enclosure systems. Clean all surfaces within the work area.

7. Where encapsulation is required, encapsulate following the Owner's pre-encapsulation inspection.

8. Minimize encapsulating of sensitive abated areas or surfaces, such as vinyl floor from wood or concrete substrates, so as not to affect the adhesion of replacement materials.

9. After encapsulation:

a. Remove the inner layer of polyethylene sheeting from the floor, walls, and other equipment.

b. Dispose as asbestos waste, as applicable.

c. Leave all critical barriers with one layer of polyethylene sheeting.

10. After removing the final layer of polyethylene sheeting (as appropriate):

a. Final-clean all surfaces, including the inner surface of the outer layer of polyethylene that serves as a critical barrier, any subfloor trenches, and similar locations.

b. Allow adequate time for settlement of dust, then repeat final cleaning operation.

c. Clean and remove all materials and equipment within the work area, using the equipment decontamination enclosure system.

11. Exterior Asbestos Work Class II abatement operations shall utilize critical barriers, drop cloths, wet methods, and HEPA vacuums as outlined under Cal/OSHA regulation 8 CCR Section 1529.

D. Field Quality Control

1. Site Tests: Reoccupancy Testing Criteria

a. Reoccupancy air samples using aggressive air sampling techniques shall be collected for all abatement zones, unless otherwise designated in the Contract Documents.

b. Phase Contrast Microscopy (PCM) Reoccupancy Testing: Areas cleared by PCM shall show an airborne concentration of total fibers for each sample at or below one hundredth fibers per cubic centimeter (≤0.01 f/cc) using the NIOSH 7400A counting rules. Any sample result exceeding one hundredth fibers per cubic centimeter (>0.01 f/cc) shall require recleaning of the work area and retesting. The Owner, based on the quantity and types of materials removed, configuration, and sequencing of the work areas, and similar considerations, shall determine the minimum number of samples.

c. When transmission electron microscopy (TEM) reoccupancy testing are required, as designated by the Contract Documents, analysis shall be by the method described in 40 CFR Part 763, Appendix A, Subpart E (AHERA), with an analysis turn-around time of twenty four (24) hours, unless otherwise designated by the Owner. Z-test requirements under the AHERA regulations will not apply to any Owner's projects.

d. The Owner shall pay the costs of the final round of visual inspections, aggressive air sampling, and PCM and/or TEM analyses that will meet the Specifications. All rounds of visual inspections, aggressive air sampling, and PCM and/or TEM analyses that fail to meet the contract criteria shall be borne by the Contractor. For the purpose of this paragraph, visual inspection includes the area isolation inspection, pre-encapsulation inspection, and final area cleanup inspection.

E. Waste Disposal and Manifesting:

1. Packing, labeling, transporting, and disposing of asbestos materials shall comply with Cal/EPA regulations under 22 CCR, including completion of the Uniform Hazardous Waste Manifest Form (DTSC 8022A, 7/92, and EPA 8700-22), and the requirements of “Waste Disposal and Manifesting,” discussed below.

3.5 WASTE DISPOSAL AND MANIFESTING

A. Hazardous Waste Disposal:

1. Packing, labeling, transporting, and disposing of hazardous waste shall comply with Cal/EPA regulations under 29 CFR 1910.1001 and 22 CCR, including completion of the Uniform Hazardous Waste Manifest Form (DTSC 8022A and EPA 8700-22). Waste and glovebags shall be properly labeled prior to their removal from the contained or regulated area, including all required asbestos warning labels.

2. Waste dumpsters shall be placarded, sealed, and locked overnight. Waste containers shall be stored to prevent public access or disturbances.

3. A "Waste Manifest" shall be completed for disposal of hazardous waste. The transporter shall posses a valid EPA Transporter I.D. number. The Contractor shall notify the Owner’s Project Manager at least forty-eight (48) hours prior to the time that the Manifest is required to be signed by the Owner.

4. Applicable information to be included in the "Waste Manifest" includes the following:

   a. EPA Generator I.D. Number: Verify with the Owner's Project Manager.

   b. Generator's Name and Address: Verify with the Owner's Project Manager.

   c. Generator Tax I.D. Number: Verify with the Owner's Project Manager.

B. Recycling:

1. Contractor is prohibited from recycling of any construction debris that has any asbestos contamination regardless of amount, including residual asbestos-containing mastics, or concrete which may be averaged to be less than or more than 1% asbestos. Material will be disposed of in accordance with requirements listed in this section.

3.6 FINAL PROJECT CLEAN-UP AND REOCCUPANCY TESTING CRITERIA

A. Asbestos-containing materials will be abated with reoccupancy testing by visual inspection and phase contrast microscopy (PCM) or transmission electron microscopy (TEM), as applicable, as outlined in the Abatement Work Plans (Section 02 26 00).

END OF SECTION 02 82 33

SECTION 02 83 33

CONTROL, REMOVAL AND DISPOSAL OF MATERIALS CONTAINING LEAD

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SECTION 02 83 33

CONTROL, REMOVAL AND DISPOSAL OF MATERIALS CONTAINING LEAD

PART 1 – GENERAL

1.1 SUMMARY

A. Section Includes: Minimum requirements for hazardous materials handling, control, and abatement activities, as applicable, including, but not necessarily limited to:

1. Hazardous materials controls.
2. Handling and disposal of lead-based paints and lead-containing materials.
3. Handling and disposal of lead-contaminated materials.
4. Demolition associated with access to hazardous materials.
5. Criteria for abatement zone reoccupancy testing.
6. Criteria for reoccupancy testing.

B. Related Sections:

1. Section 02 26 00 –Existing Conditions – Hazardous Materials Conditions
2. Section 01 33 00 - Submittals.
3. Section 02 80 01 – Hazardous Materials Abatement Workplan
4. Section 02 82 33 – Removal and Disposal of Asbestos-Containing Materials.
5. Section 02 84 33 – Removal and Disposal of PCB and Mercury-Containing Materials

1.2 REFERENCES

A. American Society for Testing and Materials (ASTM):

1. E84: "Test Method for Surface Burning Characteristics of Building Materials."
2. E119: “Standard Method for Fire Tests of Building Construction and Materials.”

B. American National Standards Institute (ANSI):

1. Z9.2: “Fundamentals Governing the Design and Operation of Local Exhaust Systems.”
2. Z41.1: “Men’s Safety Toe Footwear.”

3. Z86.1: “Commodity Specification for Air.”

4. Z87.1: “Practice for Occupational and Educational Eye and Face Protection.”

5. Z88.2: “Practices for Respiratory Protection.”

6. Z88.6: “Respiratory Protection - Respiratory Use Physical Qualifications for Personnel.”

7. Z89.1: “Requirements for Industrial Head Protection.”

C. National Fire Protection Association (NFPA):

1. Standard 10: “Fire Extinguishers.”

2. Standard 70: “National Electric Code.”

3. Standard 90A: “Fire Rating of Sprayed-On Fireproofing.”

4. Standard 701: "Small Scale Fire Test for Flame Resistant Textiles and Films."

D. California Department of Industrial Relations, Division of Occupational Safety and Health (Cal/OSHA):

1. Title 8 California Code of Regulations (8 CCR) Section 5144 - Respiratory Protection.

2. Title 8 California Code of Regulations (8 CCR) Section 1532.1 - Construction Lead Standard.

3. Title 8 California Code of Regulations (8 CCR) Sections 3203 and 1509 - Injury and Illness Prevention Program.

E. U. S. Department of Housing and Urban Development (HUD): Guidelines for the Evaluation and Control of Lead-Based Paint Hazards in Housing,” referred to as the “HUD Guidelines.”

1.3 DEFINITIONS

A. Abatement: as defined by the Department of Public Health for lead hazards work, includes any set of measures designed to reduce or eliminate lead hazards.

B. Activity Class/Category - Lead: Lead hazard designations assigned to work activities that involve lead-containing materials. Activities that fall into Classes I through III, including as examples the operations defined below, are required to assume the following personal airborne exposure levels, unless otherwise demonstrated.

1. Activity Class I; exposure below five hundred micrograms per cubic meter (<500 µg/m^3).

a. Surface clean-up of lead-containing dust or debris less than fifteen thousand micrograms per square foot (<15,000 µg/SF);

b. Spray painting with lead-based paints; Manual demolition of structures (e.g. drywall, plaster, etc.);

c. Manual sanding, grinding, needle gunning, chiseling, hammering, wire brushing, milling or scraping of lead-based coatings;

d. Head gun removal of any surface coating; and power tool cleaning with dust collection systems.

2. Activity Class II; exposure greater tan five hundred micrograms per cubic meter (>500 $\mu g/m^3$) and less than twenty-five hundred micrograms per cubic meter (<2,500 $\mu g/m^3$).

a. Using lead mortar;

b. Lead burning;

c. Rivet busting;

d. Power tool cleaning without dust collection systems;

e. Clean-up of dry abrasive; and

f. Abrasive blasting enclosure movement and removal

3. Activity Class III; exposure greater than twenty-five hundred micrograms per cubic meter (>2,500 $\mu g/m^3$).

a. Abrasive blasting of any coated surfaces;

b. Welding on any coated surfaces;

c. Torching or cutting or any coated surfaces; and

d. Torch burning of any coated surfaces.

C. Certified Lead Worker: includes those who do lead-related construction work activities on a work site under the directions of a Certified Lead Supervisor, including:

1. Removal, disposal or abatement of loose and peeling lead-based paints as defined by CDPH, including scraping, demolition or other Cal/OSHA Activity 1 through 3 work as defined above.

2. Removal or repair of lead plumbing.

3. Repainting or general construction on surfaces painted with lead-based paints.

4. Removal, enclosing or covering of lead-contaminated soils.

5. Note that renovations, remodeling, and painting, work or other activities listed above may be completed by workers satisfying the EPA's RRP training requirements only.

D. Certified Lead Supervisor: includes those who supervise daily work activities on a lead-related construction site, as well as supervision of repainting or general construction performed on surfaces with lead-based paints where abatement is designed to permanently reduce or eliminate lead hazards for public (non-industrial) buildings or to last more than twenty (20) years. The Certified Lead Supervisor shall oversee the Certified Lead Workers, enforce safe work practices, and schedule and coordinate work site activities with the building occupants and other contractors and consultants.

E. Containment: as defined by the California Department of Public Health includes any system, process or barrier used to contain lead hazards in a work area, including plastic sheeting, wet scraping, and other lead-safe work practices as described in the HUD Guidelines, Chapter 8.

1.4 SUBMITTALS

A. Lead-Related Work:

1. Submit the following, in accordance with Section 01 33 00 - Submittals, prior to commencement of the lead-related work:

a. Worker documentation, including:

1). Current CDPH Certified Lead Supervisor training certificates.

2). Current lead awareness training certificates – workers.

3). Respiratory fit test records within the past twelve (12) months minimum, or in compliance with 8 CCR 5144.

4). Medical examination approvals for respirator use within the past 12 months, or in compliance with 8 CCR 5144.

5). Blood lead test within past 90 days.

b. Abatement Plan prepared by a Certified Lead Supervisor, Certified Lead Project Monitor, or Certified Lead Project Designer including:

1). detailed lead hazards control and management measures.

2). a detailed description of abatement methods, locations and components where abatement is planned.

3). a recommended schedule for reinspection.

4). instructions to maintain potential lead hazards in safe condition.

c. Notification for abatement exceeding 100 SF per Cal/OSHA regulation 8 CCR 1532.1 for HUD-defined and presumed lead-based paints.

d. Material safety data sheets for chemicals used.

2. Submit the following, in accordance with Section 01 33 00 - Submittals, within five (5) calendar days of the request by the Owner or within five (5) calendar days of completion of the abatement or hazard control work.

a. Updated worker documentation, as needed.

b. Contractor periodic personal air-monitoring results.

c. Receipt and weight tickets from landfill operator or recycler as applicable.

d. Waste profiling data (TCLP, WET, and SW846, as applicable).

1.5 QUALITY ASSURANCE

A. Qualifications:

1. Lead Hazard/Abatement Work: Only qualified persons with CDPH approved Lead Workers training, current medical examinations and approval for the use of respiratory protection, and current fit testing of respirators under the direct supervision of a CDPH approved Lead Abatement Supervisor shall engage in work defined under Cal/OSHA regulation 8 CCR 1532.1 affecting lead-based paints and lead construction hazards, including but not limited to:

a. Working in an environment where lead exposures exceed 30 micrograms per cubic meter.

b. Abating lead-based paints, including but not limited to abatement of loose and peeling lead-based paints, demolition and disposal of concrete-encased primed structural steel and/or stripping of lead coatings from structural steel prior to torching or welding.

B. Regulatory Requirements: The Contractor shall be alerted to and familiar with the following laws and regulations regarding the hazards, control measures, management, characterizing, transport and disposal of hazardous wastes:

1. Lead Hazard/Abatement Work: All labor, materials, facilities, equipment, services, employees and training, and testing necessary to perform the work required for lead abatement, demolition, decontamination, hazard control, and disposal of waste shall be in accordance with these Specifications and the most current regulations, including but not limited to:

a. Environmental Protection Agency National Ambient Air Quality Standards, as applicable (40 CFR 61).

b. Occupational Safety and Health Administration (inclusive of OSHA 29 CFR 1926.62, 29 CFR 1926.59, and 29 CFR 1910).

c. California Department of Occupational Safety and Health (inclusive of Cal/OSHA 8 CCR 1532.1).

d. California Environmental Protection Agency (Cal/EPA), Title 22.

e. California Department of Public Health (17 CCR Sections 35001 -36100).

f. U.S. Environmental Protection Agency Renovation Repairs & Painting (RR&P Rules)

g. Other applicable federal, state, and local governmental regulations pertaining to lead hazards and lead waste.

C. Meetings:

1. Pre-Construction or Pre-Abatement Meeting:

a. Prior to any abatement work, the Contractor is to attend a pre-construction meeting to be attended by representatives of the Owner, the Owner's Consultants, the Contractor, the Hazardous Materials Abatement Subcontractor, and other Subcontractors whose work may be affected. The meeting agenda shall include the following considerations:

1). Review of the Specifications and Plans in detail related to the abatement and hazards work. All conflicts and ambiguities, if any, shall be discussed.

2). Review the project conditions, schedule, construction sequencing, abatement application requirements, and quality of completed work.

3). Review in detail the means of protecting adjoining areas, protect of Contractor's, Subcontractor's, Owner's workers, and completed work during the abatement activities.

4). Pre-job submittals requirements.

5). Site security requirements.

2. Weekly Meetings: At the Owner's option, abatement projects extending over one week in length may require attendance of the Contractor at a weekly progress meeting. The purpose of this meeting is to review abatement and project scheduling, coordination with other trades, security and site-specific requirements.

1.6 TIME LIMITATION AND DELAY CHARGES

A. Complete all lead and other hazard work specified in this Section in no more than the allotted calendar days or work shifts as outlined in the Abatement Work Plan or as otherwise specified in the Contract Documents.

1. In the event of failure to complete the Work of this Section within the specified time, the Contractor shall pay liquidated damages in the amount of one thousand dollar ($1,000.00) per calendar day for each day of delay in completion of work beyond the number of days specified in the Contract Documents. The specified amount of liquidated damages represents the Owner's estimate of costs which include, but are not limited to, those of the Owner and the Owner's Consultants for observations and inspections, daily air monitoring, equipment, transportation, and analysis charges which would be incurred by the Owner after the number of calendar days specified for completion of the Work of this Section.

PART 2 – PRODUCTS

2.1 LEAD-RELATED WORK - MATERIALS AND EQUIPMENT

A. Protective Devices:

1. Polyethylene drop cloths and dust barriers, temporary wash stations or showers, disposable clothing, respirators, gloves, hard hats, and other required items.

2. Respirators shall protect against lead and other appropriate dusts, fumes and mists as approved by:

a. the Mine Safety and Health Administration (MSHA).

b. the National Institute for Occupational Safety and Health (NIOSH) under provisions of 30 CFR Part 11.

B. Sealants and Polyethylene Sheeting:

1. Polyethylene sheeting shall be flame-retardant and approved and listed by the State Fire Marshal in accordance with Section 13121 and/or 13144.1 of the California Health and Safety Code.

a. Thickness and Size: 6-mil thick minimum, unless otherwise specified, sized to minimize the frequency of joints.

b. Flammability: Comply with NFPA Standard 701 with a flame spread rating of no greater than five (<5) and a smoke development rating of no more than seventy (<70) when tested in accordance with ASTM E84 procedures.

C. Sealing Tape shall conform to the following:

1. 2-inches or wider, capable of sealing joints of adjacent sheets of polyethylene and attaching polyethylene sheet to finished or unfinished surfaces or similar materials.

   a. Tape shall be capable of adhering under dry and wet conditions, including use of amended water.

   b. Preservation Sealing Tape: Type specifically designed for adhering to critical or sensitive surfaces without damage to surface; 3M or equal.

   c. Spray adhesives shall not contain methylene chloride or methyl chloroform (1,1,1-trichloroethane) compounds.

   d. Fire resistant sealants shall be compatible with concrete, metals, wood, cable jacketing and other materials capable of preventing fire, smoke, water and toxic fumes from penetrating through sealants.

      1). Sealants shall be asbestos free and shall have a flame spread, smoke and fuel contribution of zero.

      2). Sealants shall be ASTM -and UL-rated for three (3) hours for standard method of fire test for firestop systems.

D. Provide waste receptacles that meet federal and State regulations.

E. Paint Removers shall conform to the following:

1. Non-flammable removing solvents or gels, with a flash point above one hundred- and forty-degrees Fahrenheit (>140 deg. F.).

2. Solvent waste shall not result in the generation of hazardous waste as described under 22 CCR, Division 4.

3. Removers shall not contain methylene chloride, halogenated hydrocarbons, or any of the following glycol ethers.

Common Name	Abbrev.	CAS#	Chemical Name
ethylene glycol methyl ether	EGME	109-86-4	2-methoxyethanol
ethylene glycol methyl ether acetate	EGMEA	110-49-6	2-methoxyethyl acetate
ethylene glycol ethyl ether	EGEE	110-80-5	2-ethoxyethanol
ethylene glycol ethyl ether acetate	EGEEA	111-15-9	2-ethoxyethyl acetate
ethylene glycol dimethyl ether	EGDME	110-71-4	1,2 dimethoxyethane
ethylene glycol diethyl ether	EGDEE	629-14-1	1,2 diethoxyethane
diethylene glycol	DEG	111-46-6	2,2 dihydroxyethyl ether
diethylene glycol methyl ether	DEGME	111-77-3	2-(2-methoxyethoxy) ethanol
diethylene glycol ethyl ether	DEGEE	111-90-0	2-(2-ethoxyethoxy) ethanol
diethylene glycol dimethyl ether	DEGDME	111-90-6	bis(2-methoxyethoxy) ether
triethylene glycol dimethyl ether	TEGDME	112-49-2	2,5,8,11 tetraoxadodecane
dipropylene glycol	DPG	110-98-5	2,2 dihydroxyisopropyl ether

4.

F. Cleaning Agents: Cleaning agents, equipment, and methods employed shall not in any way damage the substrate or adjoining surfaces and finishes. Cleaning solvents shall be non-injurious to the surfaces upon which they are applied. The methods used shall cause no pitting, erosion or damages to the surfaces.

1. Do not use chemicals that may attach or leave deposits on the substrate material.

2. Modify the process or processes to suit the finish, hardness, and condition of the surface to be cleaned.

G. Vacuums and negative pressure units shall be HEPA-filtered for clean-up of loose debris and contaminants. Provide DOP testing on-site for all units, unless otherwise noted in the Abatement Work Plan.

2.2 OTHER HAZARDOUS MATERIALS - MATERIAL AND EQUIPMENT

A. Waste Containers:

1. Provide sealable metal drums, 55-gallon capacity, with sealable lids. Label the drums in accordance with EPA and DTSC requirements, including the Generator I.D. or location identification and manifest number. Drums shall be air and water tight.

PART 3 – EXECUTION

3.1 EXAMINATION

A. Review the hazardous material report(s) to familiarize oneself with hazardous material locations and conditions, and previous abatement by others, as applicable.

B. Review site conditions to verify quantities, work zones, available utilities, security, etc.

3.2 PREPARATION

A. Minimum Protective Procedures for Lead-Related Work:

1. Follow, at the minimum, dust control procedures as outlined under Cal/OSHA regulation 8 CCR 1532.1 and CDPH regulation 17 CCR Sections 35001 through 36100.

2. Respiratory Protection: Comply with Cal/OSHA Regulations included in 8 CCR Section 1532.1 and ANSI Standard Z88.2, "Practices for Respiratory Protection."

a. Use respirators approved by the National Institute for Occupational Safety and Health (NIOSH).

b. Provide respiratory protection to employees involved with lead-based paint demolition and/or abatement elements or as required for demolition work where employees may be occupationally exposed to lead at or exceeding the Action Level (AL) at no cost to the employees or Owner.

c. Workers shall wear appropriate respiratory protection during lead hazards work, unless initial testing verifies that employee exposures are below the Action Level.

3. Site security to assure that no member of the public is able to gain access to regulated work areas. Maintain access and egress routes at all times.

4. Worker training, respiratory protection, medical examinations, and blood lead monitoring to meet applicable regulations.

5. Activity Class I work areas, as a minimum, with a two (2) stage decontamination assembly, including an equipment and contiguous clean room with bucket wash-up facilities positioned as follows:

a. Equipment Room shall have lockers or labeled bags and containers for storing contaminated protective clothing and equipment.

b. Clean Room shall have lockers or containers for storing employee's street clothes and personal items. Clean Room shall also contain a suitable supply of potable water to permit each employee to wash his or her hair, hands, forearms, face and neck.

6. Sufficient sets of protective full-body clothing for workers to be worn in designated work area and/or whenever a potential airborne lead hazard exists. Clothing shall include, but not be limited to, full-body coveralls, headgear, eye protection, and gloves. Disposable-type protective clothing, headgear and footwear are acceptable.

7. Full-Body Clothing: Workers shall wear hoods covering their hair in the designated lead hazard work areas at all times.

    a. Wearing of protective clothing, in lieu of street cloths, outside the work area is not permitted.

    b. Non-disposable-type protective clothing and footwear shall be left in the Wash Room decontamination assembly for disposal.

    c. The use of cloth coveralls following the prescribed laundry procedures as identified in 8 CCR, 1532.1 is acceptable.

8. Eye Protection: Eye protection, conforming to ANSI Z87.1 shall be worn at all times within the lead hazard areas.

9. Head Protection: Hard hats or other head protection as required by applicable safety regulations and conforming to ANSI Z89.1, Class A or B.

10. Foot Protection: Construction workers shall use non-skid footwear conforming to ANSI Z41.1, Class 75.

B. Site Protective Controls:

1. Protect against unnecessary disturbances or damages to sensitive finishes or furnishings that will remain within the facility.

2. Locate temporary scaffolding and containment barriers, as required, and proceed with the construction or demolition, allowing for continued operation of any adjacent occupied areas, as applicable.

3. Protect existing furnishings and building finishes from water, lead dusts, or chemical strippers.

4. Erect temporary protective covers over pedestrian walkways and at points of passage for persons or vehicles that are to remain operational during the lead hazard work.

5. Exterior lead hazard operations shall utilize mini-containments, drop cloths, wet methods, and HEPA vacuums as outlined in Cal/OSHA regulation 8 CCR Section 1532.1 and the HUD Guidelines, Chapter 8.

6. The Owner may evaluate the lead dust concentrations outside the work area on adjoining finishes during the work progress by collecting wipe samples to evaluate the integrity of the containment and to detect dust contamination.

7. Evaluation will review possible contamination resulting from:

   a. Failure to adequately cordon off or contain work area dusts, clean-up debris, and use approved work practices, such as wet wiping and HEPA vacuuming.

   b. Failure or breaches in the work area isolation containment.

   c. Failure or rupture in the negative pressurization/HEPA filtration system.

   d. Incomplete decontamination of personnel or equipment removed from the work area(s).

8. Perimeter wipe samples may be collected adjacent to each work area and compared to the pre-construction background concentrations. The Owner will analyze the wipe sample by flame atomic absorption per NIST Standard 1578.

9. The Contractor shall reclean adjoining occupied areas with surface concentrations exceeding background level or forty micrograms per square foot (>40 µg/SF) during the construction activities. The Contractor shall bear the costs (including engineering, administrative, housekeeping, analytical and the labor and materials costs of the Owner's consultant(s)) to return elevated surface lead concentrations to acceptable levels.

3.3 LEAD ABATEMENT AND HAZARD CONTROL

A. Notifications: Cordon off active lead hazard and abatement zone(s) and post with warning signs at entries to regulated areas bearing the following information:

Danger
Lead Work Area
May damage fertility
Or the unborn child
Causes damage to
The Central Nervous System
Do not eat, drink or
Smoke in this area

B. Procedures:

1. Abatement of lead-based paints and presumed lead-based paints as defined by HUD and as regulated under the California Department of Public Health's Title 17, California Code of Regulations (CCR), Division 1, Chapter 8, "Accreditation, Certification, and Work Practices in Lead-Related Construction," Article 1, Sections 35001 et al, and Article 16, Sections 36000 and 36100 shall:

   a. Include posting and delivery of notifications prior to conducting abatement, including:

      1). Completing CDPH Form 8551 (12/97) and posting all entrances to the structure at least 5 days prior to conducting abatement. The posted form shall not be removed until abatement is completed and a reoccupancy inspection has been conducted.

      2). Deliver of the completed CDPH Form 8551 to the Department of Public Health, c/o Notification at the Childhood Lead Prevention Program Branch, 1515 Clay Street, Suite 1801, Oakland, CA 94612; fax: (510) 622-4939.

      3). Retain records of notification for at least three (3) years.

   b. Be conducted only by a Certified Lead Supervisor or a Certified Lead Worker. The Certified Lead Supervisor shall be on-site during all work site preparation and during the post-abatement clean-up of work areas. At all other times when abatement is conducted, the Certified Lead Supervisor shall be on-site or available by telephone, pager or answering service, and able to be present at the work area in no more than two (<2) hours.

   c. Be conducted using containment in a manner such as not to contaminate non-work areas with lead dust, soil, or paint debris.

d. Be conducted in accordance with procedures specified in the HUD Guidelines, Chapters 11 and 12.

C. Loose and Peeling Paint:

1. Scrape loose and peeling paints using dust control procedures and procedures as outlined under Cal/OSHA Regulation 8 CCR 1532.1.

2. Characterize the waste for possible disposal as a hazardous waste.

D. Lead Paint Abatement:

1. Remove paints on structural steel components scheduled for welding or torching using a chemical stripper, needle gun or other approved methods as outlined in the approved Contractor's Hazardous Materials Management Plan (HMMP). Note that spot abatement of structural steel components does not eliminate the possible need for respiratory protection and hazard controls by the welder or torcher under 8 CCR 1529 due to unabated residues or paints on back-to-back components, which can not be accessed for abatement.

2. Use drop cloths, polyethylene barriers, Hudson and airless sprayers and other methods as required for dust control.

3. Characterize and dispose of paints, rags, etc., separately for possible disposal as a hazardous waste.

E. Lead Dust Clean-up:

1. Clean-up background or construction-related dusts from demolition of lead-coated elements or other contaminant sources using wet methods and HEPA-filtered vacuums.

2. Do not dry sweep.

F. Lead Hazard Control:

1. Scrape loose and peeling paints and use dust controls for demolition of lead- coated architectural and structural elements as indicated by the Demolition Plans, following minimum procedures as outlined under Cal/OSHA Regulation 8 CCR 1532.1.

2. Remove and dispose of intact lead-coated architectural and structural elements as non-hazardous waste.

3. HEPA vacuum residual debris and wet wipe affected substrates as required for reoccupancy inspection or testing.

G. Special Procedures and Techniques:

1. Cordon off the proximity (within approximately 20 feet) of Activity Class I work areas using construction tape, polyethylene dust barriers, or other appropriate means.

    a. Persons entering the regulated "cordoned" work area shall wear appropriate respiratory protection and full body coveralls.

    b. Affix appropriate warning signs at the entry and approaches to the regulated area(s).

2. Lockout electrical and HVAC equipment within the regulated area as necessary.

3. Protect floors, furnishings, landscaping, and other items with polyethylene drop cloths or other acceptable means to prevent contamination or damage to other building surfaces and finishes.

4. Apply chemical strippers and scrape following the manufacturer's recommended procedures. After scraping, remove remaining loose paint with a HEPA vacuum.

5. Maintain work area surfaces as free as practicable from accumulated dust or debris. Clean equipment, tools and containment structures within regulated areas, at a minimum, with HEPA vacuums or wet methods.

6. Conduct operations to prevent injury to adjoining facilities, persons, motor vehicles, and other items as applicable.

    a. Prevent chemical cleaning agents from coming into contact with pedestrians, motor vehicles, landscaping, buildings, and other items and other surfaces that could be injured or damaged by such contact.

    b. Do not spray or scrape outdoors during winds of sufficient force to spread cleaning agents to unprotected surfaces.

7. For areas where removal of loose and peeling paints only is required, the Contractor shall ensure that the paint that remains on walls, ceilings, eaves, and other surfaces in areas of active work, as applicable, shall be adhered to the substrate sufficiently to support eventual repainting. Paints that peel or loosen during wetting will become part of the scope of work scheduled for removal and disposal.

8. Where complete removal of lead coats is required, finished work shall show no signs of stains, scratches, streaks, or runs of discoloration from use of cleaners.

    a. Leave substrate surfaces neat and clean, including removal of primers in addition to finish coats. Surfaces shall be uniformly cleaned.

    b. Neutralize substrate using a TSP and detergent wash.

9. Where mechanical sanding or removal of lead-based paints is required, the Contractor shall fully contain the work area, establish negative pressurization of the contained zone, and

attach HEPA-filtration devices to all mechanical tools. Upgrades in respiratory protection shall be provided as required under 8 CCR 1532.1.

10. Avoid direct welding or cutting on surfaces containing any detectable lead by mechanically or chemically removing the coating to a distance of at least six inches from the point at which heat is applied.

    a. If surface coatings are not removed prior to welding or cutting, provide local exhaust ventilation to capture the aerosolized lead, using HEPA filters.

    b. If surface coatings are not removed prior to torching or welding, provide upgraded welder's respiratory protection in compliance with Cal/OSHA regulation 8 CCR 1532.1.

11. Where mechanical removal of surface coatings constitutes a Level II activity, provide power tools, to the extent feasible, with local HEPA exhaust or dust collector systems to capture the aerosolized lead.

H. Demolition Procedures:

1. Removal of obstructing materials as needed for access to hazardous materials.

2. Removal of obstructing materials where hazardous materials contamination is known to exist.

3. Removal of obstructing materials where hazardous materials exposure is likely to result.

4. Follow, at the minimum, the protective procedures as outlined in Cal/OSHA regulation 8 CCR 1532.1.

5. Protection of Visitors and Other Site Personnel: Cordon off the abatement area(s) with appropriate signs, and provide temporary tunneling or scaffolding, as applicable.

6. Respiratory Protection: Comply with Cal/OSHA Regulation 8 CCR Section 1529 and ANSI Standard Z88.2, "Practices for Respiratory Protection." Use respirators approved by the National Institute for Occupational Safety and Health (NIOSH).

I. Prohibited Activities:

1. Workers shall decontaminate themselves and appropriate equipment prior to eating, drinking and smoking.

2. Clean debris and surfaces with HEPA-filtered vacuums or wet methods.

3. Shoveling, wet sweeping, and brushing may be used only where vacuuming or other equally effective methods have been tried and are found to be ineffective.

J. Field Quality Control

1. Site Test: Monitoring and Reoccupancy Testing by the Owner:

   a. During lead hazard-related work, such as demolition, refinishing, or torching and welding activities, the Owner may collect air samples for analysis by flame atomic absorption.

   b. Air sampling results in excess of the Cal/OSHA "Project Action Level" of thirty micrograms per cubic meter (30 µg/m^3) within the construction zone may require isolation of the work area, upgrades in the required respiratory protection, amendment of work procedures, and/or clean-up of the affected area.

   c. Air sampling results in excess of the EPA's National Ambient Air Quality Standard (NAAQS) of one and one-half micrograms per cubic meter (1.5 µg/m^3) at the site's property line or at adjoining occupied non-construction areas may require isolation of the work area, amendment of work procedures, and clean-up of the affected area.

   d. Resampling of the contaminated areas and handling, shipping, and analysis charges (including the Owner's time and expenses) for additional sampling required to show background levels below these lead standards shall be borne by the Contractor.

K. Reoccupancy Testing Criteria - Lead Abatement Zones:

1. The lead abatement zone shall remain secured until cleared by the Owner.

2. Visual Inspection:

   a. When the Contractor considers the work or a designated portion of the work to be complete, the Contractor shall notify the Owner's Project Manager that the work is ready for abatement zone reoccupancy inspection.

   b. Within a reasonable time after receiving notification from the Contractor, the Owner will perform a visual inspection of the work area.

   c. Evidence of lead contamination identified during the inspection will necessitate further cleaning as specified herein.

3. Wipe Sample Reoccupancy Testing Criteria: The Contractor shall reclean the area if surface concentrations exceed the following "CDPH Dust Standards:"

40 micrograms/ft^2	for interior floors
250 micrograms/ft^2	for interior horizontal surfaces
400 micrograms/ft^2	for exterior floor and exterior horizontal surfaces

4. Air Sample Reoccupancy Testing (Additional to Wipe Reoccupancy Testing): Where lead hazard abatement occur concurrently with asbestos abatement activities, the area may be cleared additionally by aggressive air sampling, where airborne lead concentrations following the final visual inspection shall not exceed the EPA's NAAQS standard of one and

one-half micrograms per cubic meter (1.5 µg/m^3) as analyzed by NIOSH method 7082 (flame atomic absorption) or 7105 (graphite furnace atomic absorption).

5. Resampling of the contaminated areas and handling, shipping, analysis charges (including the Owner's time and expenses) for additional sampling required to show background levels below these lead standards shall be borne by the Contractor.

L. Waste Disposal and Manifesting:

1. Comply with current federal, State and local regulations concerning the waste handling, containerization, transportation, and disposal of lead-based paint or lead-contaminated materials as discussed under "Waste Disposal and Manifesting" below.

2. Loose debris and scraped materials shall be treated as hazardous waste, unless otherwise approved by the Owner. Construction waste coated with intact LBP may be disposed of as construction debris in accordance with the Cal/EPA requirements.

3. Laboratory costs associated with analyses required for disposal, if required, shall be at the Contractor's expense.

4. Segregate, containerize, and characterize construction debris including rags, protective coveralls, polyethylene sheeting, and other consumable items. Waste shall be packaged in accordance with the applicable U. S. Department of Transportation regulations included in 49 CFR Parts 173, 178 and 179.

5. Profile waste with an approved landfill or incinerator by means of standard digestion and extraction tests (TCLP, WET, and SW846), as appropriate. Use the facility's EPA Generator I.D. number on the "Waste Manifest." See additional requirements specified below in Article titled "Manifesting."

6. If debris is to be recycled, provide a bill of lading and a memorandum from the recycler acknowledging that lead may be present and work activities and disposal will comply with applicable regulations. Submit in accordance with procedures of Section 01 33 00 - Submittals.

3.4 WASTE DISPOSAL AND MANIFESTING

A. Hazardous Waste Disposal:

1. Packing, labeling, transporting, and disposing of hazardous waste shall comply with Cal/EPA regulations under 22 CCR, including completion of the Uniform Hazardous Waste Manifest Form (DTSC 8022A and EPA 8700-22). Waste and glovebags shall be properly labeled prior to their removal from the contained or regulated area, including all required warning labels.

2. Waste dumpsters shall be placarded, sealed, and locked overnight. Waste containers shall be stored to prevent public access or disturbances.

3. A "Waste Manifest" shall be completed for disposal of hazardous waste. The transporter shall posses a valid EPA Transporter I.D. number. The Contractor shall notify the Owner's Project Manager a least forty-eight (48) hours prior to the time that the Manifest is required to be signed by the Owner.

4. Applicable information to be included in the "Waste Manifest" includes the following:

   a. EPA Generator I.D. Number: Verify with the Owner's Project Manager.

   b. Generator's Name and Address: Verify with the Owner's Project Manager.

   c. Generator Tax I.D. Number: Verify with the Owner's Project Manager.

3.5 FINAL PROJECT CLEAN-UP AND REOCCUPANCY TESTING CRITERIA

A. Lead:

1. Final Reoccupancy Cleaning:

   a. Final clean-up prior to Owner reoccupancy shall include wet wiping using a TSP solution and HEPA vacuuming all suspect dust and debris areas.

   b. Areas that do not comply with the "Final Reoccupancy Testing Criteria" shall continue to be cleaned by and at the Contractor's expense until the specified criteria is achieved, as evidenced by results of inspections as previously specified.

END OF SECTION 02 83 33

SECTION 02 84 33

REMOVAL AND DISPOSAL OF PCB AND MERCURY CONTAINING MATERIALS

TABLE OF CONTENTS

SECTION 02 84 33

REMOVAL AND DISPOSAL OF PCB AND MERCURY CONTAINING MATERIALS

PART 1 – GENERAL

1.1 SUMMARY

A. Section Includes: Minimum requirements for hazardous materials handling, control, and abatement activities, as applicable, including, but not necessarily limited to:

A.1 Hazardous materials controls.

A.2 Removal and disposal of existing ballasts containing PCBs.

A.3 Handling, disposal or recycling of mercury-containing lamps and thermostats.

B. Related Documents:

1. Section 02 26 00 –Existing Conditions – Hazardous Materials Conditions
2. Section 01 33 00 - Submittals.
3. Section 02 80 01 – Hazardous Materials Abatement Workplan
4. Section 02 82 33 – Removal and Disposal of Asbestos-Containing Materials.
5. Section 02 83 33 – Removal and Disposal of Material Containing Lead.

1.2 REFERENCES

A. American National Standards Institute (ANSI):

A.1 Z41.1: “Men’s Safety Toe Footwear.”

A.2 Z86.1: “Commodity Specification for Air.”

A.3 Z87.1: “Practice for Occupational and Educational Eye and Face Protection.”

A.4 Z88.2: “Practices for Respiratory Protection.”

A.5 Z89.1: “Requirements for Industrial Head Protection.”

A.6 Title 8 California Code of Regulations (8 CCR) Sections 3203 and 1509 - Injury and Illness Prevention Program.

1.3 DEFINITIONS

A. Hazardous Materials Control: Incidental work procedures for control of releases of project-related hazardous materials, including containment, enclosure, wetting, controlled renovations and demolition procedures, and removal and disposal.

B. Hazardous Waste:

1. Waste material, including mercury-containing items, PCB ballasts, PCB-containing items, and any other material which requires management, handling transport, treatment, storage or disposal according to the requirements of the Federal Resource, Conservation and Recovery Act (RCRA) and associated regulation 42 U.S.C. 6901 et seq. and 40 CFR Part 260 et seq.) or the California Hazardous Waste Control Law and associated regulations (Health and Safety Code 25000 et seq. and 22 CCR 66260 et seq.).

2. References to hazardous material or contaminated material incorporate definitions of hazardous pollutants, hazardous contaminants, hazardous material, hazardous substance, hazardous waste, toxic pollutants and toxic substance applicable in accordance with Federal, State, regional and local statutes, laws, regulations and policies.

1.4 SUBMITTALS

A. Written abatement work plan and schedule as part of the Contractor's Hazardous Materials Management Plan (HMMP) which includes:

1. Overall scope and schedule of all hazardous materials management.

2. Description of all hazardous materials work to be performed or managed, and intended control procedures.

3. Schedule of all hazardous materials work.

4. Description of personal protective equipment and methods as well as intended compliance monitoring.

5. Name, phone number, pager number of Contractor's designated Hazardous Materials Supervisor as required in this section's "Quality Control."

6. Name, address and phone number of the Contractor's landfill;

B. Emergency phone number and pager listing.

C. Copies of updated schedules and notices to regulatory agencies, as needed.

D. Receipt and weight tickets from landfill operator, recycler or incinerator, as applicable.

E. Copies of completed uniform waste manifests.

F. Waste profiling data.

G. Certification of Completion.

1.5 PROJECT CONDITIONS

A. Contractor shall pay all costs associated with the compliance with applicable hazardous materials regulations or requirements incurred by the Contractor or its subcontractors for this Project.

B. Take precautions necessary to protect the health and safety of construction workers, site visitors, the Owner personnel, outside consultants, the public and others from exposure to hazardous materials.

C. Take precautions necessary to insure all surrounding properties or adjacent occupied areas are protected from any contamination from all hazardous materials from this Project Site.

D. Review the information in the environmental and hazardous material investigation reports and make such information available to appropriate subcontractors and building occupants.

E. Contractor will obtain and pay for all sampling and profiling analyses required for waste disposal. California Environmental Laboratory Accreditation Program (ELAP)-accredited laboratories shall perform analyses. Contractor shall notify Owner and Environmental Consultant a minimum of 72 hours prior to waste profile sampling. Environmental Consultant will oversee waste profile sampling; however, contractor is responsible for all costs associated with profile sampling and characterization.

F. Minimize generation and migration of hazardous and contaminated materials, waste, dust, fumes and debris.

G. Prevent contamination or further contamination of any material or area by hazardous or contaminated material, waste, dust, fumes or debris.

H. Avoid mixing or concentrating removed, or demolished materials so as to increase the cost of disposing of such materials required to be disposed as hazardous or contaminated wastes.

I. Contractor shall retain, and the Owner will not indemnify against, any liability of Contractor resulting from the activities or duties which are the responsibility of Contractor under the terms of the Contract, including but not limited to present or future liability arising from the arrangement of transportation or disposal of any hazardous or contaminated material, whether on or off-site.

K. Contractors shall schedule and coordinate abatement activities to time limitations indicated in the Contract Documents

1.6 QUALIFICATIONS

A. Hazardous Materials Supervisor: Assign a qualified person directly responsible under the Contractor's Superintendent having the necessary training to be knowledgeable in the identification, control, and management of the hazardous materials on-site. The Hazardous Materials Supervisor is responsible for the following:

1. Enforcing safe work and hygiene practices in compliance with the Site-Specific Hazardous Materials Management Plan (HMMP).

2. Advising subcontractors of potential hazards and minimum general requirements of the HMMP.

3. Coordinating subcontractor's work regarding hazardous material procedures and controls.

4. Establishing and maintaining restricted work areas.

5. Requiring proper use of personal protective equipment.

6. Communicating approved modified safety requirements to site personnel.

7. Notification and coordinating signing of waste manifests with the Owner.

B. Hazardous Materials Handlers: Only qualified persons shall engage in hazardous material-related work. Contractor and subcontractor personnel who come into contact with, are exposed to, disturb, operate equipment or otherwise handle hazardous or contaminated material, or debris shall have appropriate hazard communication and required training, personal and medical monitoring, and shall be certified to wear appropriate personal protective equipment as required by the applicable laws and regulations. Special qualifications which may be required depending on the Contractor's means and methods include, but are not limited to, the following:

1. PCB Ballast-Related Work: Removal of non-leaking PCB ballasts may be completed by workers with PCB hazard awareness training as verified by the Contractor's Health and Safety Officer or Superintendent. Removal of leaking or damaged PCB ballasts from lighting fixtures shall be completed by a trained worker, wearing protective gloves and following safety procedures as outlined in the HMMP. Hazardous waste shall be handled according to the U. S. Environmental Protection Agency's Standards 40 CFR 761.60 and 761.65 (22 CCR Section 66699(b) in California).

2. Mercury Lamp/Thermostat-Related Work: Spent fluorescent and other mercury-containing lamps and thermostats shall be considered a hazardous waste by the California Department of Public Health (CDPH 22 CCR Section 66699(b)). Lamps and thermostats should be shipped to a commercial recycler. Removal of lamps and thermostats shall be completed by a trained worker who has successfully completed the 40-hour HAZWOPER worker training and mercury hazard communication training.

C. Hazardous Materials Haulers:

1. Possess during the hauling of hazardous material, applicable federal, state, and local vehicle insurance requirements, valid driver's license, vehicle registration and licenses, and a current Class 1 Certification of Compliance from the California Highway Patrol affixed to each vehicle or container

2. Possess a Hazardous Substance Removal Certification granted by the State of California Department of Toxic Substances Control (510-540-3802) and other required certifications and insurance.

3. Contractor shall be responsible for informing drivers of hauling vehicles about:

a) The nature of the material hauled.

b) Any recommended or required routes to and from the site.

c) Applicable city street use regulations and requirements, and State of California Department of Transportation (Caltrans) codes, regulations and requirements.

d) The Owner's requirements for proper handling and transportation of hazardous waste.

e) The legal maximum loads for each vehicle.

1.7 REGULATORY REQUIREMENTS

A. Hazardous and contaminated materials and hazardous waste shall be handled according to applicable laws and regulations in effect at the time of disturbance, transport or disposal of said hazardous materials or waste and requirements of the Contract Documents. In the event of conflict, the more stringent requirement shall apply.

B. The Owner is the generator, as defined in 22 CCR Section 66260.10 and 40 CFR Part 261, of any hazardous waste, and will be responsible for that hazardous waste to the extent required by law.

C. Contractor is alerted to and shall familiarize itself to the following laws and regulations regarding the generation, management, characterization and disposal of hazardous waste:

1. Resources Conservation and Recovery Act, 42 U.S.C. Section 6901 et seq. and regulations 40 CFR Part 260 et seq.

2. California Health and Safety Code, Division 20 and regulations, and 22 CCR Section 66000 et seq.

1.8 TIME LIMITATION AND DELAY CHARGES

A. Complete all hazard work specified in this Section in no more than the allotted calendar days or work shifts as outlined in the Abatement Work Plan or as otherwise specified in the Contract Documents.

1. In the event of failure to complete the Work of this Section within the specified time, the Contractor shall pay liquidated damages in the amount of one thousand dollar ($1,000.00) per calendar day for each day of delay in completion of work specified in the Contract Documents. The specified amount of liquidated damages represents the Owner's estimate of costs which include, but are not limited to, those of the Owner and the Owner's Consultants for observations and inspections, daily air monitoring, equipment, transportation, and analysis charges which would be incurred by the Owner after the number of calendar days specified for completion of the Work of this Section.

PART 2 – PRODUCTS

2.1 MATERIAL AND EQUIPMENT

A. Waste Containers:

1. Provide sealable metal drums, 55-gallon capacity, with sealable lids. Label the drums in accordance with EPA and DTSC requirements, including the Generator I.D. or location identification and manifest number. Drums shall be air and water tight.

2. PART 3 – EXECUTION

3.1 EXAMINATION

A. Review the hazardous material report(s) to familiarize oneself with hazardous material locations and conditions, and previous abatement by others, as applicable.

B. Review site conditions to verify quantities, work zones, available utilities, security, etc.

3.2 PREPARATION

A. Minimum Protective Procedures:

1. Protection of Visitors and Other Site Personnel: Cordon off the abatement area(s) with appropriate signs, and provide temporary tunneling or scaffolding, as applicable.

2. Provide site security to assure that no member of the public is able to gain access to the work area at any time. Maintain access and egress routes at all times.

3. Provide worker training, respiratory protection, etc. to meet applicable regulations.

4. Provide temporary lighting and power to work areas, including installation of ground fault interrupters.

5. Fully ground all equipment within the work zone and decontamination assemblies.

6. Provide workers with sufficient sets of protective full-body clothing to be worn in the designated work area and whenever a potential exposure to potential safety hazards exists. Such clothing shall include but not be limited to: full-body coveralls, headgear, eye protection, and gloves. Disposable-type protective clothing, headgear, and footwear may be provided.

    a. Full-Body Clothing: Assure that workers wear hoods covering their hair in the designated work areas at all times. Do not wear protective clothing in lieu of street clothing outside the work area. Leave non-disposable-type protective clothing and footwear in the wash room until the end of the abatement work. An acceptable alternative to disposal is proper storage in a sealed and labeled container so that containers would be opened and clothing reused only in the work area.

    b. Eye protection: Provide eye protection to be worm as required by applicable safety regulations. Wear eye protection at all times within the work areas during all phases of work: preparation, removal, clean-up, encapsulation, waste handling, and similar operations. When appropriate, based on regulatory mandates, a full facepiece respirator may be worn to satisfy this requirement. Equipment shall conform to ANSI Z87.1. Use of contact lenses with respiratory protection is prohibited.

    c. Head Protection: Provide hard hats or other head protection as required by applicable safety regulations, conforming to ANSI Z89.1, Class A or B.

    d. Foot Protection: Provide nonskid footwear to all abatement workers, conforming to ANSI Z41.1, Class 75.

3.3 PCB-CONTAINING ITEMS PROCEDURES

A. Identifying PCB fluids, ballasts, etc: All items not specifically labeled “non-PCB” or “PCB free” shall be considered PCB-containing.

B. Prohibited Activities Not Specified in this Section: Removal of ballasts from fixtures with hazard awareness training as indicated by the Contractor’s Hazardous Materials Supervisor.

C. Procedures for Removal of Non-Leaking Ballasts, reservoirs, etc.: Non-leaking items including ballasts shall be removed from their fixtures and packed in kitty litter-lined steel drums for

hazardous waste disposal. Workers removing ballasts may require protective gloves as a precaution against unforeseen leaks or damage.

D. Procedure for Handling Leaking PCB-containing items:

1. Workers removing items shall wear protective clothing and nitrile or neoprene gloves.

2. Leaking items pose a health and safety hazard and shall therefore be removed by trained workers only (Cal/OSHA 40-hour Hazwoper training is recommended).

3. Wipe down the fixture or equipment showing signs of overheated or leaking with paper towels after the unit has been cooled to room temperature.

4. Follow with additional wiping with an organic solvent, e.g., mineral spirits or isopropyl alcohol.

5. Place leaking items and rags into a plastic bag, which is tied-off and secured.

6. Pack the ballasts in steel drums for hazardous waste disposal.

E. Procedure for Disposal of PCB-containing fluids and items:

1. Pack PCB items and bagged leaking items and rags into a steel drum, sealed, labeled, and transported to an approved incinerator following required manifest procedures as specified in this Section.

2. Absorbent material, such as kitty litter, shall be used as a cushion and absorbent within the drums.

3. Do not exceed the incinerator's drum loading requirements, typically 350 to 500 lbs. per drum.

4. Transport hazardous waste for disposal per the requirements under 22 CCR Section 66268.110.

5. Dispose as a hazardous waste per EPA Regulation 40 CFR 761.00 and 761.65 and Cal/EPA Regulation 22 CCR Section 66508.

3.4 MERCURY-CONTAINING LAMP REMOVAL PROCEDURES

A. Handling and Disposal of Lamps:

1. Spent fluorescent and other mercury-containing lamps shall be considered a hazardous waste by the California Department of Public Health (CDPH; 22 CCR Section 66699(b)).

2. Ship lamps to a commercial recycler where they are to be crushed and the mercury reclaimed.

3. Comply with DOT requirements for manifests, with evidence of proper disposal provided to the Owner, including a log of shipping dates and quantities.

4. Load into secured cardboard boxes for shipment to prevent unnecessary breakage.

5. In the event of lamp breakage, clean-up broken glass and debris immediately, using a HEPA-filtered vacuum for final clean-up.

3.5 WASTE DISPOSAL AND MANIFESTING

A. Hazardous Waste Disposal:

1. Packing, labeling, transporting, and disposing of hazardous waste shall comply with Cal/EPA regulations under 22 CCR, including completion of the Uniform Hazardous Waste Manifest Form (DTSC 8022A and EPA 8700-22). Waste shall be properly labeled prior to their removal from the contained or regulated area, including all required warning labels.

2. Waste containers shall be placarded, sealed, and locked overnight. Waste containers shall be stored to prevent public access or disturbances.

3. A "Waste Manifest" shall be completed for disposal of hazardous waste. The transporter shall posses a valid EPA Transporter I.D. number. The Contractor shall notify the Owner a least 48 hours prior to the time that the Manifest is required to be signed.

4. Applicable information to be included in the "Waste Manifest" includes the following:

   a. EPA Generator I.D. Number: Verify with the Owner.

   b. Generator's Name and Address: Verify with the Owner.

   c. Generator Tax I.D. Number: Verify with the Owner.

END OF SECTION 02 84 33

SECTION 03 01 00
CONCRETE SPALL REPAIR AND CRACK INJECTION

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: Provide all labor, materials, formwork, equipment and services to complete removal of damaged concrete and repair/patching of concrete to be reconstructed.

1.02 REFERENCES

A. California Code of Regulations, Title 24, latest adopted edition (herein noted as CBC): Chapter 19 Concrete.

B. American Concrete Institute (ACI) 224.1 “Cause, Evaluation, and Repair of Cracks in Concrete Structures”.

C. ACI RAP Bulletin 1 “Field Guide to Concrete Repair Application Procedures – Structural Crack Repair by Epoxy Injection”.

1.03 SUBMITTALS

A. Submit in accordance with pertinent sections of Division 01 specifying submittal procedures. The General Contractor shall review and approve submittals prior to submittal to the Architect/Engineer. Submittals that do not meet these requirements will be returned for correction without review. Submit for review prior to installation.

B. Limitation of Review: Structural Engineer's review will be for general conformance with design intent as indicated in the Contract Documents and does not relieve Contractor of full responsibility for conformance with the Contract Documents.

C. Product Data: Submit manufacturers' data on manufactured products and other concrete related materials. Demonstrate compliance with specified characteristics. Provide samples of items upon request.

D. Manufacturer's Installation Instructions: Indicate installation procedures and interface required with adjacent construction for concrete accessories.

1.04 QUALITY ASSURANCE

A. Perform work of this section in accordance with ACI RAP Bulletin 1.

B. Perform tests specified below in article FIELD QUALITY CONTROL.

C. Contractor shall bear the entire cost of remediation, removal, and/or replacement of concrete repairs determined defective or non-conforming, including Architect/Engineer fees for redesign.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Materials specified by brand name shall be delivered in undamaged packages bearing manufacturer's label and shall be brand specified or a previously submitted and approved equal.

B. Delivery, handling and storage of other materials shall conform to the applicable sections of the current editions of the various reference standards listed in this Section.

C. Protect materials from weather, temperature variations, or other damage. Sort to prevent inclusion of foreign materials.

1.06 MOCK-UP

A. Perform spall repair and/or crack injection on an inconspicuous location for review prior to commencing work

B. Provide 2 inch diameter concrete core at injected location to ensure adequate penetration and bond of epoxy. Notify Engineer for location of core. Patch core with repair mortar.

C. If determined to be acceptable mock-up may remain as part of the Work.

1.07 SCHEDULING AND SEQUENCING

A. Perform Work in existing facilities during such hours and by methods as are approved by Owner. Owner reserves the right to modify proposed schedules to eliminate conflicts and ensure use of existing facilities during the Work. Follow exactly the schedule as finally approved by Owner.

B. Organize the work and employ shop and field crew(s) of sufficient size to minimize impact on the Owner/Tenant.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Concrete Bonding Agent: Sika “Sikadur 32 Hi-Mod”, Simpson Strong-Tie “FX-752”.

B. Steel Corrosion Inhibitor: Sika “Armatec 110 EpoCem”, Simpson Strong-Tie “FX-406”.

C. Crack Injection:

1. Epoxy Surface Seal Compound: When required furnish Sika “Sikadur 31 High Mod Gel”, Simpson Strong-Tie “CIP-F” paste-over. The surface seal material shall have adequate strength to hold injection fittings firmly in place and to resist injection pressures adequately to prevent leakage during injection.

2. Injection ports: per epoxy manufacturer’s recommendations.

3. Pressure Injected Epoxy:

   a. For installations above 60 degrees Fahrenheit: Sika “Sikadur 35 Hi-Mod LV” adhesive, Simpson Strong-Tie “CI-LV”. The epoxy resin adhesive shall conform to ASTM C881, Type I and IV, Grade 1, Class C, with a minimum 14-day bond strength per ASTM C882 of 2,750 psi.
   b. For cold weather installations (40 to 60 degrees Fahrenheit): Sika “Sikadur 35 Hi-Mod LV” adhesive, Simpson Strong-Tie “CI-LV FS”. The epoxy resin adhesive shall conform to ASTM C881, Type I and IV, Grade 1, Class B, with a minimum 14-day bond strength per ASTM C882 of 2,750 psi.

D. Spall Repairs:

1. Horizontal or formed surfaces: Sika “Sikacrete 211 SCC”, Simpson Strong-Tie “FX-Rapid Setting Mortar”.

2. Vertical or overhead surfaces: Sika “SikaQuick VOH”, Simpson Strong-Tie “FX-263”.

PART 3 - EXECUTION

3.1 GENERAL CONCRETE WORK

A. Work must be performed by a contractor having not less than 5 years successful experience with comparable concrete repair projects employing personnel skilled in the restoration process and operations indicated

B. Protect finished surfaces not to be repaired from work to be done in this section.

C. Provide formwork, shoring, and bracing as required to complete work.

3.2 CRACK INJECTION WITH EPOXY

A. Equipment for Injection: Provide the type of equipment necessary to meter and mix the two injection adhesive components and inject the mixed adhesive into the crack. Follow manufacturer’s recommendations.

B. Surface Preparation: The cracks and surface adjacent to cracks or other areas of application shall be cleaned of dirt, dust, grease, oil, efflorescence or other foreign matter detrimental to bond of epoxy injection surface seal system. Use wire

brushing, sandblasting, high pressure water blasting, etc per manufacturer's instructions. Acid and other corrosives shall not be permitted. Repair area must be dry prior to product application. Manufacturer's recommended minimum application and minimum/maximum curing temperature for substrate shall be verified.

C. Epoxy Application or Injection: In accordance with accepted procedures overseen by an experienced contractor, inject or apply epoxy compounds in strict accordance with the manufacturer's specifications and recommendations for each intended type of use. Entry ports shall be provided along the crack at intervals no greater than the thickness of the concrete (8 inch maximum spacing). Do not proceed until injected or pasted over material has gained adequate strength to continue with injection process. Perform epoxy adhesive injection continuously until all pressure-injected cracks are completely filled. The epoxy injection process should not, under any circumstances, result in any damage to the steel in the concrete.

D. Finishing and Cleaning: Excess materials, gel sealants and pastes, and plastic ports shall be removed after epoxy resin has cured. Exposed surfaces to be restored to original condition.

3.3 SPALL REPAIR OF CONCRETE

A. Remove loose/damaged concrete, sawcut straight edges with a minimum of 1/4" depth, chip and/or sand blast to assure competent concrete surfaces, expose clean aggregate surface to 1/4" minimum amplitude (ICRI CSP 9 or higher), and clean/remove rust from existing reinforcing. Remove concrete to minimum ¾ inch clear all around exposed reinforcing bars.

B. Notify Engineer for review of cleaned reinforcing.

C. If existing reinforcing steel is deemed acceptable by Engineer, coat prepared reinforcing steel with corrosion inhibitor per manufacturer's requirements. Coat prepared concrete surfaces with bonding agent per manufacturer's requirements.

D. Set formwork as required.

E. Mix and place grout per manufacturer's recommendations. Surfaces to be saturated surface dry (SSD) with no standing water unless noted otherwise. Scrub mortar into substrate, filling all pores and voids. Force grout against edge of repair, working toward the center.

F. Finishes: All finishes to match original finishes. Float, hand trowel, and edge (as for slab on grade). Remove formed edges if used (when grout has achieved sufficient set), float and hand trowel. Provide light broom, hand trowel, or other finish as required to match existing surfaces.

G. Apply curing compound or cover with water retaining materials and keep wet for 4 days minimum. Use of curing compound is limited to locations and/or conditions for which discoloration due to cure is acceptable and locations where other finishes will not be affected.

3.4 FIELD QUALITY CONTROL

A. A 2 inch diameter concrete core shall be taken for every 50 feet of injected crack (minimum 2 cores total) to verify adequate penetration and bond. Notify Engineer for location of cores. Patch core holes with repair mortar.

3.5 CLEANING

A. Remove all debris created by the work of this section.

END OF SECTION

SECTION 03 54 19

CONCRETE FLOOR UNDERLAYMENT

PART 1 - GENERAL

1.01 DESCRIPTION

A. This Section describes the requirements for furnishing and installing the following where required to prepare existing surfaces to receive new applied floor coverings:

1. Concrete floor underlayment.

2. Self-leveling concrete floor underlayment.

1.02 SUBMITTALS

A. Product Data: Manufacturer’s data sheets on each product to be used, including:

1. Preparation instructions and recommendations.

2. Storage and handling requirements and recommendations.

3. Installation instructions for each product.

1.03 QUALITY ASSURANCE

A. Manufacturer: Regularly providing underlayment materials of types specified or approved for not less than 5-years.

B. Installer: Approved by underlayment manufacturer using approved equipment.

1.04 ENVIRONMENTAL REQUIREMENTS

A. Maintain a temperature above 50-degrees F. until subfloor surface has stabilized.

B. Provide continuous heat and mechanical ventilation until floor underlayment is dry.

C. Follow manufacturer's additional requirements.

PART 2 - PRODUCTS

2.01 APPROVED MANUFACTURERS

A. Concrete Underlayment: Ardex, Inc. "Ardex SD-P Instantpatch", Bonsal B-1 Leveler" or approved equal.

B. Self-Leveling Concrete Underlayment: Ardex, Inc. "Ardex K-15 Self-Leveling Underlayment Concrete", Bonsal "Self-Leveling Underlayment", Dayton Superior “LeveLayer l”, Gyp-Crete "Level-Right", Quickcrete "Self-Leveling Floor Resurfacer" or approved equal.

2.02 MATERIALS

A. Primer: As recommended by underlayment manufacturer.

B. Concrete Underlayment: Underlayment shall have a minimum compressive strength of 4,200-psi at 28-days. Underlayment shall be able to be installed from featheredge to 1-inch and up to 3-inches with aggregate. Minimum thickness shall be 1/8-inch.

C. Self-Leveling Underlayment: Underlayment shall have a minimum compressive strength of 4,000-psi at 28-days. Self-leveling underlayment shall be able to be installed from featheredge to any thickness in one pour.

D. Aggregate: Well-graded, washed gravel for use when underlayment is installed over 1-1/2-inch thick; size of aggregate as recommended by manufacturer.

E. Water: Clean and potable.

PART 3 - EXECUTION

3.01 PREPARATION

A. Surfaces to receive underlayment shall be solid, clean and properly primed.

B. Concrete subfloors shall be clean and free of oil, grease, dirt, curing compounds, and other items that may act as bond breakers. Mechanically clean if required using shot-blasting; acid etching is not acceptable.

C. Where required, grind high spots in concrete subfloors as recommended by manufacturer.

D. Non-porous surfaces such as tile shall be clean and free of wax and sealers.

E. Repair cracks in the subfloor to prevent telegraphing through the underlayment.

3.02 INSTALLATION

A. Prime subfloor in accordance with manufacturer's recommendations. Do not leave any bare spots and remove puddles and excess primer. Do not apply underlayment until primer is dry.

B. Mixing Ratios: In accordance with manufacturer's instructions.

C. Place underlayment using a wood or magnesium float. When underlayment begins to harden, finish with a steel trowel.

D. Pour or pump self-leveling liquid underlayment and spread in place. Comply with manufacturer's instructions.

E. Prohibit foot traffic until underlayment is dry.

3.03 COMPLETION

A. When complete, underlayment shall be finished to a reasonably smooth and uniform condition, and be free from pin holes, gouges, cuts, and other damage or defects.

B. Transition between finish surfaces of underlayment and adjacent existing flooring shall be free from offsets.

END OF SECTION

05 12 00
STRUCTURAL STEEL FRAMING

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes: All labor, materials, equipment and operations required to complete structural and miscellaneous metals in shapes and configurations indicated; including:

1. Structural steel columns, beams, bracing, base plates, bolts, joist hangers, and stud bolts welded to structural steel.

2. Miscellaneous structural steel and connections; fabricated connectors and hangers installed by related sections.

3. Anchor bolts and steel inserts embedded in concrete or masonry, installed by related sections.

4. Fabricated steel items embedded in concrete or masonry installed by related sections.

5. Supervision of anchor bolt setting, leveling and elevations to ensure required fit of steel work.

6. Shop priming and field touch-up, galvanizing.

7. Bracing, Shoring, Fabrication and Erection.

B. Related Sections:

1. Pertinent sections of Division 01 specifying Quality Control and Testing Agency services.

2. Pertinent Sections of other Divisions specifying concrete reinforcement, formwork, concrete, structural and miscellaneous metal fabrications, steel joists, metal decking, cold-formed metal framing, rough carpentry.

1.02 REFERENCES

A. California Code of Regulations, Title 24, latest adopted edition (herein noted as CBC): Chapter 22 Steel.

B. American Institute of Steel Construction (AISC) 303 “Code of Standard Practice for Steel Buildings and Bridges”.

C. AISC 341 “Seismic Provisions for Structural Steel Buildings”.

D. AISC 358 “Prequalified Connection for Special and Intermediate Steel Moment Frames for Seismic Applications”.

E. AISC 360 “Specification for Structural Steel Buildings”.

F. American Welding Society (AWS) D1.1 “Structural Welding Code - Steel”.

G. AWS D1.8 “Structural Welding Code - Seismic Supplement”.

H. Research Council on Structural Connections (RCSC) “Specification for Structural Joints Using High-Strength Bolts”.

I. Underwriters Laboratories (UL) FRD “Fire Resistance Directory”.

1.03 SUBMITTALS

A. Submit in accordance with pertinent sections of Division 01 specifying submittal procedures. The General Contractor shall review and approve shop drawings prior to submittal to the Architect/Engineer. Submittals that do not meet these requirements will be returned for correction without review.

B. Limitation of Review: Structural Engineer's review will be for general conformance with design intent as indicated in the Contract Documents and does not relieve Contractor of full responsibility for conformance with the Contract Documents.

C. Product Data: Submit manufacturer's product data, specifications, location and installation instructions for proprietary materials and reinforcement accessories. Provide samples of these items upon request.

D. Shop drawings: Submit each building as a complete unit. Do not mix components from units of work in a submittal. Include all of the following;

1. Profiles, sizes, spacing, locations of structural members, openings, attachments, and fasteners.

2. Fabrication tolerances for all steel.

3. Connections: All, including type and location of shop and field connections.

4. Indicate welded connections with AWS A2.4 welding symbols. Indicate net weld lengths, type, size, and sequence. Designate demand critical welds.

5. Designation of Seismic Force Resisting System (SFRS) members and connections. Locate and dimension protected zones. Braced frame gusset plates shall be drawn to scale.

6. Cross-reference all shop drawing detail references to contract document detail references.

7. Secure all field measurements as necessary to complete this work prior to submitting shop drawings for review.

8. Provide holes, welded studs, etc. as necessary to secure work of other sections.

9. Provide the following as separate submittals for each building or unit of work:
   a. Bolt and anchor setting plans.
   b. Layout, fabrication and erection drawings.

E. Certifications:

1. Steel Materials: Submit the following for identified materials.
   a. Manufacturer's Mill Certificate: Certify that products meet or exceed specified requirements.
   b. Mill Test Reports: Indicate structural strength, destructive test analysis, and non-destructive test analysis.
   c. Contractor's affidavit certifying that all identified steel materials provided are of the grades specified and match the certificates supplied.

2. High-Strength Bolting: Certify all materials provided are the grades specified.

3. Welders Certificates: Certify welders employed on the Work, verifying AWS qualification per AWS D1.1.

F. Samples: Provide samples to the Testing Agency as specified in Article SOURCE QUALITY CONTROL, at no additional costs.

1.04 QUALITY ASSURANCE

A. Requirements of Regulatory Agencies, refer to pertinent sections of Division 01 and CBC Chapter 17.

B. All tests shall be performed by a recognized testing agency as specified in pertinent sections of Division 01.

C. Certification and Identification of Materials and Uses: Provide Testing Agency with access to fabrication plant to facilitate inspection of steel. Provide notification of commencement and duration of shop fabrication in sufficient time to allow inspection and all material identification/test information listed below.

1. Test all steel as required by ASTM A6.

2. Provide manufacturer's Mill Test Reports for all materials. Include chemical and physical properties of the material for each heat number manufactured. Tag all fabricated materials with heat number.

3. Provide letter certifying all materials supplied are from heat numbers covered by supplied mill certificates. Include in letter the physical location of each material type and/or heat number in the project (i.e. walls, braced frames etc.).

4. Unidentified Material Tests: Where identification of materials by heat number or mill tests cannot be made, Owner's Testing Agency shall test unidentified materials.

5. Provide all certification, verifications, and other test data required to substantiate specified material properties at no additional cost to the Owner.

D. Testing and Inspection: Tests and Inspections performed by Independent Testing Agency are specified below in Articles SOURCE QUALITY CONTROL and FIELD QUALITY CONTROL. Duties and limitations of Independent Testing Agency, test costs and test reports in conformance with pertinent sections of Division 01.

E. The following standards are the minimum level of quality required. Provide higher quality work as specifically indicated in the Contract Documents.

1. Workmanship and details of structural steel work shall conform to the CBC and AISC 360.

2. The quality of materials and the fabrication of all welded connections shall conform to AWS D1.1 and D1.8.

3. Comply with Section 10 of AISC 303 for architecturally exposed structural steel.

F. The Testing Agency will review all submittals and testing of materials.

G. All re-inspections made necessary by non-conforming work shall be at the Contractor's expense.

1.05 DELIVERY, STORAGE AND HANDLING

A. Deliver materials to project site in bundles marked with durable tags indicating heat number, mill, member size and length, proposed location in the structure and other information corresponding with markings shown on placement diagrams.

B. Handle and store materials above ground to prevent damage, contamination or accumulation of dirt or rust.

1.06 SCHEDULING AND SEQUENCING

A. Organize the work and employ shop and field crew(s) of sufficient size to minimize inspections by the Testing Agency.

B. Provide schedule and sequence information to Testing Agency in writing upon request. Update information as work progresses.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Structural Steel W Shapes: ASTM A992 Gr. 50 or ASTM A572 Gr. 50.

B. Structural Steel Plates: ASTM A36 or ASTM A572 Gr. 50 or ASTM A529 Gr. 50

C. HSS (Hollow Structural Sections):

1. Rectangular or Square: ASTM A500, Gr. C.

D. Pipe: ASTM A53, Grade B.

E. Bolts and Washers: See FINISHES section for galvanization, where required.

1. High Strength Bolts, Nuts, and Washers: Bearing and shear connections (denoted as “HSB”); ASTM F3125 Grade A325 or A490 with ASTM A563 Grade C nuts (Grade DH at A490) and ASTM F436 Type 1 washers.
   a. HSB-N: For use in snug tight (ST), pretensioned (PT), and slip critical (SC) joints. Conform to the RCSC Specifications.
   b. HSB-X: For use where specified on the drawings.
   c. Use of ASTM F3125 Grade F1852 (twist off assemblies) is permitted conforming to requirements of RCSC Specifications.
   d. Use of ASTM F959 Load Indicator Washers is permitted conforming to the requirements of RCSC Specifications.
   e. Slip critical (SC) bolt faying surfaces shall be prepared per RCSC as Class A, unless noted to be Class B per the drawings. Galvanized surfaces at SC bolts shall be hand wire brushed.

F. Arc-Welding Electrodes: AWS Standards E70 or equivalent, except no E70T-4 allowed. Additionally, welding electrodes to be used in the welding of seismic force resisting system to conform to AISC 341 and AWS D1.8.

G. Other Welding Materials: AWS D1.1; type required for materials being welded.

H. Metal Grating: GW-150 by McNichols Co. Material to be carbon steel. Finish to be galvanized. Height = 1 ½”, surface to be serrated. Bearing bar centers = 1 3/16”, cross bar centers = 4”. Fasten each grating panel to steel framing w/ saddle clip each corner (4 clips minimum per panel). Max span = 4’-6” for 60 psf load rating.

2.02 ACCESSORIES

A. High Strength Grout: ASTM C1107, non-shrink, premixed compound consisting of aggregate, cement, and water reducing plasticizing agents.

1. Minimum Compressive Strength at 3 days: 3000 psi.

2. Minimum Compressive Strength at 28 days: 7000 psi, placed in a “fluid” state.

3. Provide only non-metallic grout at exposed work.

4. Meet or exceed properties of BASF "Master Flow 928" mixed to fluid consistency. Other acceptable manufacturers: The Burke Company and W.R. Meadows, Inc.

B. Building Structural Steel Primers: Comply with local VOC limitations of authorities having jurisdiction and the California Green Building Code. Verify compatibility with finish coats specified in other sections. Follow manufacturers printed instructions. Apply one coat unless otherwise directed.

1. Type A: Self-Crosslinking Hydrophobic Acrylic passing 2000 hours ASTM D4585 and 7000 hours ASTM D5894. “Series 115 Uni-Bond DF” by Tnemec (2.0 to 4.0 mils DFT).

2. Type B: Organic Zinc-Rich Urethane passing 50,000 hours ASTM B117 and 15000 hours ASTM G85. “Series 90-97 Tneme-Zinc” by Tnemec (2.5 to 3.5 mils DFT) or “Series 94-H20 Hydro-Zinc” by Tnemec (2.5 to 3.5 mils DFT).

3. Type C: MIO-Zinc Filled Urethane passing 10,000 hours ASTM B117 and 5000 hours ASTM D4585. “Series 394 PerimePrime” by Tnemec (2.5 to 3.5 mils DFT).

C. Galvanizing: ASTM A153 and A123.

D. Touch-Up Primer for Galvanized Surfaces: Type B primer.

2.03 FABRICATION

A. Shop fabricate to greatest extent possible.

B. Continuously seal built up members by continuous welds where exposed to weather.

C. Fabricate connections for bolt, nut, and washer connectors.

D. Protect all materials, before and after fabrication, from rust, corrosion, dirt, grease, and other foreign matter.

E. Fabricate framing members free from twists or bends. Form holes, cut and sheared edges neatly without kinks, burrs, or warped edges.

F. Exposed Steel: Straight, smooth, free of nicks, scars or dents.

G. Gas Cutting: Gas cutting of holes in a member shall not be permitted.

H. Splicing of members: Members requiring splicing due to length requirements may be spliced using full penetration butt welds when such welds and procedures are inspected and certified by the Testing Agency, in conformance with AWS and AISC standards. The location of splices shall be approved by the Architect/Engineer in writing prior to fabrication.

I. Welding: Welding of structural steel connections shall be performed by qualified

welders in accordance with AWS Standards. All weld sizes shall match those shown on the drawings.

1. Preparation: Clean all surfaces free of rust, paint and all foreign matter. Remove paint or scale by brushing, chipping or hammering as required. Chip clean and wire brush burned or flame cut edges before welding. Space and alternate welds, clamping as necessary to prevent warp or misalignment.

2. Sequence Welding: When welds enclose, or partially enclose, the perimeter or portion of the surface of a member, make weld bead in sequence, or staggered. Minimize internal stresses. Weld groups of members occurring in a single line in staggered sequence to minimize distortion of the structural frame.

3. Faulty and Defective Welding: Welds failing to meet AWS standards and the Contract Documents shall be rejected and remade at Contractor expense. All welds showing cracks, slag inclusion, lack of fusion, bad undercut or other defects, ascertained by visual or other means of inspection shall be removed and replaced with conforming work.

4. Minimum Weld Strengths: All welds shall match the minimum weld sizes recommended by AISC. Details of fabrication not specifically shown shall match similar details which are specifically shown. All bevel and groove welds shall be full penetration unless size is noted otherwise.

5. Threaded studs, headed studs, and deformed bar anchors shall be full-fusion welded conforming to ASW D1.1.

J. Camber: Fabricate all beams cambered as indicated on the drawings.

1. Fabricate beams without camber for installation with any "natural" crown up.

2. Exception: Fabricate cantilever beams with "crown" down.

K. Grinding: Grind smooth the following structural steel and connections;

1. Exposed cut ends of structural and fabricated shapes.

2. All welds exposed to view.

3. Mitered and fit-up corners and intersections.

L. Back-Up Bars: Required for all complete penetration welds. See requirements of AISC 358.

M. Bolt Holes: Edge, end distances and spacing shall conform to dimensions shown on the drawings, and as follows;

1. Round: Size indicated and 1/16 inch maximum oversize, except 1 inch and larger bolts may have 1/8 inch maximum oversize.

2. Slotted: At locations specifically noted on the drawings, provide size indicated and 1/16 inch by 1/4 inch oversize slotted in direction perpendicular to applied loads.

3. Holes in base plates for anchor bolts may be 1/8 inch oversize.

N. Comply with Section 10 of AISC 303 for architecturally exposed structural steel (AESS). See architectural & structural drawings for locations of AESS.

2.04 FINISHES

A. Steel exposed to inclement atmospheric conditions or weather (such as coastal moisture or seasonal rain) shall be sufficiently primed or otherwise protected against corrosion. If condition of steel is suspect due to weathering/corrosion, Contractor shall bear cost of inspection to determine if excessive corrosion is present and if steel member(s) requires repair or replacement. Contractor shall bear cost of repair or replacement.

B. Prepare and finish structural and miscellaneous steel component surfaces as follows, unless a higher standard-of-care is determined necessary per item A:

1. Unpainted, interior, dry exposure surfaces need not be primed.

2. Finish painted surfaces with exterior exposure, interior exposure subject to wet conditions or fumes, or surfaces to receive high performance finish coatings (for example epoxy or urethane coatings.
   a. Surface Preparation: SSPC-SP6 / NACE No. 3 Commercial Blast-Cleaning to create a dense, uniform angular surface profile of 2.0 mils minimum. For severe (immersion) exposure, SSPC-SP10 / NACE No. 2 Near-White Blast-Cleaning is required.
   b. Apply Primer Type B. Field touchup with same primer.

3. Surfaces to be fire proofed need not be primed unless required by the fireproofing manufacturer or if jobsite exposure is expected to be inclement per item A. Where unprimed steel is to receive fireproofing, prepare steel surface as required by fireproofing manufacturer. If fireproofed surfaces are to be primed, provide primer as follows:
   a. Surface Preparation: SSPC-SP3 Power-Tool Cleaning.
   b. Apply Primer Type C. Field touchup with same primer.

4. Exterior exposed (unpainted) surfaces and as otherwise indicated to receive galvanizing:
   a. Galvanize per ASTM A123 Class 55 minimum. Passivation agents are not permitted on galvanized metal that is to be painted. Provide vent holes per ASTM A385 at closed sections (such as HSS). Submit proposed location of vent holes for review by Engineer.
   b. Connection hardware shall be hot-dip galvanized per ASTM A153 or F2329. Grade A325 high-strength bolt assemblies may be mechanically galvanized per ASTM B695 class 55 or hot-dip galvanized per ASTM F2329. Mating bolts and nuts shall receive the same zinc-coating process.

c. Repair all uncoated, damaged, or altered galvanized surfaces per ASTM A780.

C. Do not prime the following surfaces unless otherwise indicated:

1. Connections to be field welded.

2. Steel in contact with concrete.

3. Surfaces to receive welded metal decking.

D. Slip critical bolted connection surfaces shall either be unfinished & prepared per the RCSC or primed per item B3 or B4.

E. Do not cover up work with finish materials until inspection is complete and work is approved by the Testing Agency.

2.05 SOURCE QUALITY CONTROL

A. An independent Testing Agency will perform source quality control tests and submit reports, as specified in pertinent sections of Division 01.

B. Steel Materials Testing:

1. No testing is required for materials identified in accordance with CBC Section 2202.1 (heat number, grade stencil, etc.).

2. Unidentified steel- General: Test all structural shapes. In addition, test to verify Fy and Fu values when engineering requirements exceed Fy = 25 ksi for design.

3. Charpy V-Notch (CVN) testing requirements are per AISC 341. Heavy sections requiring CVN testing are indicated on the documents.

C. Shop Welding Inspection:

1. Testing Agency shall inspect and certify all structural welds unless the fabricating shop has been accredited in conformance with CBC requirements. Submit certification to the Architect/Engineer for review and the Building Official for approval.

2. Welder Qualifications: Welding inspector shall verify that all the welders are properly qualified prior to steel fabrication and state the qualifications of each welder in the welding inspection report.

3. Welding Inspection: Continuous inspection required unless otherwise noted below. Comply with requirements of AWS D1.1, AWS D1.8 and AISC 341.
   a. Welding Inspector shall check all welds, materials, equipment and procedures.
   b. Welding Inspector shall provide reports certifying the welding is as required and has been done in conformity with the plans, specifications and codes.

c. Welding Inspector shall use radiographic, ultrasonic, magnetic particle, or any other necessary aid to visual inspection to assure adequacy of welds.

4. Periodic Inspection Acceptable:
   a. Single pass fillet welds not exceeding 5/16 inch.
   b. Welding of studs to beams.

D. Bolts, Nuts and Washers: Provide samples to Testing Agency for required testing, at no additional cost.

E. High Strength Bolted Connections: Provide testing and verification of shop-bolted connections in accordance with RCSC specifications. Test all bolts at each connection.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that conditions are appropriate for erection of structural steel and that the work may properly proceed.

3.02 ERECTION

A. Erect structural steel in compliance with AISC 303.

B. Framing:

1. Erect all structural steel true and plumb.

2. Verify proper final alignment prior to making final connections.

C. Field Connections:

1. Workmanship of field bolted and welded connections shall conform in all respects to methods and tolerances specified for fabrication.

2. Field weld components indicated on shop drawings. Sequence field welds to minimize built-up stress and distortion of the structural frame. Verify sequence with Engineer. Coordinate field welding schedule with Testing Laboratory.

3. Welded Studs: Install in accordance with manufacturer's instructions and structural welding code AWS D1.1 and AWS D1.8.

D. Templates: Provide bolt setting templates for all anchor bolts. Provide instructions for the setting of anchors and bearing plates, verify these items are set correctly as work progresses.

E. Bolting - General:

1. Inspect mating surfaces to ensure that bolt head and nut will have full bearing and that metal plies will mate flush between bolts.

2. Install bolts in matching holes. Do not distort metal or enlarge holes by drifting during assembly. Remake mismatched components to achieve tolerances indicated.

3. Holes mismatched in excess of 1/8 inch will be rejected.

4. Holes mismatched less than 1/8 inch may be reamed to the next larger size bolt.

5. Do not enlarge holes by flame cutting or air/arc ("plasma") cutting.

6. Provide flat washer(s) at over-size holes.

7. Provide washers for all conditions per RCSC Section 6 and under nuts to connected parts less than ¼ inch thick.

8. Provide ASTM F436 beveled washers when the slope of the surfaces of parts in contact with the bolt head or nut is greater than 1:20.

9. Do not install bolts with damaged threads.

10. Threads shall commence outside of the shear plane where noted as HSB-X on drawings.

F. Bolting - Specific:

1. Machine Bolts (MB): Install and tighten to a snug condition (ST) such that laminated surfaces bear fully on one another, using an impact wrench or "full effort" of an installer using a standard spud wrench.

2. High Strength Bolts in Bearing/Shear or Static Tension joints snug tight (ST):
   a. Provide a hardened washer at the head/nut at slotted holes
   b. Install and tighten as per Machine Bolts (MB) snug tight (ST) and other requirements of RCSC specification Section 8.
   c. Use ASTM F436 washer only in snug tight connections with static tension loads.

3. High Strength Bolts in Pretensioned joints (PT):
   a. Provide ASTM F436 washer per requirements of RCSC Section 6.
   b. Install and tighten in accordance with the requirements of RCSC Section 8.
   c. Install bolts in all holes of the joint and compact the joint until the connected plies are in firm contact prior to pretensioning.
   d. The following tightening methods and bolt type are acceptable for PT joints:
      (a) Turn-of-the-nut pretensioning method
      (b) Calibrated wrench pretensioning method
      (c) Twist-off-type tension-control bolts
      (d) Direct-tension-indicator washer pretensioning method.

4. High Strength Bolts in Slip Critical (SC) joints:
   a. Provide tensioning for High Strength Bolts (PT) per above.
   b. Faying surfaces to be prepared per RCSC Section 3 and PART 2.

G. Supports, Shoring and Bracing: Allow for erection loads and provide sufficient temporary bracing to maintain structure in safe condition, plumb, and in true alignment until completion of erection and installation of permanent bracing. Conform to requirements of all applicable laws and governing safety regulations. Resist imposed loads, including those of stored materials and equipment.

1. Provide all temporary supports, shoring and bracing necessary to achieve work of tolerances indicated.

2. Provide all necessary temporary flooring, planking and scaffolding required for erection of steel, and support of erection machinery.

3. Construction Loading: Do not overload the structure or temporary supports with stored materials, equipment or other loads.

4. Maintain temporary bracing and shoring until work is complete, and longer as required to ensure stability and safety of structure.

H. Do not make final connections until structure is aligned to meet specified tolerances.

3.03 ERECTION TOLERANCES

A. Maximum Variation From Plumb: 1/4 inch per story, non-cumulative.

B. Maximum Offset From True Alignment: 1/4 inch.

3.04 FIELD QUALITY CONTROL

A. The independent Testing Agency will perform field quality control tests, as specified in pertinent sections of Division 01.

B. Field Welding Inspection: Conform to all requirements of section SOURCE QUALITY CONTROL.

C. High Strength Bolting: Provide testing and verification of field-bolted connections in accordance with RCSC Section 9.

1. Inspect mating surfaces.

2. Test all materials prior to use. Use only materials meeting specified requirements.

3. Inspector shall review installation and verify “full effort” with installers for ST joints and shall randomly manually verify “full effort” on 10 percent of installed bolts.

4. Inspector shall verify installation for 100% of SC and PT joints.

5. Review installation procedures for all types of HSB joints and verify installation of “Twist-off” and load-indicator type bolts.

6. If any bolt fails testing, all bolts at the joint shall be loosened and re-tightened. Exception: Galvanized bolts shall be replaced prior to re-testing.

3.05 ADJUSTING

A. Touch-up damaged finishes with compatible specified primer.

B. Replace defective or damaged work with conforming work. Replace all defective work at Contractor's expense.

C. Straighten materials by means that will not injure the materials.

D. Replace defective or damaged work which cannot be corrected in the field with new work, or return defective items to the shop for repair.

E. Architect/Engineer shall review all proposals for the repair or replacement of damaged, defective, or missing work.

F. Pay expenses incurred by Owner for Architect/Engineer's costs for (re-)design and obtaining approvals of Authorities Having Jurisdiction (AHJ) necessitated by incomplete, inefficiently scheduled, improperly performed, defective or nonconforming work, as specified in pertinent sections of Division 01.

G. Pay expenses due to re-testing and re-inspection necessitated by incomplete, inefficiently scheduled, improperly performed, defective or nonconforming work, as specified in pertinent sections of Division 01.

3.06 CLEANING AND PROTECTION

A. Clean all surfaces upon completion of erection; leave free of grime and dirt. Remove unused materials, tools, equipment and debris from the premises and leave surfaces broomed clean.

B. Protect work from damage by subsequent operations.

END OF SECTION

05 40 00
COLD-FORMED METAL FRAMING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. All design and other services, material, labor and equipment as necessary for the fabrication, erection and completion of all cold formed metal framing including all bracing and shoring required for erection, miscellaneous metal, and related work.

B. Related Sections:

1. Pertinent Sections of Division 01 Specifying Quality Control and Testing Agency Sections

2. Pertinent Sections of Division 05 Specifying Structural Steel.

1.02 REFERENCE STANDARDS

A. California Code of Regulations, Title 24, latest adopted edition (herein noted as CBC): Chapter 22 Steel.

B. American Iron and Steel Institute (AISI) S100 “North American Specification for the Design of Cold-Formed Steel Structural Members”.

C. AISI S200 “North American Standard for Cold-Formed Steel Framing – General Provisions”.

D. AISI D100 “Cold-Formed Steel Design Manual.

E. American Welding Society (AWS) D1.3 “Structural Welding Code – Sheet Steel”

F. American Society for Testing and Materials (ASTM):

1. ASTM A307 “Stand Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60000 PSI Tensile Strength”.

2. ASTM A606 “Standard Specification for Steel, Sheet and Strip, High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, with Improved Atmospheric Corrosion Resistance”.

3. ASTM A653 “Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process”.

4. ASTM A780 “Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings”.

5. ASTM A1003 “Standard Specification for Steel Sheet, Carbon, Metallic- and Nonmetallic-Coated for Cold-Formed Framing Members”.

6. ASTM A1008 “Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable”.

7. ASTM A1011 “Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength”.

8. ASTM C645 “Standard Specification for Nonstructural Steel Framing Members”.

9. ASTM C754 “Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products”.

10. ASTM C955 “Standard Specification for Load-Bearing (Transverse and Axial) Steel Studs, Runners (Tracks), and Bracing or Bridging for Screw Application of Gypsum Panel Products and Metal Plaster Bases”.

11. ASTM C1007 “Standard Specification for Installation of Load Bearing (Transverse and Axial) Steel Studs and Related Accessories”.

12. ASTM C1513 “Standard Specification for Steel Tapping Screws for Cold-Formed Steel Framing Connections”.

G. The Society for Protective Coatings (SSPC) SSPC-Paint20 “Zinc-Rich Coating (Inorganic or Organic)”.

1.03 SUBMITTALS

A. Manufacturer's Literature:

1. Descriptive data illustrating cold-formed framing system components including framing members, fasteners, and accessories, including ICC-ES reports.

2. Erection instructions containing sequence of operations.

B. Samples: Provide adequate samples of unidentified material to the Owner's Testing Laboratory for testing purposes.

1.04 QUALITY ASSURANCE

A. Erector Qualifications:

1. Minimum of three years successful experience on comparable cold-formed metal framing projects.

2. Welders qualified in accordance AWS D1.3.

B. Cold form carbon and low alloy steel used for structural purposes shall be identified per CBC Section 2202.1.

C. Welding inspections shall conform to AWS D1.3 and CBC 1705.2.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Members of the "Steel Stud Manufacturers Association (SSMA)" with products meeting ICC-ES ESR-3064P. Members of the "Certified Steel Stud Association (CSSA)" with products meeting ICC-ES ESR-3016.

2.02 MATERIALS

A. Steel Framing System:

1. All stud and/or joist framing members shall be of the type & size as shown on the plans and reviewed shop drawings.

2. All runner and end tracks, bridging, and non-load bearing studs shall be of the type & size shown on the plans.

3. All studs, joists, and tracks 54 mils or greater in thickness shall be formed from steel that corresponds to the requirements of ASTM A1003 (Grade ST50H or ST50L) with a minimum yield of 50,000 psi.

4. All studs, joists, track, bridging, U-channel, (hat) furring (F) channels, and accessories 43 mils or thinner in thickness shall be formed from steel that corresponds to the requirements of ASTM A1003 (Grade ST33H or ST33L) with a minimum yield of 33,000 psi.

5. All stud and joist components shall be formed from steel having a minimum G-60 galvanized coating (equivalent coatings such as “G60e” are not acceptable), unless noted otherwise, or shall be primed with paint meeting the performance requirements SSPC-Paint20, where noted.

6. Welding Electrodes: Shall conform to AWS D1.3. E60 or E70. Touch up all welds with zinc-rich paint in compliance with ASTM A780.

7. Primer: SSPC-Paint20.

B. Screws shall be per ASTM C1513.

C. Machine bolts shall be per ASTM A307.

D. Power Actuated Fasteners (PAF): Hilti X-U, ICC ESR-2269. For use only where specified by the drawings.

E. Accessories: Cold-formed metal framing manufacturer's standard.

2.03 FABRICATION

A. Form members to manufacturer's standard shapes meeting design criteria.

B. Cut right angle connections of framing components to fit squarely against abutting members.

C. Prime un-galvanized steel to 1.5 mil (0.038) minimum dry film thickness.

PART 3 - EXECUTION

3.01 ERECTION

A. Clean surfaces that will be in contact after assembly.

B. Position members plumb, square and true to line.

C. Seat studs squarely in track with stud web and flange abutting track web with maximum 1/8 inch gap.

D. Connect members together by welding and/or fasteners in accordance with the drawings.

E. Do not splice studs. Provide "headers" and "trim studs" at openings as required. Studs shall be securely attached to tracks at all exterior walls except as noted below.

F. Provide for expansion and contraction between floors at solid wall sections of two stories or more by providing a slip joint between stud and track at one end. This connection shall be capable of transmitting lateral loads to the structure.

G. Provide and install bridging, fire blocking, etc. per manufacturer's recommendations, the plans, and code requirements.

H. Perform welding in accordance with AWS D1.3

I. Remove erection bolts and screws used in welded construction.

J. Do not use gas cutting for field correction of fabrication without concurrence of Architect/Engineer.

K. Touch-up field connections and breaks in shop coating with same primer used for shop priming.

3.02 DEFECTIVE WORK AND MATERIALS

A. Work found to be defective, missing or damaged shall be immediately replaced with proper work. Such replaced work and the inspection for same shall be at the expense of the Contractor.

B. Straightening of any materials, if necessary, shall be done by a process and in a manner that will not injure the materials, and which is approved by the Architect. Sharp kinks or bends shall be cause for rejection. Heating will not be allowed.

C. If defects or damaged work cannot be corrected in the field, the material shall be returned to the shop or new parts furnished, as the Architect directs; the Contractor shall replace all work at his own expense.

3.03 CLEANING

A. After erection, all surfaces shall be cleaned and left free of all grime and dirt. Remove unused materials, tools, equipment and debris from the premises and leave broom clean.

END OF SECTION

SECTION 05 50 00

METAL FABRICATIONS

PART 1 - GENERAL

1.01 DESCRIPTION

A. This Section describes the requirements for furnishing and installing metal fabrications made from steel shapes, plates, bars, strips, tubes, pipes and castings not a part of structural steel or specified in other Sections, including but not limited to the following items:

1. Miscellaneous steel framing for partition supports.
2. Handrail brackets.
3. Guardrails, railings, and handrails.
4. Steel pipe bollards.
5. Miscellaneous angles, plates, bars, rods and other items not specified in other Sections but shown or required to complete the work.

1.02 SYSTEM PERFORMANCE REQUIREMENTS

A. Guardrails, Railings and Handrails: Design, engineer, fabricate and install guardrails, railings and handrails to withstand the following structural loads:

1. Top Rail of Railing System: Capable of withstanding a lateral load of 50-psf applied horizontally at right angles to the top rail.
2. Handrails: Capable of withstanding a load of 200-psf applied at any direction and point along the handrail.
3. Handrails and Railings shall comply with ADA requirements.

1.03 SUBMITTALS

A. Product Data: Include information on stair treads, paint products, and grout.

B. Shop Drawings: Include plans, elevations and details of metal fabrications and their connections. Show anchorage and accessory items. Furnish templates for anchors and bolts installed under other Sections.

1.04 QUALITY ASSURANCE

A. Stairway handrails shall comply with California Building Code (CBC) Section 11B-505 and 1012.

B. Ramp handrails shall comply with CBC Section 11B-505 and 1012.

C. Ramp guardrails shall comply with CBC Section 11B-505 and 1013.

D. Fabricator Qualifications: Firm experienced in successfully producing metal fabrications like that indicated for this Project, with sufficient production capacity to produce required units without causing delay in the work.

E. Welding Qualifications: Qualify welding processes and welding operators in accordance with AWS D1.1, D1.2, and D1.3 as applicable. Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved.

1.05 PROJECT CONDITIONS

A. Field Measurements: Check actual locations of walls and other construction to which metal fabrications must fit, by accurate field measurements before fabrication. Show recorded measurements on shop drawings. Coordinate fabrication schedule to avoid delay of work.

1.06 SEQUENCING AND SCHEDULING

A. Painting: Items specified in this Section as having a shop applied prime coat will be job painted as specified in Section 09 91 00, unless otherwise noted.

PART 2 - PRODUCTS

2.01 FERROUS METALS

A. General: For fabrication of metal work which will be exposed to view, use only materials which are smooth and free of surface blemishes including pitting, seam marks, roller marks, rolled trade names and roughness.

B. Steel Plates, Shapes and Bars: ASTM A36.

C. Steel Tubing: Cold-formed, ASTM A500; or hot-rolled, ASTM A501.

D. Structural Steel Sheet: Hot-rolled, ASTM A570; or cold-rolled ASTM A611, Class 1.

E. Galvanized Structural Steel Sheet: ASTM A653, galvanized in accordance with ASTM A525, G90 coating designation.

F. Steel Pipe: ASTM A53; type and grade selected by fabricator; black finish unless galvanizing is indicated or specified; standard weight, schedule 40, unless otherwise indicated.

G. Gray Iron Castings: ASTM A48, Class 30.

H. Malleable Iron Castings: ASTM A47, grade selected by fabricator.

2.02 ALUMINUM

A. Extrusions: ASTM B221, alloy 6063-T6.

B. Sheet: ASTM B209, alloy 5005-H15.

C. Bars, Rods and Wires: ASTM B211.

D. Drawn Seamless Tubing: ASTM B210.

E. Castings: ASTM B26 or B108, alloy 214 unless otherwise recommended by aluminum producer or finisher.

2.03 STAINLESS STEEL

A. Tubing: ASTM A554, grade MT 304.

B. Pipe: ASTM A312, grade TP304.

C. Castings: ASTM A743, Grade CF 8 or CF 20.

D. Plate: ASTM A167, type 304.

E. Finish: No. 4 satin polish finish matching approved sample.

2.04 FASTENERS

A. Bolts and Nuts: Regular hexagon-head bolts, ASTM A307, Grade A, with hex nuts, ASTM A563, and flat washers.

B. Machine Screws: ANSI B18.6.3.

C. Lag Bolts: ANSI B18.2.1.

D. Wood Screws: Flat head, carbon steel, ANSI B18.6.1.

E. Plain Washers: Round, carbon steel, ANSI B18.22.1.

F. Lock Washers: Helical, spring type, carbon steel, ANSI B18.21.1.

G. Expansion Anchors: Anchor bolt and sleeve assembly with capability to sustain, without failure, a load equal to 6 times the load imposed when installed in unit masonry and equal to 4 times the load imposed when installed in concrete, determined in accordance with ASTM E448.

2.05 GROUT

A. Non-Shrink Non-Metallic Grout: Euclid Chemical Co. "Euco N-S Grout", L&M Construction Chemicals, Inc. "Crystex", Master Builders Technologies, Inc. "Masterflow 928 and 713" or approved equal.

2.06 PAINT

A. Metal Primer: SSPC 20, Type 2; VOC-compliant.

1. Exposed to view items to be field painted shall be primed with a primer compatible with final finish coats specified in Section 09 91 00.

B. Galvanizing Repair Paint: VOC-compliant, high zinc dust content paint for re-galvanizing welds in galvanized steel; Rust-Oleum Corp. "Zinc-Rich Cold Galvanizing Compound", Tnemec 90-93, ZRC Worldwide "Galvalite" or approved equal.

2.07 FABRICATION, GENERAL

A. Workmanship:

1. Use materials of size and thickness indicated or required to produce strength and durability in finished product for use intended.

2. Work to dimensions indicated,

3. Form exposed work true to line and level with accurate angles and surfaces and straight, sharp edges.

4. Ease exposed edges to a radius of approximately 1/32-inch, unless otherwise indicated.

5. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

6. Weld corners and seams continuously, complying with AWS recommendations. At exposed connections, grind exposed welds smooth and flush to match and blend with adjoining surfaces. Welds shall be imperceptible in the finished work.

7. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners wherever possible. Use Phillips flat- head countersunk screws or bolts for exposed fasteners unless tamperproof security screws are indicated.

8. Cut, reinforce, drill and tap miscellaneous metal work as indicated to receive finish hardware and similar items.

B. Galvanizing: Provide zinc coating for all exterior items exposed to the elements, as follows:

1. ASTM A153 for galvanizing iron and steel hardware.

2. ASTM A123 for galvanizing both fabricated and un-fabricated iron and steel products made of uncoated rolled, pressed, and forged shapes, plates, bars, and strip 0.0299-inch thick and heavier.

C. Fabricate joints exposed to the weather to exclude water or provide weep holes.

D. Shop Painting:

1. Shop paint miscellaneous metal work, except members or portions of members to be embedded in concrete or masonry, surfaces and edges to be field welded, and galvanized surfaces.

2. Remove scale, rust and other deleterious materials before applying shop coat. Clean off heavy rust and loose mill scale in accordance with SSPC SP-2, SP-3, or SP-7.

3. Remove oil, grease and similar contaminants in accordance with SP-1.

4. Brush or spray on primer in accordance with manufacturer's instructions, at a rate of 2.0-mils thickness for each coat.

5. Apply one shop coat to fabricated metal items, except apply 2-coats to inaccessible surfaces after assembly or erection. Change color of second coat to distinguish from the first.

6. Primer on exposed to view items to be field painted shall be smooth and suitable for application of final finish coats specified in Section 09 91 00.

7. Apply a heavy coat of bituminous paint, compounded for application in 30-mil coat, to metal surfaces in contact with concrete, masonry and dissimilar metals. Do not apply on exposed surfaces.

2.08 MISCELLANEOUS METAL FABRICATIONS

A. Curb Nosings:

1. Fabricate of structural steel shapes of welded construction with mitered corners and continuously welded joints.

2. Provide anchors welded to nosing for embedding in concrete or masonry construction, spaced not more than 6-inches from each curb end, 6-inches from corners and 24-inches on center unless otherwise indicated.

3. Finish: Galvanized.

B. Miscellaneous Framing and Supports:

1. Provide miscellaneous framing and supports not a part of structural steel framework, as required to complete work.

2. Fabricate to sizes, shapes and profiles shown or required.

3. Fabricate from structural steel shapes and plates and steel bars of welded construction using mitered joints for field connection.

4. Cut, drill and tap units to receive hardware and similar items.

5. Furnish integrally welded anchors for casting into concrete or building into masonry.

6. Finish: Galvanize exterior frames and supports, shop prime interior frames and supports.

C. Steel Guardrails, Railings and Handrails: Fabricate to design, dimensions and details indicated. Railings and handrails shall comply with ADA requirements.

1. Interconnect railing and handrail members by butt welding or welding with internal connectors.

2. Provide coped joints at tee and cross sections.

3. Form simple and compound curves by bending tubing in jigs to produce uniform curvature for each repetitive configuration. Maintain cylindrical cross-section of tube throughout entire bend without buckling, twisting or deforming exposed surfaces.

4. Provide wall returns at ends of wall-mounted handrails.

5. Close exposed ends of tubing by welding 3/16-inch steel plate in place or by using prefabricated fittings.

6. Flanges, Fittings and Anchors: Provide end closures, flanges, miscellaneous fittings and anchors for interconnections of tubing and attachment of railings and handrails to other work. Furnish inserts and other anchorage devices for connecting to concrete or masonry.

7. Finish: Galvanize exterior steel guardrails, railings and handrails, including tubing, fittings, brackets, fasteners, and other ferrous components. Provide shop-primed metal for interior guardrails, railings and handrails. Guardrails, railings and handrails will be field painted as specified in Section 09 91 00.

D. Steel Pipe Bollards: Fabricate bollards from galvanized steel pipe of diameter and height indicated. Embed in concrete footings, fill with concrete and close top end by welding a 1/4-inch steel plate in place or provide a smooth concrete domed cap. Bollards will be field painted as specified in Section 09 91 00.

PART 3 - EXECUTION

3.01 PREPARATION

A. Coordinate and furnish anchorages, setting drawings, diagrams, templates, instructions, and directions for installation of anchorages, such as concrete inserts, sleeves, anchor bolts and miscellaneous items having integral anchors.

3.02 INSTALLATION

A. General:

1. Fastening to in-Place Construction: Provide threaded fasteners for concrete and masonry inserts, toggle bolts, through-bolts, lag bolts, wood screws and other connectors as required.

2. Cutting, Fitting and Placement:

a. Perform cutting, drilling and fitting required for installation of miscellaneous metal fabrications.

b. Set work accurately in location, alignment and elevation, plumb, level, true and free of rack, measured from established lines and levels.

c. Provide temporary bracing or anchors in formwork for items to be built into concrete, masonry or similar construction.

3. Fit exposed connections together forming tight hairline joints.

    a. Weld connections not shop-welded.

    b. Grind exposed joints smooth and imperceptible, and touch-up shop paint coat.

    c. Do not weld, cut or abrade the surfaces of exterior units which have been hot-dip galvanized after fabrication, and intended for bolted or screwed field connections.

4. Field Welding: Comply with AWS for procedures of manual shielded metal-arc welding, appearance and quality of welds, and methods used in correcting welding work.

B. Steel Guardrails, Railings and Handrails:

1. Adjust railings prior to anchoring to ensure matching alignment at abutting joints.

2. Space posts as indicated.

3. Plumb posts in each direction.

4. Secure handrails to wall with wall brackets and end fittings.

    a. Locate brackets as indicated.

    b. Secure wall brackets in accordance with manufacturer's instructions.

5. Expansion Joints: Provide at intervals not exceeding 40-feet. Provide slip joint with internal sleeve extending 2-inches beyond joint on either side; fasten internal sleeve securely to one side; locate joint within 6-inches of posts.

C. Bollards: Anchor bollards in concrete with preset pipe sleeves or expansion bolts and base plate, as indicated. After bollards have been inserted into sleeves, fill annular space between bollard and sleeve solid with non-shrink, non-metallic grout.

3.03 ADJUST AND CLEAN

A. Touch-Up Painting: Clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with same material used for shop painting. Apply by brush or spray to provide a minimum dry film thickness of 2.0-mils.

B. Galvanized Surfaces: Clean field welds, bolted connections and abraded areas and spot prime with specified primer applied to a minimum dry film thickness of 2.5-mils.

END OF SECTION

SECTION 06 05 73

WOOD TREATMENT

PART 1 - GENERAL

1.01 DESCRIPTION

A. This Section describes the requirements for preservative treated and fire-retardant treated wood where indicated or specified.

1.02 SUBMITTALS

A. Wood Treatment Data: Treatment manufacturer's instructions for handling, storing, installing and finishing of treated material.

1.03 QUALITY ASSURANCE

A. Wood Treatment Plant: Experienced in performing work required in this Section that has specialized in treatment of wood like that required for this Project and is licensed by the wood treatment manufacturer.

1.04 ENVIRONMENTAL QUALITY ASSURANCE

A. Protect against airborne transmission of chemical treatments to surrounding area.

B. Where ground treatment is required, protect ground water from contamination.

1.05 DELIVERY, STORAGE AND HANDLING

A. Store treated wood materials protected from exposure to harmful environmental conditions and at temperature and humidity conditions recommended by manufacturer. Prevent exposure to precipitation during shipping, storage or installation. Store material off ground and under cover.

B. For interior fire-retardant treated wood, avoid exposure to precipitation during shipping, storage and installation. If wood becomes wet, replace or allow to dry to a maximum moisture content of 19-percent for lumber and 15-percent for plywood prior to covering or enclosure by gypsum board, roofing or other construction materials.

PART 2 - PRODUCTS

2.01 PRESERVATIVE TREATED WOOD

A. General: Provide preservative-treated wood at areas where wood is in contact with concrete, masonry and where indicated.

B. Approved Wood Preservatives: Copper Naphthenate and Zinc Naphthenate.

C. Comply with AWPA Standard U1 and T1.

D. Retention Rates: As recommended by manufacturer for applications required.

E. End Cut Preservative: Acceptable to manufacturer of wood preservative.

F. All preservative treated wood members shall bear an end tag or permanent ink stamp indicating name of wood treating company, treatment plant city and state, preservative retention level, approved use, and code report number.

2.02 BORATE-TREATED WOOD

A. General: Provide preservative-treated wood at areas where wood is in contact with concrete, masonry and where indicated.

B. Material: SillBor pressure-impregnated with a borate (SBX) preservative which makes wood resistant to attack by insects and fungal decay.

C. Retention Rates: As recommended by manufacturer for applications required.

2.03 FIRE-RETARDANT PRESSURE TREATED WOOD

A. General: All lumber and plywood designated to be exterior fire retardant treated shall be pressure impregnated with fire-retardant chemicals and shall have a flame spread rating of 25 or less when tested in accordance with ASTM E84. When test conditions are extended to 30-minutes, the flame spread shall not progress more than 10-1/2-feet beyond the center line of the burners, with no evidence of significant progressive combustion.

B. Each piece of fire-retardant treated lumber and plywood shall be manufactured under Timber Products Inspection or other independent third-party follow-up inspection service, and each piece shall bear the appropriate qualified inspection agency's label indicating surface burning characteristics in the 30-minute ASTM E84 flame spread test. Each piece shall be labeled indicating kiln dried after treatment (KDAT) and identifying the treating company and location.

C. Interior Wood:

1. Approved Manufacturer: Hoover Treated Wood Products, Inc. "Pyro-Guard", Chemical Specialties, Inc. "D-Blaze" or approved equal.

2. Structural performance of fire-retardant treated wood shall be evaluated in accordance with ASTM D5664 for lumber and ASTM D5516 for plywood. Evaluation of plywood data shall be in accordance with ASTM D6304. The resulting design value and span rating adjustments shall be published in ICC Evaluation Service Report (ESR) – 1791 issued by the ICC Evaluation Service, Inc. which includes evaluation of high temperature strength testing for roof applications.

3. Interior fire-retardant treated lumber and plywood shall have equilibrium moisture content of not over 28-percent when tested in accordance with ASTM D3201 at 92-percent relative humidity.

4. Interior fire-retardant treated wood shall be kiln dried after treatment to a maximum moisture content of 19-percent for lumber and 15-percent for plywood.

5. The fire-retardant formulation shall be free of halogens, sulfates, chlorides, arsenic, ammonium phosphate, formaldehyde, and urea formaldehyde.

6. Provide lumber of the appropriate grade and species as specified by the design criteria of the intended application after consideration of design value adjustment.

7. Provide plywood of the appropriate size, grade and species as specified by the design criteria of the intended application after consideration of span rating adjustments.

D. Exterior Wood:

1. Approved Manufacturer: Hoover Treated Wood Products, Inc. "Exterior Fire-X" or approved equal.

2. Exterior fire-retardant treated wood shall be kiln dried after treatment to a maximum moisture content of 19-percent for lumber and 15-percent for plywood.

3. Exterior fire-retardant treated lumber and plywood shall use design value adjustments and span ratings as published by the manufacturer.

4. The fire-retardant formulation shall be free of halogens, sulfates, chlorides, and ammonium phosphate.

5. Provide lumber of the appropriate grade and species as specified by the design criteria of the intended application.

6. Provide plywood of the appropriate size, grade and species as specified by the design criteria of the intended application.

E. Fire-retardant treatment shall be a clear product and shall not change the appearance of the wood.

PART 3 - EXECUTION

3.01 INSTALLATION, GENERAL

A. Preservative-Treated Wood: Handle, store, and install fire-retardant-treated wood in compliance with recommendations of chemical treatment manufacturer, including those for adhesives where required for installation.

1. Field Cuts: Where cut or drilled in field, treat cut ends with preservative solution used in original treatment by brushing, spraying, dipping, or soaking. Treat end cuts of ACQ preservative treated wood members with field-applied end coat prior to installation.

B. Fire-Retardant Treated Wood: Handle, store, and install fire-retardant-treated wood in compliance with recommendations of chemical treatment manufacturer, including those for adhesives where required for installation.

1. Field Cuts:

a. Lumber: Do not rip or mill fire retardant treated lumber. Cross cuts, joining cuts, and drilling holes are permitted.

b. Plywood: Fire retardant plywood may be cut in any direction.

2. Do not install interior fire-retardant treated wood in areas where it is exposed to precipitation, direct wetting, or regular condensation. Do not install as sill plates; use exterior fire-retardant treated wood.

END OF SECTION

SECTION 06 10 53

MISCELLANEOUS ROUGH CARPENTRY

PART 1 - GENERAL

1.01 DESCRIPTION

A. This Section describes the requirements for miscellaneous rough carpentry items, including but not limited to the following;

1. Wood blocking and backing.

2. Plywood backing at mechanical, electrical and telecommunications rooms.

1.02 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Keep materials under cover and dry. Protect against exposure to weather and contact with wet or damp surfaces.

B. Stack lumber, plywood and other panels; provide for air circulation within and around stacks and under temporary coverings.

PART 2 - PRODUCTS

2.01 LUMBER

A. Manufacture lumber to comply with PS 20 and with applicable grading rules of inspection agencies certified by ALSC Board of Review.

B. Factory-mark each piece of lumber identifying grading agency, grade, species, moisture content at time of surfacing, and mill.

C. Nominal sizes are indicated, except as indicated by detail dimensions. Provide actual sizes as required by PS 20, for moisture content specified for each use. Provide dressed lumber, S4S, unless otherwise indicated.

D. Moisture Content: 19 percent maximum.

E. Species and Grade: Douglas Fir, No. 2 unless otherwise indicated.

2.02 PLYWOOD BACKING

A. Standards: Comply with requirements of PS 1 Voluntary Product Standard "Construction and Industrial Plywood" for veneer plywood and APA PRP-108 "Performance Standards and Policies for Structural-Use Panels" for performance-rated panels.

B. Miscellaneous Exposed Plywood: APA A-D Interior, 3/4-inch thick, fire-retardant treated.

2.03 FASTENERS

A. General: Provide fasteners with hot-dip zinc coating in accordance with ASTM A153 or stainless steel.

B. Nails, Wire, Brads, Staples: FS FF-N-105.

C. Bolts: ASTM A307, Grade A; with hex nuts and flat washers.

D. Screws: Type, size and length appropriate for securing gypsum and plywood sheathing to metal studs.

PART 3 - EXECUTION

3.01 INSTALLATION, GENERAL

A. Discard units of material with defects which might impair quality of work, and units in sizes that would require an excessive number or poor arrangement of joints.

B. Cut and fit miscellaneous carpentry accurately. Install members plumb and true to line and level.

C. Securely attach carpentry work to substrate by anchoring and fastening as indicated and required.

D. Use fasteners of appropriate type and length and compliant with CBC Chapter 23. Install fasteners without splitting wood; pre-drill as required.

3.02 WOOD GROUNDS, NAILERS, AND BLOCKING

A. Provide where indicated and required for screeding or attachment of other work. Form to shapes indicated and cut as required for true line and level of work to be attached. Coordinate location with other work involved.

B. Attach to substrates as required to support applied loading. Countersink bolts and nuts flush with surfaces.

C. Provide permanent grounds of dressed, preservative treated, key- beveled lumber not less than 1-1/2-inches wide and of thickness required to bring face of ground to exact thickness of finish material. Remove temporary grounds when no longer required.

3.03 PLYWOOD BACKING

A. Saw cut plywood accurately for tight fit.

B. Install with grain of outer plies at right angles to supports.

C. Fasten securely at each support with self-tapping sheet metal screws driven flush with face of plywood and terminate ends only over supports.

D. Maintain tight joints but do not force panels into place.

E. Comply with additional recommendations in APA Form E30, "Design/Construction Guide - Residential & Commercial".

END OF SECTION

SECTION 06 41 00

ARCHITECTURAL WOOD CASEWORK

PART 1 - GENERAL

1.01 DESCRIPTION

A. This Section describes the requirements for furnishing and installing architectural wood casework, including but not limited to the following:

1. Custom plastic laminate faced cabinetwork.

1.02 SUBMITTALS

A. Samples:

1. Samples shall comply with NAAWS 04, Section 01.7.

2. Specified plastic laminate colors for verification of initial selections.

3. Exposed hardware items if requested by the Architect.

B. Shop Drawings: Show details of fabrication and installation, dimensioned plans, elevations, and sections. Each set of shop drawings shall comply with North American Architectural Woodwork Standards 4.0 (NAAWS 4.0) Section 01 – Submittals.

1. Shop drawings shall bear the Woodwork Institute Certified Compliance Program Label on the first page. Photocopies of architectural drawings are not acceptable. Highlight any modifications to the Specifications or NAAWS 04 requirements.

C. Warranty.

1.03 QUALITY ASSURANCE

A. Materials and fabrication of cabinetwork shall be in accordance with the standards of the NAAWS 4.0 for the grades specified.

B. Fabricator shall be a Woodwork Institute Accredited Millwork Company in good standing.

1. Fabricator shall have not less than 5-years of production experience similar to that required for this Project, whose qualifications indicate the ability to comply with the requirements of this Section.

2. The fabricator shall have a least one project in the past 5-years where the value of the work was within 20-percent of the cost of casework for this Project.

C. Single Source Responsibility: A single fabricator shall provide and install the work of this Section.

D. Certified Compliance Program (CCP):

1. Before delivery to the Project site, provide a Woodwork Institute Certified Compliance Certificate indicating the items to be provided and certifying that they meet the requirements of the NAAWS 4.0, the plans and specifications.

2. Each elevation of casework and plastic laminate countertops shall bear the WI Certified Compliance Label indicating conformance to specified grade.

3. Upon completion of installation, furnish a WI Certified Compliance Certificate for the installation.

4. In the event of question as to compliance with the referenced standard of any item of work, the Architect may require independent inspection service of questioned items as specified in "Independent Inspection Service " of “WI Services and Quality Control Options” published by the WI.

5. Fees charged by the WI for its Certified Compliance program are the responsibility of the casework manufacturer and/or installer and shall be included in their Bid.

E. Certified Seismic Installation Program (CSIP):

1. Before walls are closed, furnish a written Woodwork Institute Certified Seismic Installation Program report confirming that backing is provided in all locations required for casework installation or identify those locations where backing is missing or improperly located.

2. On completion of installation, furnish a Woodwork Institute Certified Seismic Installation Program Certificate, identifying the work covered and certifying that installation meets the requirements of the WI CSIP attachment details and schedules.

3. Fees charged by the Woodwork Institute for its Certified Seismic Installation Program are the responsibility of the Contractor and shall be included in the Bid.

1.04 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install cabinets until building is enclosed, wet work is completed, and HVAC system is operating and will maintain temperature and relative humidity at occupancy levels during the remainder of the construction period.

B. Field Measurements: Check actual dimensions of other construction by accurate field measurements before fabrication and show recorded measurements on shop drawings. Coordinate fabrication schedule with construction progress to avoid delaying the work.

1. Verify locations of concealed framing, blocking, backing, reinforcements, and other items that support cabinetwork by accurate field measurements before being enclosed and record on shop drawings.

C. Verify that wall, ceiling and floor surfaces to receive casework are within acceptable tolerances.

1.05 COORDINATION

A. Cabinets shall be left in a well-ventilated warehouse for a minimum of 72-hours prior to delivery to the Project site.

B. Cabinets shall be acclimated to the field conditions for a minimum of 72-hours prior to installation.

1.06 INDOOR AIR QUALITY

A. Do not use wood products containing urea formaldehyde glues inside the shell of the building.

B. When machining plastic products, protect surrounding areas from dust.

1.07 WARRANTY

A. Warrant architectural wood casework to be of good material and workmanship and free from defects that render it unserviceable for the use for which it is intended for a period of 5-years from date of Substantial Completion. This warranty is in addition to and not a limitation of other rights the Owner may have against the Contractor under the Contract Documents.

PART 2 - PRODUCTS

2.01 MATERIALS

A. General: Provide materials that comply with requirements of NAAWS 4.0 for each type and grade of casework specified.

B. High-Pressure Decorative Laminate (HPDL): Comply with NAAWS 4.0 Section 04.8 and NEMA LD-3.

1. Vertical Surfaces: Grade VGP, 0.028-inch nominal thickness.

2. Cabinet Liner: Grade CLS, 0.020-inch nominal thickness.

3. Backer: Grade BKL, 0.020-inch nominal thickness.

4. Manufacturer, Pattern, Sheen, Color: As selected by the Architect.

C. Low-Pressure Decorative Laminate (LPDL): Comply with NAAWS 4.0 Section 04 and NEMA LD3. LPDL shall consist of melamine, polyester or foil resin-impregnated paper thermally fused under pressure to an approved core and have a balance sheet.

D. Balance Sheet:

1. Plastic Laminate Faced Casework: Grade HPL of the same thickness.

E. Particleboard:

1. ANSI A208.1, Grade M2 or better, moisture resistant.

2. At sink cabinets, ANSI A208.1, water-resistant Grade M3 MR-50.

3. Particleboard shall contain no added urea formaldehyde resins and CARB compliant.

F. Medium Density Fiberboard (MDF):

1. ANSI A208.2, Grade 130 or better, moisture resistant.

2. At sink cabinets, ANSI A208.2, water-resistant Grade 155 MR-50.

3. Medium density fiberboard shall contain no added urea formaldehyde resins and CARB compliant.

G. Plywood: NAAWS 4.0 Grade B closed grain hardwood veneer core plywood, smooth, well-sanded, thickness indicated.

1. Provide exterior grade with waterproof glue at countertops with sinks.

2. Plywood shall contain no added urea formaldehyde resins and CARB compliant.

H. Hardboard: Manufactured of interfelted lignocellulosic fibers, consolidated under heat and pressure to a density of 31-pcf or greater, tempered grade, 1/4-inch-thick tempered, smooth both sides.

I. Core Material:

1. Plastic Laminate: Medium density fiberboard, plywood, or particleboard at fabricator’s option.

J. Lumber:

1. NAAWS 4.0 Section 03, grade specified for the product being fabricated.

2. Moisture Content: 6- to 12-percent for boards up to 2-inch nominal thickness; not to exceed 19-percent for thicker pieces.

K. Adhesives: VOC compliant contact, Type II, water-resistant except Type I, fully waterproof at sink tops and sink base cabinets.

L. Hardware: Furnish and install as required to provide a complete casework installation.

1. General: Hardware shall meet the requirements of ANSI/BHMA, minimum Grade 2 requirements except for requiring “dynamic” load testing for a minimum of 50,000 cycles and NAAWS 4.0.

2. Hinges: Concealed European style Grade II, minimum 120-degree opening, capacity meeting ANSI/BHMA 156.9.

3. Pulls: To be selected by the Architect.

4. Drawer Guides: Full extension, roller or ball bearing, meeting the requirements of NAAWS 4.0 for the type and size of drawer.

a. Pencil Drawers: Minimum 50-pound capacity.

b. General Purpose Drawers: Minimum 75-pound capacity.

c. File Drawers: Minimum 150-pound capacity, except for 200-pound capacity for lateral file drawers over 30-inches in width.

5. Shelf Supports: Bored hole system with minimum 5 mm metal pin or recessed metal shelf standard and compatible supports as indicated or as directed by the Architect.

6. Locks: Provide where indicated, installed to withstand a minimum of 50-lb. pull force in the locked position, complying with ADA Section 4.13.9.

a. Non-digital / -electronic locks shall be keyed as directed.

b. Digital / electronic locks shall have non-volatile memory, have minimum 4-digit user access pin codes and 5 digit master pin code.

7. Finish:

a. Exposed hardware: To be selected by the Architect.

b. Semi-exposed Hardware: Manufacturer’s standard finish.

8. Grommets: Provide at penetrations through countertops. Material, size, finish and color as approved by the Architect. Coordinate location with Owner.

9. Base Adjusters: Adjustable screw type having a floor bearing surface of at least 1-1/8-inch in diameter at each foot with cover caps.

2.03 FABRICATION

A. Fabricate products in accordance with the approved Shop Drawings and specified NAAWS 4.0 Grade requirements. The architectural drawings indicate form and profile concept only. Fabrication and construction details shall comply with NAAWS unless otherwise specified.

B. Fabricate laminated plastic casework in accordance with NAAWS 4.0 Section 10, Construction Type – Frameless, Door Interface Style - Flush Overlay.

1. Grade: Custom except as otherwise specified.

2. Exposed exterior portions shall be covered with a HPDL as specified.

3. Exposed interior surfaces, except at doors and drawer fronts shall be covered with a HPDL matching exposed exterior surfaces.

4. Exposed interior surfaces of door and drawer fronts shall be covered with the same material, pattern, color, and thickness as the door face.

5. Edge Banding: HPDL or PVC, minimum 0.02-inch thick, color-matched to the exposed face.

6. Semi-exposed surfaces of cabinet tops and bottoms, cabinet ends, fixed and adjustable shelves, cabinet back, shall be finished with a low-pressure melamine overlay or cabinet liner; exposed edges of semi-exposed surfaces shall be finished with extruded PVC or self-edged plastic laminate.

7. Door and Drawer Edge: Square edge with thin applied band.

8. Shelf Thickness: As specified in NAAWS 4.0 for a uniform load of 50-lb./sq. ft.

9. Drawer Construction: Dowel or dovetail construction. Sides of ½-inch thick 7 or 9 ply hardwood plywood with no voids. Bottoms of hardwood plywood of the same species and cut as the sides, ¼-inch thick. Drawer boxes wider than 30-inches shall have ½-inch thick bottoms.

C. Make cuts required to accommodate the work of other Sections in the shop where possible. Review other drawings and work to determine extent of items to be mounted in cabinetwork. Notify the Architect of discrepancies.

D. Shop-fabricate cabinets in whole units or partial units practical for handling and transporting. Assemble partial units in place so that each complete unit becomes a unified whole visually and structurally. Fabricate fillers and scribe strips of same materials and finishes as adjacent units.

E. Make cuts for hardware and equipment neat and true. Install hardware and fit securely.

F. Adjust drawers, doors, and movable shelves to operate easily and smoothly without binding.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install cabinetwork in accordance with NAAWS 4.0 Section 14, Premium Grade requirements.

B. Install products plumb and level.

C. Securely fasten cabinetwork to supporting substrate as indicated.

D. Fit tight and scribe to walls, ceilings, and other surfaces so no open joints occur.

E. Remove and replace materials damaged beyond repair or stained beyond cleaning.

F. Installation Tolerances: As specified in NAAWS 4.0 Section 15.

3.02 ADJUSTMENT, CLEANING, AND PROTECTION

A. Repair damaged and defective cabinetwork where possible to eliminate defects; where not possible to properly repair, replace.

B. Clean, lubricate and make final adjustments to hardware for proper operation.

C. Clean cabinetwork on exposed and semi-exposed surfaces. Touch-up shop-applied finishes to restore damaged or soiled areas.

D. Protect cabinetwork to ensure work will be without damage at time of Substantial Completion. Cover completed cabinetwork with 4-mil polyethylene film protective enclosure, applied in a manner to permit easy removal.

3.03 FIELD QUALITY CONTROL

A. Furnish Woodwork Institute Certified Seismic Installation Program inspection reports and certification as specified.

END OF SECTION

SECTION 07 42 43

COMPOSITE METAL PANELS

PART 1 - GENERAL

1.01 DESCRIPTION

A. This Section describes the requirements for furnishing and installing rout and return dry aluminum composite metal wall panels.

1.02 SYSTEM DESCRIPTION

A. Rout and return dry panel system consisting of continuous perimeter extrusions along the panel fastener edges and panel to panel interlocking joints, extruded stiffeners, fasteners and related flashings, and previously installed adjacent construction, and other miscellaneous accessories required for a complete installation.

1.03 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide metal composite material panel system capable of withstanding the effects of the following loads, based on testing according to ASTM E330.

1. Wind Loads: As required by California Building Code (CBC).

2. Deflection Limits: For wind loads, no greater than L/175 for frame elements and L/100 for panel materials.

B. Fire-Resistance Ratings: Comply with ASTM E84. Identify products with appropriate markings of applicable testing agency. Indicate design designations from UL “Fire Resistance Directory” or from the listings of another qualified testing agency.

C. Fire Performance Characteristics: Metal composite material wall panel systems with 4mm FR Reynobond passes NFPA 285 testing.

D. Aluminum composite materials shall have a current ICC-ES report.

1.04 SUBMITTALS

A. Product Data: Include composite panel manufacturer’s specifications, calculations, installation instructions, and laboratory test reports for review. Include maintenance data

B. Shop Drawings: Show profiles of panel units, details of forming, joint supports, anchors, trim, flashings, and accessories. Show details of edge terminations, elevations, and layout of entire work. Shop drawings shall be signed by manufacturer’s engineer of record.

1. Indicate Project layout from control grid lines and elevations referring to the required details for each condition.

2. Show the profiles and performance requirements.

3. Show girts and panel attachments.

C. Calculations: Signed by a professional engineer licensed in the State of California showing that girts and panel attachments comply with specified and CBC requirements.

D. Samples: Furnish two samples, minimum 8-inches square, of material, gauge, and specified finish, complete with factory-applied edge treatment, fabricated into units representative of the actual system.

E. Test Reports: Furnish certified test reports which meet or exceed the specified requirements. Include the following:

1. Name and location of the certified independent testing laboratory with the contact phone numbers.

2. Date the test was performed.

3. Unit description and system name of the panel system tested. Include the test drawings with elevations with details showing the tested panel joinery.

4. Include engineering judgment showing compliance with NFPA 285 requirements.

F. Installer's Qualifications: Furnish list of Projects showing compliance with specified qualification requirements.

G. Warranty.

1.05 QUALITY ASSURANCE

A. Manufacturer: Composite panel manufacturer shall have a minimum of 10-years experience with an ICC ESR Report.

B. Installer: Minimum of 5-years' experience installing composite wall panels of the type required for this Project.

C. Fabricator: Capable of providing field service representation during construction with a minimum of 10-years experience fabricating composite wall panels of the type required for this Project.

D. Pre-installation Meetings: Conduct at Project site as specified in Section 01 31 19.

1. Review and finalize construction schedule and verify availability of materials.

2. Review methods and procedures related to metal composite material panel installation.

3. Examine support conditions for compliance with requirements, including alignment between and attachment to structural members.

4. Review flashings, wall penetrations, openings, and condition of other construction that affect metal composite material panels.

5. Review procedures for repair of panels damaged after installation.

1.06 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Store composite metal panels on end in a dry, well ventilated place to prevent condensation. Do not allow panels and other components to come in contact with mud, uncured concrete, cement, lime, and other strong chemicals which might cause staining.

B. Deliver and store panel components wrapped or otherwise protected to prevent damage to finish.

1.07 WARRANTY

A. Furnish warranties covering defective materials and workmanship, including but not limited to the following:

1. Deterioration or discoloration of finishes for a period of 30-years, defined as follows:

a. Fading: Maximum 10-percent change from original color sample, for a period of 5-years from date of Substantial Completion.

b. Non-Uniformity: None discernible from 10-foot distance, including smutting and chalking for a period of 5-years from date of Substantial Completion.

c. Pitting and Corrosion: None discernible from 10-foot distance.

2. Failure of the system to meet performance requirements.

3. Excessive deflections for a period of 2-years from date of Substantial Completion.

4. Adhesive failure, cohesive failure, cracking or discoloration of sealants for a period of 20-years from Date of Substantial Completion.

5. Disengagement of gaskets or weatherstripping under conditions not exceeding design criteria for a period of 2-years from Date of Substantial Completion.

6. Delamination, oil canning, or excessive bowing of aluminum panels for a period of 10-years from date of Substantial Completion.

7. Failure of any components for a period of 2-years from date of Substantial Completion.

B. This warranty shall be in addition to and not a limitation of other rights the Owner may have against the Contractor under the Contract Documents.

PART 2 - PRODUCTS

2.01 APPROVED PANEL FABRICATORS

A. Alumawall “1800 System Rain Screen” or approved equal.

2.02 MATERIALS

A. Panel System: Alcoa “Reynobond Aluminum Composite Material”, ICC-ES 3435 and a system of custom aluminum extrusions of size and shape indicated. The panels shall conform to the following:

1. Perimeter Extrusions: Extruded aluminum with integral weatherstripping as indicated, providing the following features:

a. Rout and return on all perimeters.

b. Maximum overall panel thickness, including the attachment shim space, shall not exceed 2-inches.

c. The Alucobond shall be attached to perimeter extrusions with non-corrosive sheet metal screws and structural silicone sealant.

2. Stiffeners: Extruded aluminum sections secured to edge trim and bonded to rear face of Alucobond with silicone, and of sufficient size and strength to maintain flatness of the panel within the specified tolerances.

3. Reveals at Panels: Joint size between the faces of the perimeter extrusions shall be 1/2-inch nominal.

4. Flatness Criteria: Maximum 1/8-inch in 15’-0” on panel in any direction for assembled units.

B. Reynobond Composite Material:

1. Composite: Two sheets of aluminum sandwiching a core of fire-rated extruded thermoplastic, formed in a continuous process with no glues or adhesives between dissimilar materials. Total composite thickness is 4 mm.

2. Face Sheets: 0.020-inch thick aluminum, 3003 alloy for coil-coated sheets; 5005 alloy for anodized sheets.

3. Colors: As selected by the Architect.

4. Finish: Comply with the weathering performance criteria of AAMA 2605. Exterior surfaces shall be chromate pre-treated with Henkel Corp. “Alodine” or “Bonderite” or approved equal complying with ASTM B449 and coil coated with Duranar or approved equal coating system that has passed the following tests:

   a. Humidity Resistance: No formation of blisters when subjected to condensing water fog at 100-percent relative humidity and 100-deg. F. for 4,000-hours, ASTM D2247.

   b. Salt Spray Resistance: ASTM B117, expose coating system to 4,000-hours using 5-percent NaCl solution.

      1) Maximum rating of 7 on scribe or cut edges.

      2) Minimum blister rating of 8 within the test specimen field.

   c. Weather Exposure:

      1) 10-year exposure at 45-degree angle facing south Florida exposure.

      2) Maximum color change of 5 Delta E units as calculated in accordance with ASTM D2244.

      3) Maximum chalk rating of 8-inches in accordance with ASTM D659.

      4) No checking, crazing, adhesion loss.

5. Core: Thermoplastics.

C. Aluminum Extrusions:

1. Perimeter Extrusions: AA-6063-T5 alloy, perimeter extrusion shall have a mill finish.

2. Stiffeners: AA-6063-T5 alloy, stiffeners shall have a mill finish.

D. Flashings: Fabricate from 0.062-inch minimum thickness aluminum sheet. Where exposed to view, finish to match adjacent panels. Provide lap strip under flashing at abutted conditions; with lapped surfaces sealed with a full-bed of non-hardening sealant.

E. Fasteners:

1. Attachment of the panel system to the primary panel structural supports shall be made using a ELCO Textron, Inc. Drill-Flex Fastener or as recommended by panel fabricator.

2. Typical joinery shall be attached with concealed fasteners. When exposed fasteners are required in isolated conditions, the fastener shall be obscured in the panel joinery.

F. Sealants: ASTM C 920; elastomeric polyurethane or silicone sealant; of type, grade, class, and use classifications required to seal joints in metal composite material panels and remain weathertight; and as recommended in writing by metal composite material panel manufacturer.

2.03 FABRICATION

A. Fabricate panels to dimensions indicated. Allow for ambient temperature range at time of fabrication and erection.

B. Fabricate panels in sizes indicated using composite aluminum panel material and perimeter extrusion so that the panel thickness at the joinery is no more than 1-3/4-inches. Completed panel shall be properly fabricated and designed so that no restraints are placed on the panel, which might result in excessive compressive skin stresses. The installation detailing shall be such that the installed panels shall remain flat due to temperature changes. Oil canning of panel surface is not acceptable.

C. Shop-fabricate panels ready for installation.

D. Provide stiffeners secured to rear face of panels mechanically fastened to edge trim members, with spacing as required by wind loading.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions with installer present, for compliance with requirements for installation tolerances, composite panel supports, and other conditions affecting performance of the work.

1. Examine wall sheathing to verify sheathing joints are supported by framing or blocking and that installation is within flatness tolerances. Verify that air and water resistive barriers have been installed over sheathing.

B. Examine roughing-in for components and assemblies penetrating metal composite material panels to verify actual locations of penetrations relative to seam locations.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Install sub-framing, furring, and other miscellaneous panel support members and anchorages according to ASTM C754 and metal composite panel manufacturer’s written instructions.

3.03 INSTALLATION

A. Install panels in accordance with the manufacturer's printed instructions and the reviewed shop drawings.

B. Anchor metal composite material panels and other components securely in place, with provisions for thermal and structural movement.

1. Shim or otherwise plumb substrates receiving metal composite panels.

2. Flashing and seal metal composite panels at perimeter of all openings. Fasten with self-tapping screws.

3. Locate and space fastenings in uniform vertical and horizontal alignment.

4. Install flashing and trim as metal composite panel work proceeds.

5. Locate panel splices over, but not attached to, structural supports. Stagger panel splices and end laps to avoid a four-panel lap splice condition.

6. Align bottoms of metal composite panels and fasten with blind rivets, bolts, or self-tapping screws. Fasten flashings and trim around openings and similar elements with self-tapping screws.

C. Attach metal composite panels to supports at locations, spacings, and with fasteners recommended by manufacturer.

1. Install using systems standard assembly with vertical and horizontal continuous channels and flashings that provide support and secondary drainage at each panel and the base of the wall.

2. Install starter tracks and flashings prior to installing panels.

3. Install panels plumb and level in accordance with panel system shop drawings.

4. Do not apply sealants to joints unless otherwise indicated.

D. Installation Tolerances: Shim and align metal composite panels within an installed tolerance of 1/4-inch in 20-feet, non-accumulative, on level, plumb, and location lines as indicated and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

3.04 CLEAN-UP AND PROTECTION

A. Replace panels and other components damaged or deteriorated beyond repair by means of finish touch-up or similar minor repair procedures.

B. Remove temporary protective coverings and strippable films as each panel is installed. Upon completion of panel installation, clean finished surfaces as recommended by panel manufacturer and maintain in a clean condition.

END OF SECTION

SECTION 07 51 13.13

BUILT-UP ASPHALT ROOFING, COLD-APPLIED

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: Cold-applied, hybrid built-up asphalt roofing system on existing roof deck, including but not limited to:

1. Roof insulation.
2. Roof insulation cover board.
3. Roofing membrane ply sheets.
4. Roofing membrane cap sheet.
5. Base flashings.
6. Roof surfacing consisting of surfacer with aggregate surfacing.
7. Walkway material.

1.02 DEFINITIONS

A. Roofing Terminology: Refer to ASTM D1079 "Standard Terminology Relating to Roofing and Waterproofing" and glossary in applicable edition of NRCA's "The NRCA Roofing Manual: Membrane Roof Systems" for definition of terms related to roofing work in this Section.

1.03 PREINSTALLATION MEETINGS

A. Preinstallation Roofing Conference: Conduct conference at Project site.

1. Meet with the Owner’s Representative, Owner’s insurer if applicable, testing and inspecting agency representative, roofing Installer, roofing manufacturer's representative, and installers whose work interfaces with or affects roofing, including installers of roof accessories and roof-mounted equipment.
2. Review drawings and specifications.
3. Review methods and procedures related to roofing installation, including manufacturer's written instructions.
4. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
5. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect roofing.
6. Review governing regulations and requirements for insurance and certificates if applicable.

7. Review temporary protection requirements for roofing during and after installation.

8. Review roof observation and repair procedures after roofing installation.

1.04 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: For roofing system, include plans, elevations, sections, details, and attachments to other work. Provide roof plan showing orientation and types of roof deck, orientation of membrane roofing, and fastening spacings and patterns for mechanically fastened components.

1. Base flashings and built-up terminations. Indicate that details meet requirements of this Section.

2. Tapered insulation, including slopes.

3. Crickets, saddles, and tapered edge strips, including slopes.

4. Membrane fastening or adhesion requirements.

1.05 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer, Manufacturer, and Roofing Inspector.

1. Include letter from Manufacturer written for this Project indicating approval of Installer.

B. Manufacturer Certificates: Signed by roofing manufacturer certifying that built-up roofing complies with requirements specified in "Performance Requirements" Article.

1. Submit evidence of compliance of proposed roofing system with performance requirements, including UL listing certificate and energy performance.

2. Product Compatibility: Indicate manufacturer has verified compatibility of roofing system components, including but not limited to: Roofing membrane, flashing sheets, adhesives, and sealants.

C. Field Quality Control Reports: Reports of Roofing Inspector. Include weather conditions, description of work performed, tests performed, defective work observed, and Contractor's corrective actions taken to correct defective work.

D. Maintenance Data: To include in maintenance manuals.

E. Warranty.

1.06 QUALITY ASSURANCE

A. Installer Qualifications: An employer of workers trained and certified by manufacturer, including a full-time on-site supervisor with a minimum of five years' experience installing similar work, able to communicate verbally with Contractor, Owner’s Representative, and employees, and qualified by the manufacturer to furnish warranty of type specified.

B. Manufacturer Qualifications: Approved manufacturer with UL listed roofing systems comparable to those specified for this Project, with minimum five years' experience in manufacture of comparable products in successful use in similar applications, and able to furnish warranty with provisions matching specified requirements.

C. Roofing Inspector Qualifications: A technical representative of manufacturer, not engaged in the sale of products, and experienced in the installation and maintenance of the specified roofing system, qualified to perform roofing observation and inspection specified in Field Quality Control Article to determine Installer's compliance with the requirements of this Project, and approved by the manufacturer to issue warranty certification. The Roofing Inspector shall be one of the following:

1. An authorized full-time technical employee of the manufacturer.

D. Manufacturer's Installation Instructions: Obtain and maintain on-site manufacturer's written recommendations and instructions for installation of products.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver roofing materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, approval or listing agency markings, and directions for storing and mixing with other components.

B. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing manufacturer. Protect stored liquid material from direct sunlight.

1. Discard and legally dispose of liquid material that cannot be applied within its stated shelf life.

C. Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Store in a dry location. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.

D. Handle and store roofing materials and place equipment in a manner to avoid permanent deflection of deck.

1.08 PROJECT / FIELD CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit roofing to be installed according to manufacturer's written instructions and warranty requirements.

B. Daily Protection: Coordinate installation of roofing so insulation and other components of roofing system not permanently exposed are not subjected to precipitation or left uncovered at the end of the workday or when rain is forecast.

1. Provide tie-offs at end of each day's work to cover exposed roofing and insulation with a course of roofing sheet securely in place with joints and edges sealed.

2. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing.

3. Remove temporary plugs from roof drains at end of each day.

4. Remove and discard temporary seals before beginning work on adjoining roofing.

1.09 WARRANTY

A. Manufacturer's Warranty: Roof System Manufacturer's standard form in which Manufacturer agrees to repair or replace components of roofing system that fail in materials or workmanship within warranty period, as follows.

1. Form of Warranty: Manufacturer's standard warranty form.

2. Scope of Warranty: Work of this Section and including sheet metal details and termination details installed by the roof system Installer and approved by the Roof System Manufacturer.

3. Warranty Period: 20 years from date of Substantial Completion.

B. Manufacturer Inspection Services: By manufacturer's technical representative, to report maintenance responsibilities to Owner necessary for preservation of Owner’s warranty rights. The cost of manufacturer's inspections is included in the Contract Sum.

1. Inspections to occur in following years: 2, 5, 10, 15 following completion.

C. Installer Warranty: Installer's warranty signed by Installer, as follows.

1. Form of Warranty: Form acceptable to Roofing Manufacturer and Owner’s Representative.

2. Scope of Warranty: Work of this Section.

3. Warranty Period: 2 years from date of completion.

PART 2 - PRODUCTS

2.01 APPROVED MANUFACTURERS

A. Tremco, Inc. as specified or approved equal.

2.02 PERFORMANCE REQUIREMENTS

A. General Performance: Roofing shall withstand exposure to weather without failure or leaks due to defective manufacture or installation.

1. Accelerated Weathering: Roofing system shall withstand 2000 hours of exposure when tested according to ASTM G152, ASTM G154, or ASTM G155.

B. Exterior Fire-Test Exposure: ASTM E 108, Class A; for application and roof slopes indicated, as determined by testing identical membrane roofing materials by a qualified testing agency. Materials shall be identified with appropriate markings of applicable testing agency.

C. Fire-Resistance Ratings: Where indicated, provide fire-resistance-rated roof assemblies identical to those of assemblies tested for fire resistance per ASTM E 119 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.

D. Solar Reflectance Index: Not less than 78 when calculated according to ASTM E1980, based on testing identical products by a qualified testing agency.

2.03 MATERIALS, GENERAL

A. Material Compatibility: Roofing materials shall be compatible with one another and adjacent materials under conditions of service and application required, as demonstrated by roof membrane manufacturer based on testing and field experience.

B. FM Global Material Standards: Roofing, base flashings, and component materials shall be identical to materials that comply with requirements in FM Global 4470 as part of a roofing system listed or approved by FM Global. Identify applicable materials with FM Global markings.

2.04 ROOFING MEMBRANE MATERIALS

A. Ply Sheets:

1. SBS-modified asphalt coated composite polyester / fiberglass/fiberglass mat reinforced high tensile strength base sheet, ASTM D4601 Type II.

a. Basis of design product: Tremco, BURmastic Composite Ply HT.

b. Tensile Strength at 77-deg. F., minimum, ASTM D5147: Machine direction, 165-lbf/in; Cross machine direction, 150-lbf/in.

c. Tear Strength at 77-deg. F., minimum, ASTM D5147: Machine direction, 260-lbf; Cross machine direction, 230-lbf.

d. Thickness, minimum, ASTM D5147: 0.060-inch.

B. Cap Sheet:

1. SBS-modified asphalt-coated glass-fiber-reinforced sheet, granular surfaced, ASTM D6163 Type I Grade G.

a. Basis of design product: Tremco, POWERply Standard FR.

b. Exterior Fire-Test Exposure, ASTM E108: Class A.

c. Tensile Strength at 77-deg. F., minimum, ASTM D5147: Machine direction 80-lbf/in; Cross machine direction 75-lbf/in.

d. Tear Strength at 77-deg. F., minimum, ASTM D5147: Machine direction, 100-lbf; Cross machine direction 108-lbf.

e. Elongation at 77-deg. F., minimum, ASTM D5147: Machine direction 7-percent; Cross machine direction 8-percent.

f. Low Temperature Flex, maximum, ASTM D5147: -15 deg. F.

g. Thickness, minimum, ASTM D5147: 0.120-inch.

C. Membrane Flashing Backer Sheet:

1. SBS-modified asphalt coated composite polyester / fiberglass/fiberglass mat reinforced high tensile strength base sheet, ASTM D4601 Type II.

    a. Basis of Design Product: Tremco, BURmastic Composite Ply HT.

    b. Tensile Strength at 77-deg. F., minimum, ASTM D5147: Machine direction, 165-lbf/in; Cross machine direction, 150-lbf/in.

    c. Tear Strength at 77-deg. F., minimum, ASTM D5147: Machine direction, 260-lbf; Cross machine direction, 230-lbf.

    d. Thickness, minimum, ASTM D5147: 0.060-inch.

D. Membrane Flashing Sheets:

1. SBS/RET/Urethane-modified asphalt-coated polyester-reinforced sheet, white granular surfaced, fire-resistant, ASTM D6164 Type II Grade G.

    a. Basis of Design Product: Tremco, POWERply Endure 200 FR.

    b. Tensile Strength at 77-deg. F., minimum, ASTM D5147: Machine direction 130-lbf/in; Cross machine direction 110-lbf/in.

    c. Tear Strength at 77-deg. F., minimum, ASTM D5147: Machine direction, 160-lbf; Cross machine direction 140-lbf.

    d. Elongation at 77-deg. F., minimum, ASTM D5147: Machine direction 55-percent; Cross machine direction 60-percent.

    e. Low Temperature Flex, maximum, ASTM D5147: -25 deg. F.

    f. Thickness, minimum, ASTM D5147: 0.150-inch.

2.05 COLD-APPLIED ADHESIVE MATERIALS

A. General: Adhesive and sealant materials recommended by roofing manufacturer for intended use and compatible with built-up roofing.

1. Liquid-type auxiliary materials shall comply with VOC limits of authorities having jurisdiction.

2. Adhesives and sealants that are not on the exterior side of weather barrier shall comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):

    a. Plastic Foam Adhesives: 50 g/L.

    b. Nonmembrane Roof Sealants: 300 g/L.

    c. Sealant Primers for Nonporous Substrates: 250 g/L.

    d. Sealant Primers for Porous Substrates: 775 g/L.

B. Asphalt Primer:

1. Asphalt primer, water-based, polymer modified.

a. Basis of design product: Tremco, TREMprime WB.

b. Volatile Organic Compounds (VOC), maximum, ASTM D3960: 2 g/L.

c. Color: Brown/black.

C. Ply Sheet Adhesive:

1. Cold-applied roofing adhesive and surfacer, one-part, formulated for compatibility and use with specified roofing membranes and flashings.

a. Basis of design product: Tremco, POWERply STD Cold Adhesive.

b. Volatile Organic Compounds (VOC), maximum, ASTM D6511: 250 g/L.

c. Nonvolatile Content, minimum, ASTM D6511: 72-percent.

D. Cap Sheet Adhesive:

1. Cold-applied roofing adhesive and surfacer, one-part, formulated for compatibility and use with specified roofing membranes and flashings.

a. Basis of design product: Tremco, POWERply Standard Cold Adhesive.

b. Volatile Organic Compounds (VOC), maximum, ASTM D6511: 250 g/L.

c. Nonvolatile Content, minimum, ASTM D6511: 72-percent.

d. Flash Point, minimum, ASTM D93: 100-deg F.

E. Flashing Backer Sheet Adhesive:

1. Roof Cement, Asphalt-Based: ASTM D4586, Type II, Class I, fibrated roof cement formulated for use in installation and repair of asphalt ply and modified bitumen roofing plies and flashings; UL-classified for fire resistance.

a. Basis of design product: Tremco, ELS.

b. Volatile Organic Compounds (VOC), maximum, ASTM D3960: 190 g/L.

c. Non-Volatile Matter, ASTM D4586: 85-percent.

d. Resistance to sag ASTM D4586: 1/8-in.

F. Flashing Sheet Adhesive:

1. Cold-applied bio-based low odor urethane roofing adhesive, two-part, USDA BioPreferred, formulated for compatibility and use with specified roofing membranes and flashings.

a. Basis of design product: Tremco, ELS Mastic.

b. Volatile Organic Compounds (VOC), maximum, ASTM D3690: 0 g/L.

c. Low Temperature Flexibility, ASTM D2240: Pass at -30 deg F.

d. Solids, by Volume, ASTM D2697: 100-percent.

e. Biobase Content, Minimum, ASTM D6866: 70-percent.

G. Mastic Sealant: Polyisobutylene, plain or modified bitumen, non-hardening, non-migrating, non-skinning, and non-drying.

1. Roofing Mastic, Low-Volatile: Modified asphalt elastomeric roof mastic, one-part, trowel-grade, formulated for compatibility and use with specified roofing membranes and flashings.

a. Basis of design product: Tremco, POLYroof LV.

b. Volatile Organic Compounds (VOC), maximum, ASTM D3960: 300 g/L.

c. Elongation at -30 deg. F., minimum, ASTM D412: 100-percent.

d. Tensile strength at 77 deg F., ASTM D412: 30-psi.

e. Flexibility at -40 deg. F., ASTM D3111: No cracking.

f. Nonvolatile matter, ASTM D4586: 70-percent.

2.06 AUXILIARY BUILT-UP ROOFING MATERIALS

A. General: Auxiliary materials recommended by roofing system manufacturer for intended use and compatible with roofing membrane.

B. Stripping Reinforcing Fabric:

1. Woven Glass Fiber Mesh, Vinyl-Coated: Non-shrinking, non-rotting, vinyl-coated woven glass mesh for reinforcing flashing seams, membrane laps, and other roof system detailing.

a. Basis of design product: Tremco, BURmesh.

b. Tensile strength, 70 deg. F, min ASTM D146: Warp, 65-lbf/in; fill, 75-lbf/in.

c. Color: Aqua green.

C. Joint Sealant: Elastomeric joint sealant compatible with roofing materials, with movement capability appropriate for application.

1. Joint Sealant, Polyurethane: ASTM C920, Type S, Grade NS, Class 50 single-component moisture curing sealant, formulated for compatibility and use in dynamic and static joints; paintable.

a. Basis of design product: Tremco, TremSEAL Pro.

b. Volatile Organic Compounds (VOC), maximum, ASTM D3960: 40 g/L.

c. Hardness, Shore A, ASTM C661: 40.

d. Adhesion to Concrete, ASTM C794: 35-pli.

e. Tensile Strength, ASTM D412: 350-psi.

f. Color: White.

D. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening built-up roofing components to substrate, tested by manufacturer for required pullout strength, and acceptable to roofing manufacturer.

E. Metal Flashing Sheet: As specified in Section 07 62 00.

F. Miscellaneous Accessories: Provide miscellaneous accessories recommended by built-up roofing manufacturer.

2.07 SUBSTRATE BOARDS

A. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Global 4470, designed for fastening substrate board to roof deck.

2.08 ROOF INSULATION MATERIALS

A. Roofing Insulation, General: Preformed roof insulation boards manufactured or approved by roofing manufacturer, selected from manufacturer's standard sizes suitable for application, of thicknesses indicated

1. Provide preformed saddles, crickets, tapered edge strips, and other insulation shapes where indicated for sloping to drain. Fabricate to slopes indicated.

B. Roof Insulation:

1. Polyisocyanurate board insulation, ASTM C1289 Type II Class 1 CFC- and HCFC- free, with recycled content glass-fiber mat facer on both major surfaces.

a. Basis of design product: Tremco, Trisotech Insulation.

b. Compressive Strength, ASTM C1621: Grade 2: 20-psi.

c. Conditioned Thermal Resistance at 75 deg. F: 14.4- at 2.5-inches thick.

2.09 ROOF INSULATION ACCESSORIES

A. Insulation Cover Board:

1. Glass-mat-faced gypsum panel, primed, ASTM C1177.

a. Basis of design product: Tremco/GP Gypsum DensDeck Prime.

b. Thickness: ½-inch.

B. Insulation Adhesive:

1. Cold fluid-applied bead-applied low-rise adhesive, two-component solvent-free low odor elastomeric urethane, formulated to adhere roof insulation to substrate.

a. Basis of design product: Tremco, Low Rise Foam Insulation Adhesive.

b. Flame Spread Index, ASTM E84: 10.

c. Smoke Developed Index, ASTM E84: 30.

d. Volatile Organic Compounds (VOC), maximum, ASTM D3960: 0 g/L.

e. Tensile Strength, minimum, ASTM D412: 250-psi.

f. Peel Adhesion, minimum, ASTM D903: 17-lbf/in.

g. Flexibility, 70-deg. F, ASTM D816: Pass.

C. Insulation Cant Strips: ASTM C 208, Type II, Grade 1, cellulosic-fiber insulation board.

D. Wood Cant Strips: Comply with requirements in Section 06 10 53.

E. Substrate Joint Tape: 6- or 8-inch-wide, coated, glass fiber.

2.10 SURFACING

A. Cold-Applied Adhesive Surfacer:

1. Cold-applied roofing surfacing adhesive, one-part white solar reflective low-volatile polymeric, formulated for compatibility and use with specified roofing membranes and flashings.

a. Basis of design product: Tremco, Rock-It Adhesive.

b. Volatile Organic Compounds (VOC), maximum, ASTM D6511: 250 g/L.

c. Nonvolatile content, minimum ASTM D6511: 70-percent.

B. Aggregate Surfacing Material:

1. Aggregate Stone Surfacing, White Marble: Highly reflective white marble aggregate, meeting sustainable design SRI requirements when applied in conjunction with manufacturer's specially formulated adhesive.

a. Basis of design product: Tremco, Tremco/A-1 Grit Snow White Marble Roofing Aggregate.

b. Size: 3/8-inch.

c. Hardness: 5.0 Mohs.

d. Specific gravity: 2.75.

e. Color: White.

f. Solar Reflectance Index (SRI), adhesive plus gravel, ASTM E1980: 86.

g. Aggregate application rate, average: 200-lb/100 sq ft.

2.11 WALKWAYS

A. Walkway Material:

1. Walkway pads, ceramic-granule-surfaced reinforced asphaltic composition slip-resisting pads, manufactured as a traffic pad for foot traffic, ½-inch thick minimum.

a. Basis of design product: Tremco, Trem-Tred.

b. Flexural Strength at max. load, minimum, ASTM C203: 218-psi.

c. Granule adhesion (weight loss), maximum, ASTM D4977: 1.1-gram.

d. Impact Resistance at 77-deg. F, ASTM D3746: No Damage to Roof.

e. Pad Size: 36 by 48 inch.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with the following requirements and other conditions affecting performance of roofing system:

1. Verify that roof openings and penetrations are in place and curbs are set and braced and that roof drain bodies are securely clamped in place.

2. Existing Prepared Roof Substrate: Verify that existing insulation and substrate is sound and dry.

3. Concrete Roof Deck:

a. Verify that minimum concrete drying period recommended by roofing manufacturer has passed.

b. Verify that concrete substrate is visibly dry and free of moisture.

c. Moisture Test: Verify that concrete substrate is visibly dry and free of moisture, and that minimum concrete internal relative humidity is not more than 75-percent, or as recommended by roofing system manufacturer, when tested according to ASTM F2170.

1) Test Frequency: One test probe per each 1000-sq ft or portion thereof, of roof deck, with no fewer than three test probes.

d. Verify that concrete curing compounds that will impair adhesion of roofing components to roof deck have been removed.

4. Verify that deck is securely fastened with no projecting fasteners and with no adjacent units exceeding 1/16-inch out of plane relative to adjoining deck.

5. Verify that existing substrate is sound and dry.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Clean substrate of dust, debris, moisture, and other substances detrimental to roofing installation according to roofing manufacturer's written instructions. Remove sharp projections.

B. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction. Remove roof-drain plugs when no work is taking place or when rain is forecast.

C. Concrete Surface Priming: Prime surface of concrete deck with asphalt primer at rate required by manufacturer and allow primer to dry.

3.03 INSTALLATION, GENERAL

A. Install roofing system in accordance with manufacturer’s written instructions, approved shop drawings, and Contract Documents.

3.04 ROOFING INSTALLATION DETAILS

A. NRCA Installation Details: Install roofing system in accordance with applicable NRCA Manual Plates and NRCA recommendations; modify as required to comply with manufacturer's approved details.

3.05 INSULATION INSTALLATION

A. Comply with built-up roofing manufacturer's written instructions for installing roof insulation.

B. Coordinate installing membrane roofing system components so insulation is not exposed to precipitation or left exposed at the end of the workday.

C. Cant Strips: Install and secure preformed 45-degree cant strips at junctures of built-up roofing with vertical surfaces or angle changes greater than 45 degrees.

D. Tapered Insulation and Crickets: Install tapered insulation under area of roofing to conform to slopes indicated.

1. Where crickets are indicated or required to provide positive slope to drain, make slope of crickets minimum of two times the roof slope and not less than ¼-inch in 12-inches.

E. Install insulation with long joints of insulation in a continuous straight line with end joints staggered between rows, abutting edges and ends between boards. Fill gaps exceeding ¼-inch with insulation.

1. Cut and fit insulation within ¼-inch of nailers, projections, and penetrations.

F. Install insulation under area of roofing to achieve required thickness. Where overall insulation thickness is 2.7-inches or greater, install two or more layers with joints of each succeeding layer staggered from joints of previous layer a minimum of 6-inches in each direction.

1. Insulation Drain Sumps: Tapered insulation sumps, not less than 2- by 2-feet, sloped to roof drain, with a minimum insulation thickness of not less than one inch less than the Project-stipulated continuous insulation thickness based upon code requirements.

G. Trim surface of insulation where necessary at roof drains so completed surface is flush and does not restrict flow of water.

H. Install tapered edge strips at perimeter edges of roof that do not terminate at vertical surfaces.

I. Adhered Insulation Application Method: Install each layer of insulation and adhere to substrate as follows:

1. Prime substrate with primer as recommended by manufacturer and allow to dry.

2. Set each layer of insulation in ribbons of bead-applied insulation adhesive, firmly pressing and maintaining insulation in place.

J. Adhered Insulation Application Method: Install first layer of insulation to deck using bead applied insulation adhesive, firmly pressing and maintaining insulation in place.

1. Set each subsequent layer of insulation in ribbons of bead-applied insulation adhesive, firmly pressing and maintaining insulation in place.

K. Cover Board Installation: Install cover boards over insulation with long joints in continuous straight lines with end joints staggered between rows. Offset joints of insulation below a minimum of 6-inches in each direction. Loosely butt cover boards together. Tape joints if required by roofing manufacturer.

1. Set cover board in ribbons of bead-applied insulation adhesive, firmly pressing and maintaining cover in place.

3.06 COLD-APPLIED BUILT-UP ROOFING INSTALLATION, GENERAL

A. Install roofing membrane system according to roofing system manufacturer's written instructions and applicable recommendations in NRCA's "Quality Control Guidelines for the Application of Polymer Modified Bitumen Roofing" and as follows:

1. Number of Ply Sheets: Two.

a. Adhering Method: Cold-applied adhesive.

2. Mineral-granule-surfaced cap sheet in addition to number of ply sheets specified.

a. Adhering Method: Cold-applied adhesive.

3. Surfacing Type: A (aggregate).

B. Start installation of built-up roofing in presence of manufacturer's technical personnel.

C. Cooperate with testing agencies and personnel engaged or required to perform services for installing roofing.

D. Coordinate installation of roofing system so insulation and other components of the roofing membrane system not permanently exposed are not subjected to precipitation or left uncovered at the end of the workday or when rain is forecast.

1. Provide tie-offs at end of each day's work configured as recommended by NRCA Roofing Manual Appendix: Quality Control Guidelines - Insulation to protect new and existing roofing.

2. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing.

3. Remove temporary plugs from roof drains at end of each day.

4. Remove and discard temporary seals before beginning work on adjoining roofing.

E. Substrate-Joint Penetrations: Prevent roofing asphalt and adhesives from penetrating substrate joints, entering building, or damaging built-up roofing components or adjacent building construction.

3.07 ROOFING MEMBRANE INSTALLATION

A. Ply Sheets: Install ply sheets starting at low point of roofing. Align ply sheets without stretching. Shingle side laps of ply sheets uniformly to achieve required number of plies throughout thickness of roofing membrane. Shingle in direction to shed water. Extend ply sheets over and terminate beyond cants.

1. Embed each ply sheet in cold-applied membrane adhesive applied at rate required by roofing manufacturer, to form a uniform membrane without ply sheets touching.

B. Cap Sheet: Install lapped cap sheet starting at low point of roofing. Offset laps from laps of preceding ply sheets and align cap sheet without stretching. Lap in direction to shed water. Extend cap sheet over and terminate beyond cants.

1. Embed each ply sheet in in cold-applied ply sheet adhesive applied at rate required by roofing manufacturer, to form a uniform membrane without ply sheets touching.

3.08 FLASHING AND STRIPPING INSTALLATION

A. Install base flashing over cant strips and other sloping and vertical surfaces, at roof edges, and at penetrations through roof, and secure to substrates according to built-up roofing manufacturer's written instructions and as follows:

1. Extend base flashing up walls or parapets a minimum of 12-inches above built-up roofing and 6-inches onto field of built-up roofing.

2. Prime substrates with asphalt primer if required by built-up roofing manufacturer.

3. Backer Sheet Application: Adhere backer sheet to substrate in cold-applied flashing sheet adhesive.

4. Flashing Sheet Application: Adhere flashing sheet to substrate in cold-applied adhesive. Apply cold-applied flashing sheet adhesive to back of flashing sheet if recommended by roofing manufacturer. Mechanically fasten top of base flashing securely at terminations and perimeter of roofing.

a. Flashing Sheet Top Termination: Mechanically fasten top of base flashing securely at terminations and perimeter of roofing.

1) Seal top termination of base flashing with a strip of glass-fiber fabric set in asphalt roofing cement.

b. Flashing Sheet Bottom Termination: Adhere flashing sheet to roofing membrane in continuous bed of cold-applied adhesive.

1) Bituminous Flashing: Seal bottom termination of base flashing by adhering to roofing membrane and stripping flashing to membrane joint.

B. Install stripping, according to roofing manufacturer's written instructions, where metal flanges and edgings are set on built-up roofing.

C. Roof Drains: Set 30-by-30-inch metal flashing in bed of asphalt roofing cement on completed built-up roofing. Cover metal flashing with built-up roofing cap-sheet stripping and extend a minimum of 6-inches beyond edge of metal flashing onto field of built-up roofing. Clamp built-up roofing, metal flashing, and stripping into roof-drain clamping ring.

1. Install flashing sheet stripping according to roofing manufacturer's written instructions.

3.09 SURFACING AND COATING INSTALLATION

A. Flood Coat and Aggregate Surfacing: Promptly after installing and testing roofing membrane, base flashing, and stripping, flood-coat roof surface with cold-applied adhesive surfacing adhesive applied at rate required by roofing manufacturer.

1. While adhesive coating is fluid, cast aggregate surfacing in a uniform application at the average weight indicated in Part 2 product listing.

3.10 WALKWAY INSTALLATION

A. Walkways, General: Install walkways according to roofing manufacturer's written instructions.

1. Install walkways at following locations:

a. Where indicated on Drawings.

b. Perimeter of each rooftop unit.

c. Between each rooftop unit location, creating a continuous path connecting rooftop unit locations.

d. Between each roof hatch and each rooftop unit location or path connecting rooftop unit locations.

e. Top and bottom of each roof access ladder.

f. Between each roof access ladder and each rooftop unit location or path connecting rooftop unit locations.

B. Walkway Pads: Install walkway pads using units of size indicated or, if not indicated, of manufacturer's standard size according to walkway pad manufacturer's written instructions.

1. Sweep away loose aggregate surfacing.

2. Set walkway pads in cold-applied adhesive.

C. Walkway Cap Sheet Strips: Install cap sheet strips, approximately 36-inches wide and in lengths not exceeding 10-feet, leaving a space of 6-inches between strips. Install roofing membrane walkway cap sheet strips over roofing membrane in cold-applied adhesive.

3.11 FIELD QUALITY CONTROL

A. Roofing Inspector: Owner will engage a qualified roofing inspector to perform roof tests and inspections and to prepare test reports.

B. Roofing Inspector: Contractor shall engage a qualified roofing inspector for a minimum of 2 days per week to perform roof tests and inspections and to prepare start up, interim, and final reports. Roofing Inspector's quality assurance inspections shall comply with criteria established in NRCA's "Quality Control and Quality-assurance Guidelines for the Application of Membrane Roofing Systems."

C. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation at commencement and upon completion.

1. Notify Owner’s Representative 48-hours in advance of date and time of inspection.

D. Repair or remove and replace components of built-up roofing where test results or inspections indicate that they do not comply with specified requirements.

1. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.12 PROTECTING AND CLEANING

A. Protect built-up roofing from damage and wear during remainder of construction period. When remaining construction will not affect or endanger roofing, inspect roofing for deterioration and damage, describing its nature and extent in a written report, with copies to University’s Representative.

B. Correct deficiencies in or remove built-up roofing that does not comply with requirements, repair substrates, and repair or reinstall roofing to a condition free of damage and deterioration at time of Substantial Completion and according to warranty requirements.

C. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION

SECTION 07 62 00

SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.01 DESCRIPTION

A. This Section describes the requirements for furnishing and installing flashing and sheet metal.

1.02 PERFORMANCE REQUIREMENTS

A. General: Sheet metal flashing and trim assemblies shall withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation or other defects. Completed sheet metal flashing and trim shall not rattle, leak, or loosen and shall remain watertight.

B. Fabricate and install roof edge flashing and copings capable of resisting forces required by the California Building Code (CBC) according to recommendations in FMG Loss Prevention Data Sheet 1-49.

C. Thermal Movements: Provide sheet metal flashing and trim that allows for thermal movements from ambient and surface temperature changes of 120-deg. F. ambient and 180-deg. F. material surfaces.

1.03 SUBMITTAL

A. Product Data: Manufacturer's product data, installation instructions and general recommendations for each specified sheet material and fabricated product. Include construction details, material descriptions, dimension of components and profiles, and finishes for each manufactured product or accessory.

B. Samples: 8-inch square samples of specified sheet materials to be exposed as finished surfaces.

C. Shop Drawings: Show fabrication and installation layouts of sheet metal flashing and trim, including plans, elevations, and details. Distinguish between shop- and field-assembled work. Include the following:

1. Identification of material, thickness, weight, and finish for each item and location.

2. Details of forming sheet metal flashing and trim, including profiles, shapes, seams, and dimensions.

3. Details for joining, supporting, and securing sheet metal flashing and trim, including layout of fasteners, cleats, clips and other attachments. Include pattern of seams.

4. Details of termination points and assemblies, including fixed points.

5. Details of edge conditions, including eaves, ridges, valleys, rakes, crickets, and counterflashings, as applicable.

6. Details of special conditions.

7. Details of connections to adjoining work.

D. Warranty.

1.04 QUALITY ASSURANCE

A. Fabricator Qualifications: Shop that employs skilled workers who custom fabricate sheet metal flashing and trim like that required for this Project and whose products have a record of successful in-service performance.

B. Sheet Metal Flashing and Trim Standard: Comply with SMACNA “Architectural Sheet Metal Manual” unless more stringent requirements are indicated or specified.

C. Pre-installation Conference: Conduct conference at Project site.

1. Meet with Owner, Architect, Owner’s insurer, installer and installer whose work interfaces with or affects sheet metal flashing and trim including installers of roofing materials, roof accessories, skylights, and roof-mounted equipment.

2. Review methods and procedures related to sheet metal flashing and trim.

3. Examine substrate conditions for compliance with requirements, including flatness and attachment to structural members.

4. Review special roof details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect sheet metal flashing and trim.

5. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.

1.05 DELIVERY, STORAGE AND HANDLING

A. Do not store sheet metal flashing and trim materials in contact with other materials that might cause staining, denting or other surface damage. Store sheet metal flashing and trim materials away from uncured concrete and masonry.

B. Protect strippable protective covering on sheet metal flashing and trim from exposure to sunlight and high humidity, except to the extent required for the period of sheet metal flashing and trim installation.

1.06 WARRANTY

A. Special Warranty on Finishes: Warrant factory-applied finish that shows evidence of deterioration within 20-years from date of Substantial Completion. Deterioration includes, but is not limited to, the following:

1. Color fading more than 5 Hunter units when tested according to ASTM D2244.

2. Chalking exceeding a No. 8 rating when tested according to ASTM D4214.

3. Cracking, checking, peeling, or failure paint to adhere to bare metal.

B. This warranty shall be in addition to and not a limitation of other rights the Owner may have against the Contractor under the Contract Documents.

PART 2 - PRODUCTS

2.01 SHEET METALS

A. General: Protect mechanical and other finishes on exposed surfaces from damage by applying a strippable, temporary protective film before shipping.

B. Sheet Metal Thickness: The following table may be used to covert specified sheet metal thickness to gauges. Not all materials will be used in the Project.

Gauge No.	Aluminum	Stainless steel	Zinc-Tin Coated Stainless Steel	Galvanized	Aluminum-Zinc Coated Steel	Zinc

12	---	---	---	---	---	.028”
13	---	---	---	---	---	.032”
14	---	---	---	---	---	.036”
15	---	---	---	---	---	.040”
16	.063”	.063”	---	.064”	.064”	.045”
18	.050”	.050”	---	.052”	.052”	.055”
20	.040”	.038”	---	.040”	.040”	.070”
22	.034”	.031”	---	.034”	.034”	.090”
23	.032”	.028”	---	.031”	.031”	.100”
24	.028”	.025”	---	.028”	.028”	.125”
25	.024”	.022”	.024”	.025”	.025”	---
26	.022”	.019”	.018”	.022”	.022”	---
28	---	.016”	.015”	.019”	.019”	---

C. Metallic-Coated Steel Sheet: Restricted flatness steel sheet, metallic coated by the hot-dip process.

1. Zinc-Coated (Galvanized) Steel Sheet: ASTM A653, G90 coating designation; structural quality.

2. Surface: Smooth, flat and mill phosphatized for field painting as specified in Section 09 91 00.

3. Exposed Coil-Coated Finish: Three coat fluoropolymer finish containing not less than 70-percent PVDF resin by weight in both color coat and clear topcoat, complying with AAMA 621. Custom color to match color sample furnished by the Architect, including mica and metallic finishes. Concealed surfaces may be finished with manufacturers light-colored acrylic or polyester backer finish applied to a dry film thickness of 0.5 mil. Provide for flashings exposed to view where indicated as prefinished.

D. Stainless Steel Sheet: ASTM A240 or ASTM A666, Type 304, dead soft, fully annealed, 2D finish, smooth flat surface. Provide for flashings in contact with the ground and where indicated.

2.02 UNDERLAYMENT MATERIALS

A. Self-Adhering, High-Temperature Sheet Flashing: As specified in Section 07 56 26.

2.03 MISCELLANEOUS

A. General: Provide materials and types of fasteners, solder, welding rods, protective coatings, separators, sealants and other miscellaneous items as required for complete sheet metal flashing and trim installation.

B. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts and other suitable fasteners designed to withstand design loads and recommended by manufacturer.

1. General: Blind fasteners or self-drilling screws, gasketed, with hex-washer head.

a. Exposed Fasteners: Heads matching color of sheet metal using plastic caps or factory-applied coating.

b. Blind Fasteners: High-strength aluminum or stainless steel rivets suitable for metal being fastened.

2. Fasteners for Zinc-Coated (Galvanized) Steel Sheet: Hot-dip galvanized steel according to ASTM A153 or ASTM F2329 or Series 300 stainless steel.

3. Fasteners for Stainless Steel Sheet: Series 300 stainless steel.

C. Solder:

1. For Zinc-Coated (Galvanized) Steel: ASTM B32, Grade Sn50, 50-percent tin and 50-percent lead or Grade Sn60, 60-percent tin and 40-percent lead.

2. For Stainless Steel: ASTM B32, Grade Sn60, with an acid flux of type recommended by stainless steel sheet manufacturer.

D. Sealant Tape: Pressure-sensitive, 100-percent solids, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, non-sag, non-toxic, non-staining tape 1/2-inch wide and 1/8-inch thick.

E. Elastomeric Sealant: ASTM C920, elastomeric polyurethane, polysulfide or silicone polymer sealant; low modulus; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.

F. Butyl Sealant: ASTM C1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked-type expansion joints with limited movement.

G. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D1187.

H. Asphalt Roofing Cement: ASTM D4586, asbestos free, of consistency required for application.

2.04 MANUFACTURED SHEET METAL FLASHING AND TRIM

A. Reglets: Cheney Flashing Company, Fry Reglet Corporation, Hohmann & Barnard, Inc., Keystone Flashing Company, Inc. or approved equal. Form to provide secure interlocking of separate reglet and counterflashing pieces, compatible with flashing material. Provide factory-mitered and -welded corners and junctions and interlocking counterflashing on exterior face of same metal as reglet.

1. Material: 0.022-inch galvanized steel.

2. Surface-Mounted Type: Provide with slotted holes for fastening to substrate, with neoprene or other suitable weatherproofing washers and with channel for sealant at top edge.

3. Stucco Type: Provide with upturned fastening flange and extension leg of length to match thickness of applied finish materials.

4. Concrete Type: Provide temporary closure tape to keep reglet free of concrete materials, special fasteners for attaching reglet to concrete forms, and guides to ensure alignment of reglet section ends.

5. Masonry Type: Provide with offset top flange for embedment in masonry mortar joint.

6. Provide counterflashing wind-resistant clips to be installed before counterflashing to prevent wind uplift of counterflashing lower edge.

2.05 FABRICATION, GENERAL

A. General: Custom fabricate sheet metal flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, geometry, metal thickness and other characteristics. Fabricate items at the shop to the greatest extent possible.

1. Fabricate sheet metal flashing and trim in thickness or weight required to comply with performance requirements, but not less than that specified for each application and metal.

2. Obtain field measurements for accurate fit before shop fabrication.

3. Form sheet metal flashing and trim without excessive oil canning, buckling, and tool marks and true to line and levels, with exposed edges folded back to form hems.

4. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces exposed to view.

B. Fabrication Tolerances: Fabricate sheet metal flashing and trim that is capable of installation to a tolerance of 1/4-inch in 20-feet on slope and location lines and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

C. Sealed Joints: Form non-expansion but movable joints in metal to accommodate elastomeric sealant.

D. Expansion Provisions: Where lapped expansion provisions cannot be used, form expansion joints of intermeshing hooked flanges, not less than 1-inch deep, filled with butyl sealant concealed within joints.

E. Fabricate cleats and attachment devices from same material as accessory being anchored or form compatible, non-corrosive metal. Fabricate of sizes as recommended by SMACNA's "Architectural Sheet Metal Manual" and FMG Loss Prevention Data Sheet 1-49 for application, but not less than thickness of metal being secured.

F. Seams: Fabricate non-moving seams with flat-lock seams. Form seams and seal with elastomeric sealant. Rivet joints where required for strength.

2.06 LOW SLOPE ROOF SHEET METAL FABRICATIONS

A. Copings: Fabricate in minimum 96-inch long, but not exceeding 10-foot long sections. Fabricate joint plates of same thickness as copings. Furnish with continuous cleats to support edge of external leg and interior leg. Miter corners, seal, and solder or weld watertight.

1. Profile: As indicated.

2. Joint Style: Butt with 12-inch wide concealed backup plate and 6-inch wide exposed cover plates.

3. Fabricate from the following material:

Material	Thickness
Galvanized Steel	0.040"

B. Counterflashing: Fabricate from the following material:

Material	Thickness
Galvanized Steel	0.028"

C. Roof Penetration Flashing: Fabricate from the following material:

Material	Thickness
Galvanized Steel	0.028"

2.07 MISCELLANEOUS SHEET METAL FABRICATIONS

A. Equipment Support Flashing: Fabricate from the following material:

Material	Thickness
Galvanized Steel	0.028"

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions with installer present, to verify actual locations, dimensions and other conditions affecting performance of the work.

1. Verify compliance with requirements for installation tolerances of substrates.

2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.

B. For the record, prepare written report, endorsed by installer, listing conditions detrimental to performance of the work.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 UNDERLAYMENT INSTALLATION

A. Self-adhering Sheet Underlayment: Install as specified in Section 07 65 26.

3.03 INSTALLATION

A. General: Anchor sheet metal flashing and trim and other components securely in place, with provisions for thermal and structural movement. Use fasteners, solder, welding rods, protective coatings, separators, sealants and other miscellaneous items as required to complete sheet metal flashing and trim.

1. Install sheet metal flashing and trim true to line and levels indicated. Provide uniform, neat seams with minimum exposure of solder, welds, and sealant.

2. Install sheet metal flashing and trim to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.

3. Space cleats not more than 12-inches apart. Anchor each cleat with two fasteners, Bend tabs over fasteners.

4. Install exposed sheet metal flashing and trim without excessive oil canning, buckling, and tool marks.

5. Install sealant tape where indicated and required for a watertight installation.

6. Torch cutting of sheet metal flashing and trim is not permitted.

7. Do not use graphite pencils to mark metal surfaces.

B. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating or by other permanent separation as recommended by SMACNA.

1. Underlayment: Where installing metal flashing directly on cementitious or wood substrates, install a course of felt underlayment and cover with a slip sheet or install a course of polyethylene sheet.

C. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10-feet with no joints allowed within 24-inches of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently watertight, form expansion joints of intermeshing hooked flanges, not less than 1-inch deep, filled with sealant concealed within joints.

D. Seal joints as required for watertight construction.

1. Where sealant-filled joints are used, embed hooked flanges of joint members not less than 1-inch into sealant. Form joints to completely conceal sealant. When ambient temperature at time of installation is moderate, between 40- and 70-deg. F., set joint members for 50-percent movement each way. Adjust setting proportionately for installation at higher ambient temperatures. Do not install sealant type joints at temperatures below 40-deg. F.

2. Prepare joints and apply sealants to comply with requirements specified in Section 07 92 00.

E. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter. Pre-tin edges of sheets to be soldered to a width of 1-1/2-inches, except reduce pre-tinning where pre-tinned surface would show in completed work.

1. Do not solder prefinished galvanized steel flashing.

2. Do not use torches for soldering. Heat surfaces to receive solder and flow solder into joint. Fill joint completely. Remove flux and spatter from exposed surfaces.

3.04 ROOF FLASHING INSTALLATION

A. General: Install sheet metal flashing and trim to comply with performance requirements, sheet metal manufacturer's written instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, set units true to line, and level. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.

B. Copings: Anchor to resist uplift and outward forces according to recommendations in FMG Loss Prevention Data Sheet 1-49 for required wind pressures.

1. Interlock exterior bottom edge of coping with continuous cleat anchored to substrate.

2. Anchor interior leg of coping with screw fasteners and washers at 24-inch centers.

C. Pipe or Post Counterflashing: Install counterflashing umbrella with close-fitting collar with top edge flared for elastomeric sealant, extending a minimum of 4-inches over base flashing. Install stainless steel draw band and tighten.

D. Counterflashing: Coordinate installation of counterflashing with installation of base flashing. Insert counterflashing in reglets or receivers and fit tightly to base flashing. Extend counterflashing 4-inches over base flashing. Lap counterflashing joints a minimum of 4-inches and bed with sealant. Secure in a waterproof manner by means of snap-in installation and sealant or lead wedges and sealant.

E. Roof Penetration Flashing: Coordinate installation of roof penetration flashing with installation of roofing and other items penetrating roof. Seal with elastomeric or butyl sealant and clamp flashing to pipes that penetrate roof.

3.05 MISCELLANEOUS FLASHING INSTALLATION

A. Equipment Support Flashing: Coordinate installation of equipment support flashing with installation of roofing and equipment. Weld or seal flashing with elastomeric sealant to equipment support member.

3.06 INSTALLATION TOLERANCES

A. Installation Tolerances: Shim and align sheet metal flashing and trim within installed tolerance of 1/4-inch in 20-feet on slope and location lines as indicated and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

3.07 CLEANING AND PROTECTION

A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.

B. Clean and neutralize flux materials. Clean off excess solder.

C. Clean off excess sealants.

D. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed. On completion of installation, remove unused materials and clean finished surfaces. Maintain in a clean condition during construction.

E. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION

SECTION 07 65 26

SELF-ADHERING SHEET FLASHING

PART 1 - GENERAL

1.01 DESCRIPTION

A. This Section describes the requirements for furnishing and installation modified bituminous sheet flashing material under metal flashings and where indicated.

1.02 SUBMITTALS

A. Product Data: Furnish manufacturer's standard product data sheets and installation recommendations and instructions. Include written instructions for evaluating, preparing and treating substrates as well as technical data including tested physical and performance properties.

B. Installer qualifications.

1.03 QUALITY ASSURANCE

A. Installer: Certified or approved by the self-adhering sheet flashing manufacturer to install the specified products with a minimum of 5-years' continuous experience installing the specified materials.

1.04 JOB CONDITIONS

A. Apply flexible flashings in fair weather at temperatures of 40-degrees F. and above.

B. Provide adequate ventilation of enclosed spaces where primer is used.

1.05 DELIVERY, STORAGE AND HANDLING

A. Store materials in their original, sealed packages, labeled with manufacturer's name, product brand name and type, date of manufacture, lot number, and directions for storing.

B. Store materials in clean, dry and protected location and within temperature range required by the manufacturer. Protect stored materials from direct sunlight.

C. Remove and replace materials that cannot be applied within stated shelf life.

PART 2 - PRODUCTS

2.01 APPROVED MANUFACTURERS

A. Henry / Fortifiber Corporation ""FortiFlash 40 mil Waterproof Flashing", GCP Applied Technologies "Ultra", Carlisle Coatings & Waterproofing Inc. "CCW WIP 300HT", Henry Company "Blueskin PE200 HT", Owens Corning "WeatherLock Metal High Temperature Underlayment" or approved equal.

2.02 MATERIALS

A. Self-Adhering Sheet Flashing: 40-mil thick consisting of slip-resisting polyethylene-film top surface laminated to layer of butyl or SBS-modified asphalt adhesive, with release-paper backing; cold applied.

1. Thermal Stability, ASTM D1970: Stable after testing at 240-deg. F.

2. Low Temperature Flexibility, ASTM D1970: Passes after testing at minus 20-deg. F.

3. Water Vapor Permeance: <.05 perms 40-Mil (waterproof); ASTM F1249.

4. Water Resistance: 200 hours (waterproof); ASTM D779.

B. Primer: As recommended by membrane manufacturer for priming substrates to receive modified bituminous sheet flashing.

C. Joint Sealant: Certified by self-adhering flashing manufacturer as being compatible with flashing.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions under which self-adhering sheet flashing will be applied with installer and manufacturer's representative present for compliance with requirements and for other conditions affecting performance of the self-adhering sheet flashing system. Do not proceed with installation until unsatisfactory conditions have been corrected and reviewed by the Architect.

B. Installation of self-adhering sheet flashing constitutes acceptance of substrate conditions.

3.02 PREPARATION

A. Remove dust, dirt, loose fasteners and other protrusions. Clean, prepare and treat substrates according to manufacturer's written instructions. Provide clean, sound and dry substrate.

B. Prime substrates to receive self-adhering sheet flashing if required by manufacturer. Allow primer to dry for one hour or until tack-free. Re-prime surfaces not covered within 36-hours.

3.03 INSTALLATION

A. Self-Adhering Sheet Flashing:

1. Install self-adhering sheet flashing in accordance with manufacturer's written instructions. Ensure that flashing adheres continuously with the substrate and is free of wrinkles, fish mouths, bubbles, creases and other irregularities.

2. Comply with temperature restrictions of underlayment manufacturer for installation. Use primer rather than nails for installing at low temperatures.

3. Apply in shingle fashion to shed water, with end laps of not less than 6-inches staggered 24-inches between courses.

4. Overlap side edges not less than 3-1/2-inches.

5. Carefully notch and fold flashing corners and returns.

6. Roll installed flashing with roller.

7. Installed membrane shall be covered as soon as possible with subsequently applied covering material. Do not leave membrane exposed to the weather for longer periods than approved by the manufacturer.

3.04 COMPLETION

A. Remove and replace self-adhering sheet flashing that does not comply with specified requirements. Holes in the flashing shall be patched with a minimum 6-inch overlap or in accordance with the self-adhering sheet flashing manufacturer's instructions.

END OF SECTION

SECTION 07 71 00

ROOF SPECIALTIES

PART 1 - GENERAL

1.01 DESCRIPTION

A. This Section describes the requirements for furnishing and installing the following roof specialties:

1. Roof walkways.

2. Safety railings.

3. Crossover stairs.

1.02 SUBMITTALS

A. Product Data: Manufacturer's technical data, installation instructions and general recommendations for each specified product. Include data substantiating materials and performance comply with requirements.

B. Shop Drawings: Include layout, joining, profiles, accessories, anchorages, flashing connections, and relationship to supporting structure and to adjoining roof and wall construction.

C. Samples:

1. For initial selection, manufacturer's sample finishes showing full range of colors and textures available for those units with a factory-applied finish.

2. For verification purposes, each type of exposed finish prepared on minimum 8-inch long samples of same thickness and material specified. Where finishes involve normal color and texture variations, include sample sets showing full range of variations expected.

1.03 QUALITY ASSURANCE

A. Provide units which comply with applicable requirements of SMACNA "Architectural Sheet Metal Manual".

1.04 JOB CONDITIONS

A. Coordinate work of this Section with adjoining work for proper sequencing of each installation to ensure best possible weather resistance and protection of materials and finishes against damage.

PART 2 - PRODUCTS

2.01 ROOF WALKWAY SYSTEM

A. Approved Manufacturer: Kee Safety, Inc. “Kee Walk” or approved equal.

B. Material: Slip-resistant glass reinforced nylon and extruded aluminum.

C. Module Sizes: As indicated.

2.02 ROOF GUARDRAIL SYSTEM

A. Approved Manufacturer: Kee Safety, Inc. “KeeGuard” or approved equal.

B. Railing shall consist of top rails, mid rails, uprights, counterweights, and connections.

C. Pipe: ASTM A53, 1-1/2-inch schedule 40, galvanized.

D. Rails and Posts: 1-1/2-inch diameter steel pipe, galvanized.

E. Clamp Fittings: Galvanized.

F. Mounting Bases: Galvanized steel with rubber underside.

G. Counterweights: Steel with rubber pad on the underside.

H. Fasteners: Type 304 stainless steel.

2.03 ROOF CROSSOVER STAIRS

A. Approved Manufacturer: Kee Safety, Inc. “Safe Access Platforms” or approved equal.

B. Material: Galvanized steel.

C. Walkway: Metal grating.

D. Base Feet: Roof mounted.

E. Platform Size: As indicated.

PART 3 - EXECUTION

3.01 INSTALLATION

A. General: Comply with manufacturer's written instructions and recommendations.

B. Isolation: Where metal surfaces of units are installed in contact with dissimilar metal or corrosive substrates, including wood, apply bituminous coating on concealed metal surfaces, or provide other permanent separation as recommended.

3.02 CLEANING AND PROTECTION

A. Clean exposed metal surfaces in accordance with manufacturer's instructions. Touch-up damaged metal coatings.

B. Protection: Provide protective measures as required to ensure that work of this Section will be without damage or deterioration at time of Substantial Completion.

END OF SECTION

SECTION 07 81 16

CEMENTITIOUS FIREPROOFING

PART 1 - GENERAL

1.01 DESCRIPTION

A. This Section describes the requirements for furnishing and applying the following types of cementitious sprayed-on fireproofing:

1. Repair of existing damaged fireproofing.

1.02 SUBMITTALS

A. Certificates:

1. Furnish manufacturer's certificate stating materials provided comply with specified standards.

2. Furnish applicator's certificate stating that material has been applied in accordance with manufacturer's instructions, and meets fire-resistance ratings, thickness requirements, and application requirements of regulatory agency having jurisdiction.

B. Test Reports: Furnish certified test reports from a listed laboratory that fireproofing materials can be applied to substrate materials required and conform to specified fire-resistance and fire-resistive characteristics requirements, including thickness and dry density requirements of the fireproofing in accordance with ASTM E605.

C. Shop Drawings: Including framing plans or schedules, indicating the following:

1. Extent of fireproofing for each construction and fire-resistive rating.

2. Applicable fire-resistance design designations of a qualified testing and inspecting agency acceptable to authorities having jurisdiction.

3. Minimum fireproofing thicknesses needed to achieve required fire-resistance rating of each structural component and assembly.

4. Treatment of fireproofing after application.

D. Samples: For each exposed product and for each color and texture specified, in manufacturer’s standard dimensions in size.

1.03 QUALITY ASSURANCE

A. Materials and application procedures shall be tested and listed by UL and be acceptable to governing agencies for assemblies to be fireproofed.

B. Applicator: Approved by the manufacturer of the fireproofing materials.

C. Fireproofing shall provide fire-resistive rating as required by California Building Code (CBC).

1.04 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver fireproofing material in manufacturer's original, unopened packaging, identified with manufacturer's name, brand, and UL label.

B. Store under cover, above ground and in a manner to keep dry until ready to use. Discard material that has been exposed to moisture prior to mixing for use.

C. Remove from storage and discard fireproofing material that has not been used prior to its expiration date.

1.05 JOB CONDITIONS

A. Scheduling:

1. Ensure that clips, hangers, supports, sleeves, and other items required to penetrate fireproofing are placed before installing fireproofing systems.

2. Schedule installation of ducts, piping equipment, conduit, and other suspended items after the installation of fireproofing materials.

3. Schedule application of fireproofing system to underside of metal roof deck assemblies after roofing work is completed. Upon commencement of fireproofing application, roof traffic will be prohibited until the fireproofing material is cured and fully dried.

B. Environmental Requirements:

1. Temperature of substrate and ambient air shall be a minimum of 40-deg. F. for a minimum of 24-hours before, during, and after application of fireproofing. If required for job progress, provide enclosures with heat to maintain required temperatures.

2. Ventilate areas to receive fireproofing; introduce fresh air and exhaust air continuously during and after application. Provide forced air circulation in poorly ventilated areas to achieve a total air exchange rate of 4 times per hour until the material is substantially dry.

C. Protection:

1. Provide temporary enclosures, as necessary, to prevent spray from contaminating air.

2. Protect adjacent surfaces and equipment from damage by over spray, fallout, and dusting of sprayed fireproofing.

3. Where concrete, masonry, or other surfaces subject to overspray are to remain exposed to view in the completed work, provide protective masks, drop cloths, or other satisfactory coverings to prohibit contact with sprayed fireproofing materials.

PART 2 - PRODUCTS

2.01 FIREPROOFING REPAIR MATERIALS

A. Standard Density Fireproofing for Existing Areas: GCP Applied Technologies "Retro-Guard Type RG" or approved equal factory-mixed, gypsum-based cementitious fireproofing, free of asbestos and mineral wool fibers, and conforming to the following performance criteria.

1. Bond Strength: When tested in accordance with ASTM E736, fireproofing shall have an average bond strength of not less than 200-psf and an individual bond strength of not less than 150 psf.

2. Compressive Strength: Fireproofing shall not deform more than ten percent (10%) when subject to 1,200-psf compressive forces in accordance with ASTM E761.

3. Air Erosion: Fireproofing material shall not be subject to losses from the finished application by sifting, flaking, or dusting. Allowable weight loss of the fireproofing material shall not exceed 0.005-gram per square foot when tested in accordance with ASTM E859. Total weight loss shall be the weight loss over a 24-hour period.

4. Dry Density: Average field density of the fireproofing material shall be not less than 15-pcf when measured in accordance with ASTM E605, and as listed in the UL Fire Resistance Directory, ICBO Evaluation Report, or as required by the authority having jurisdiction.

5. Corrosion Resistance: Steel with applied fireproofing shall not promote corrosion of steel when tested in accordance with ASTM E937.

6. Deflection: Fireproofing material shall not crack or delaminate from the surface to which it is applied when tested in accordance with ASTM E759.

7. Bond Impact: Fireproofing material shall not crack or delaminate from the surface to which it is applied when subjected to impact tests in accordance with ASTM E760.

8. Combustibility: Fireproofing material shall have a maximum total heat release of 20 MJ per square meter and a maximum 125 kw per square meter peak rate of heat release 600 seconds after insertion when tested in accordance with ASTM E1354 at a radiant heat flux of 75 kw per square meter with the use of electric spark ignition. The sample shall be tested in the horizontal orientation.

9. Resistance to Mold: Fireproofing material shall be formulated with a mold inhibitor at the time of manufacturer and shall show resistance to mold growth for a period of 60 days when inoculated with mixed spore cultures in accordance with ASTM G21.

10. Surface Burning Characteristics: When tested in accordance with ASTM E84, fireproofing material shall have a Flame Spread Index of 0 and Smoke Developed Index of 0.

2.02 MISCELLANEOUS FIREPROOFING MATERIALS

A. The sprayed fireproofing material shall have been tested and reported by UL in accordance with the procedures of ASTM E119 and shall be listed in the UL Fire Resistance Directory.

B. Sprayed fireproofing material and application shall meet requirements of OSHA regulation 29 CFR 1926.58 which regulates the use of asbestos in construction.

C. Mixing water shall be clean, fresh and suitable for domestic consumption and free from such amounts of mineral or organic substances as would affect the set of the fireproofing material.

D. Primers: VOC-compliant type approved by fireproofing manufacturer for substrate and exposure conditions.

E. Adhesives: VOC-compliant type as recommended by fireproofing manufacturer.

PART 3 - EXECUTION

3.01 INSPECTION

A. Examine surfaces to receive fireproofing and verify the following:

1. That surfaces to receive fireproofing are free of loose mill scale, dirt, paint/primers, grease, oil, and other material that would impair bond of fireproofing materials.

2. That shop-primed surfaces designated to receive fireproofing are compatible with fireproofing bond requirements and materials. If surfaces are painted or primed, verify that bonding requirements established in the UL "Fire Resistance Directory" latest edition for sprayed fireproofing material are met.

3. Objects that will penetrate fireproofing have been attached.

4. Substrates are not obstructed by construction that could inhibit application of fireproofing.

5. Verify that roof construction, installation of roof-top HVAC equipment, and other related work is complete before beginning fireproofing work. Objects penetrating fireproofing, including clips, hangers, support sleeves and similar items shall be securely attached to substrates.

3.02 PREPARATION

A. Clean substrates of loose mill scale, dirt, grease, oil, rolling compounds, incompatible paints/primers, and other substances that would affect the bond of fireproofing. Sandblast surfaces if normal cleaning methods fail to remove adhering substances.

B. Prime substrates where recommended by fireproofing manufacturer.

C. Cover other work which might be damaged by fall-out or over-spray. Provide temporary enclosure to confine spraying operations and ensure adequate ambient conditions.

3.03 APPLICATION

A. Apply fireproofing materials in accordance with manufacturer's recommendations as required to achieve thickness and densities required by UL Fire Resistance Directory, ICC Evaluation Report, or as required by authority having jurisdiction.

B. Coat substrates with adhesive where recommended by manufacturer.

C. Extend fireproofing full thickness over entire area of each substrate.

D. Apply materials by sprayed-on method.

E. Angles, channels, rods and miscellaneous shapes shall be fireproofed as a beam.

F. Splice plates and bolts shall be fireproofed to the thickness required for the column or beam to which they are attached.

G. Apply exposed fireproofing (SOF) to required thicknesses. Fireproofing exposed to view shall be neat and uniform in thickness.

3.04 FIELD QUALITY CONTROL

A. Testing Laboratory or its agent will perform laboratory tests and inspections as specified in CBC Section 1704.10.

B. Tests will include material thickness in accordance with requirements of CBC Section 1704.10.2.

C. Correct unacceptable work and pay for further testing required to provide acceptable installations.

D. Patch areas from which fireproofing materials have been taken for test and inspection purposes to restore required fire-resistive ratings, at no additional increase in Contract Sum.

3.05 CLEANING, REPAIR, AND PROTECTION

A. Cleaning: Remove over-spray and fall-out of materials from adjacent surfaces and clean exposed surfaces to remove evidence of soiling, and unless otherwise indicated or specified, leave exposed surfaces in a scraped clean condition.

B. Protect fireproofing from damage resulting from construction operations and other causes.

C. Repair or replace work that has not been adequately protected. Patching and repairing of sprayed fireproofing, due to damage by other work, shall be performed under this Section at no additional cost to the Owner.

END OF SECTION

SECTION 07 84 00

FIRESTOPPING

PART 1 - GENERAL

1.01 DESCRIPTION

A. This Section describes the requirements for furnishing and installing firestopping.

1.02 SYSTEM PERFORMANCE REQUIREMENTS

A. General: Provide firestopping systems capable of closing or filling through-penetrations created by the burning or melting of combustible pipes, cable jacketing, or pipe insulation materials, or by the deflection of sheet metal due to thermal expansion.

B. For firestopping exposed to view, traffic, moisture, and physical damage, provide products that do not deteriorate when exposed to these conditions.

C. For firestopping exposed to view, provide products when flame-spread values of less than 25 and smoke-developed values of less than 450, when tested in accordance with ASTM E84.

1.03 SUBMITTALS

A. Product Data: Manufacturer's descriptive, technical data and illustrations. Include manufacturer's Material Data Safety Sheets and installation instructions.

B. Certification:

1. Manufacturer's certification that products comply with local regulations controlling use of volatile organic compounds (VOC's) and are nontoxic to building occupants.

2. Manufacturer's certification that firestopping materials comply with ASTM E814 and UL 147.

C. UL Design Numbers: Furnish UL Design No. from the "Fire Resistance Directory - Volume II" for each required penetration type and configuration. Indicate which materials will be used in firestopping the penetration.

1.04 QUALITY ASSURANCE

A. Firestopping materials and systems shall be listed and labeled in accordance with requirements of Underwriters Laboratories, Inc. (UL) Building Materials Directory.

B. Firestopping materials shall conform to California Building Code for fire resistance standards and requirements for penetrations in walls, partitions, and floor/ceiling and floor/roof assemblies.

C. Firestopping materials shall comply with ASTM E814 and UL 1479.

D. Form materials to remain in place in the completed work and sealant used for firestopping work shall be UL listed and labeled.

E. Firestopping materials shall be rated as required when tested in accordance with ASTM E119.

F. Firestopping materials shall be asbestos free and shall not incorporate nor require the use of hazardous solvents.

G. Firestopping materials shall not shrink upon drying as evidenced by cracking or pulling back from contact surface.

H. Installer shall have a minimum of 3-years experience installing UL listed firestop systems in similar type construction.

1.05 JOB CONDITIONS

A. Follow manufacturer's instructions for temperature, ventilation, and other conditions for mixing and installing foam seals.

B. Observe and follow manufacturer's precautions when using materials considered toxic and hazardous.

C. Maintain current copy of UL "Fire Resistance Directory" on Project site.

D. Installation of firestopping shall precede finishing of gypsum board.

1.06 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in the manufacturer's unopened containers and packages with manufacturer's name, labels, product identification, lot numbers, and mixing and installation instructions, as applicable.

B. Store materials in unopened containers and packages, and under conditions recommended by manufacturer.

C. Store and handle firestopping materials in accordance with manufacturer's Material Safety Data Sheets.

1.07 PROJECT CONDITIONS

A. Environmental Conditions: Do not install firestopping when ambient or substrate temperatures are outside limits permitted by firestopping manufacturers or when substrates are wet due to rain, frost, condensation, or other causes.

B. Ventilation: Ventilate firestopping in accordance with manufacturers' instructions by natural means or forced air circulation.

1.08 SEQUENCING AND SCHEDULING

A. Perform work of this and other Sections in proper sequence to prevent damage to the firestopping materials and to ensure that their installation will occur prior to enclosing or concealing work.

B. Do not cover firestopping materials until they have been inspected and accepted by the authority having jurisdiction.

PART 2 - PRODUCTS

2.01 FIRESTOPPING, GENERAL

A. Compatibility: Provide firestopping composed of components that are compatible with each other, the substrates forming openings, and the penetrating items.

B. Accessories: Provide components of each firestopping system required to install fill materials. Use only components specified by firestopping manufacturer and which are approved by UL for the designated fire-resistance-rated system.

C. Manufacturers or systems not listed in UL "Fire Resistance Directory" but who can furnish certification of UL approval may be used in the work.

2.02 THROUGH-PENETRATION FIRESTOPPING MATERIALS

A. General: Listed manufacturers of through-penetration firestopping are intended as guidelines only; manufacturer and material type shall be as required by the UL Design No. for each penetration to receive firestopping.

B. Approved Manufacturers: Hilti Construction Chemicals, Inc., STI Firestop, CWS Industrials / RectorSeal, Tremco, Inc., 3M Fire Protection Products or approved equal.

C. Provide mortar, sealants and caulk, putty, wrap strips, pillows, bags, and other types required for UL Design No. for each penetration to receive firestopping.

2.03 MINERAL FIBER FIRESTOPPING MATERIALS

A. Material: Semi-rigid mineral fiber insulation, minimum 4-pcf density; Owens Corning "Thermafiber Safing", Johns Manville "Insul-SHIELD", Tremco “TREMstop FS Blanket” or approved equal.

B. Support Clips: Manufacturer's standard impaling clips or custom designed to suit installation conditions, fabricated from galvanized sheet steel.

2.04 FIRESTOPPING AT ELECTRICAL BOXES AND UTILITY OUTLETS

A. Utility penetrations in walls, ceilings, or floors requiring protected openings shall be firestopped and sealed with an approved material securely installed, capable of maintaining its integrity when subjected to test temperatures specified in ASTM E814.

B. Steel electrical outlet boxes on opposite sides of walls requiring protected openings shall be separated by a horizontal distance of 24-inches.

C. Steel electrical outlet boxes which occur in combination with outlet boxes of any size such that the aggregate area of unprotected outlet boxes exceeds 100-square inches in any 100-square feet of wall area shall be protected by an approved material or detail to decrease the aggregate area of unprotected utility boxes to less than 100-square inches in any 100-square feet of wall.

D. Steel electrical outlet boxes which exceed 16-square inches in area shall be protected by 3M "Moldable Putty Pads", STI Firestop "SpecSeal SSP Putty & Putty Pads" or approved equal.

E. Utility and electrical outlets or boxes shall be securely fastened to the stud or framing of the wall or ceiling assembly. The opening in the gypsum board shall be cut so that the clearance between the box and the gypsum board does not exceed 1/8-inch.

1. Fill the 1/8-inch gap with an approved fire-rated sealant.

2.05 MIXING

A. For those products requiring mixing prior to application, comply with manufacturer's instructions.

2.06 IN-FILL AT TOP OF FULL HEIGHT PARTITIONS ABUTTING UNDERSIDE OF FRAMING

A. Rigid Insulation Board: Minimum 6-pcf density fiberglass or mineral wool boards, thickness as required to fill spaces between joists without sagging.

B. Sprayed Firestopping: Specified Technologies Inc. (STI) “SpecSeal Series AS200 Elastomeric Fire Stop Spray” or approved equal.

2.07 ESCUTCHEONS

A. Provide brushed stainless-steel escutcheon plates at pipes and conduit exposed to view. Size to suit penetration.

PART 3 - EXECUTION

3.01 INSPECTION

A. Inspect openings and voids to be sealed to determine if conditions are satisfactory for the proper installation of firestopping. Do not commence work until unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Surface Cleaning: Clean out openings and joints immediately prior to installing firestopping to comply with recommendations of firestopping manufacturer.

1. Remove foreign materials from surfaces of opening and joint substrates and from penetrating items that could interfere with adhesion of firestopping.

2. Clean opening and joint substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with firestopping.

3. Remove laitance and form release agents from concrete.

B. Priming: Prime substrates where recommended by manufacturer using manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

C. Masking: Use masking tape to prevent firestopping from contacting adjoining surfaces that will remain exposed upon completion of the work. Remove tape as soon as possible.

3.03 EXTENT OF FIRESTOPPING WORK

A. General: Provide solid continuous firestopping wherever the penetration or addition of a construction element through or adjacent to a fire-rated floor, wall or partition, or roof creates a discontinuity of such a rated separation. Application limited in size and configuration to tested systems. Do not install insulation types specified in other Sections in lieu of specified firestopping materials.

B. Penetrations:

1. Penetrations include conduit, cable, wire, pipe, duct, and other elements which pass through one or both outer surfaces of a fire-rated floor, roof, wall, or partition.

2. Fill penetrations as indicated in applicable UL Design No.

3. Verify that annular space around sprinkler pipes through fire-rated walls and floors is provided as required by NFPA 13.

C. Fire Rated Partitions:

1. Fire-rated or smoke-rated partitions shall be firestopped with a firestop sealant as listed in UL "Fire Resistance Directory" and as specified. Apply minimum 3/8-inch bead at intersection of finish material and adjacent surface, both sides and along entire perimeter.

2. Intersections at fire-rated or smoke-rated partitions and steel deck type floor-ceiling or roof-ceiling assemblies shall be firestopped as indicated.

D. Provide firestopping to fill miscellaneous voids or openings at fire-rated construction as specified.

3.04 INSTALLATION

A. Do not install firestopping until:

1. Building is sufficiently enclosed or protected against adverse weather conditions.

2. Supporting framing and surrounding construction is in a dry condition.

B. Prepare and install firestopping in accordance with manufacturer's instructions.

C. Mineral Fiber:

1. Provide in thickness for compressing into voids for a tight friction fit when installed.

2. Provide in width sufficient to fill the depth of the void space using single width pieces.

3. Install with ends tight against terminal end construction, and with intermediate joints well compressed together and tight.

4. For vertical void spaces, provide support clips near each end, spaced not over 24-inches on center.

D. Foam:

1. Provide form materials to retain foam when placed.

2. Prime contact surfaces as recommended by foam manufacturer.

3. Inject foam into void spaces so foam develops full and complete contact with adjoining surfaces, and the space is free from air pockets.

4. Cure foam 24-hours, remove form materials not required to remain, and inspect.

5. Provide additional foam or sealant to fill insufficient depth and remaining voids.

E. Sealants:

1. Prepare penetrations in vertical and horizontal surfaces as required to receive finish products.

2. Install damming materials as required.

3. Apply caulk or putty in accordance with manufacturer's recommendations.

F. Finish surfaces of exposed to view firestopping to a uniform and level condition.

G. In-fill at Top of Partitions Abutting Underside of Framing:

1. Install rigid board to fit tightly between joists. Provide supplementary framing as required for attachment of rigid boards.

2. Spray-apply elastomeric firestopping spray over rigid boards in accordance with manufacturer’s instructions. Spray-apply to a minimum thickness of 1/8-inch.

H. Install escutcheon plates at pipes and conduit exposed to view.

3.05 FIELD QUALITY CONTROL

A. Identify firestop systems after installation. Identify the firestop system that has been installed and include the appropriate UL Design Number.

B. At fire-rated walls, partitions, smoke barriers and other walls required to have protected openings or penetrations, provide a sign or stenciling on each side of the wall above the accessible ceiling stating that penetrations through fire-rated walls and partitions are not permitted unless such penetrations or openings are protected with firestopping meeting code requirements. Letters shall not be less than 1/2-inch in height. Repeat at intervals not exceeding 10-feet measured horizontally. Signs or stenciling shall comply with CBC Chapter 7 requirements.

3.06 CLEANING

A. Remove spilled and excess materials without damaging adjacent surfaces.

B. Leave finished work in neat, clean condition with no evidence of spill-overs or damage to adjacent surfaces.

END OF SECTION

SECTION 07 92 00

JOINT SEALANTS

PART 1 - GENERAL

1.01 DESCRIPTION

A. This Section describes the requirements for furnishing and installing joint sealants.

1.02 SUBMITTALS

A. Product Data: Manufacturer's technical data for each product required, including instructions for joint preparation and sealant application. Include certification by joint sealant manufacturer that sealants, primers, and cleaners comply with local regulations controlling the use of volatile organic compounds (VOC).

B. Samples: Manufacturer's bead samples of actual products showing full range of colors available, for each product exposed to view.

C. Test Reports:

1. Certified test results of elastomeric sealants showing compliance with specified requirements. Include results of aged performances including hardness, stain-resistance, adhesion and cohesion under cyclic movement, low temperature flexibility, modulus of elasticity at 100-percent strain, affects of heat and aging, and affects of accelerated weathering.

2. Pre-construction field test results indicating which products and joint preparation methods demonstrated acceptable adhesion to joint substrates.

D. Certificates: Manufacturer's certification that joint sealants comply with specified requirements and are suitable for uses indicated.

E. Warranty.

1.03 QUALITY ASSURANCE

A. Installer's Qualifications: Completion of at least 3 installations similar in type and size to this Project.

B. Obtain joint sealant materials from a single manufacturer for each product required unless otherwise approved.

C. Preconstruction Field Testing: Prior to installation of joint sealants, field-test adhesion to joint substrates.

2. Install joint sealants in 5-foot joint lengths. Allow to cure before testing. Test adhesion by pulling sealant out of joint according to “Method A, Field-Applied Sealant Joint Hand Pull Tab”, in Appendix X1 in ASTM C1193. For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.

3. Perform field tests for each type of elastomeric sealant and joint substrate.

4. Arrange for tests to take place with joint sealant manufacturer's technical representative present.

5. Report whether sealant in joint connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each type of product and joint substrate.

6. Sealants not evidencing adhesive failure from testing, in absence of other indications of noncompliance with requirements, will be considered satisfactory. Do not use sealants that fail to adhere to joint substrate during testing.

1.04 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in the unopened, original containers or unopened packages with manufacturer's name, labels, product identification, color, expiration period, curing time and mixing instructions for multi-component materials.

B. Store materials in the original, unopened containers or packages, and under conditions recommended by manufacturers.

1.05 PROJECT CONDITIONS

A. Environmental Conditions: Do not install sealants when ambient and substrate temperature conditions are outside limits permitted by joint sealant manufacturer, or to wet joint substrates.

B. Joint Width Conditions: Do not install sealants when joint widths are less than permitted by sealant manufacturer.

C. Joint Substrate Conditions: Do not proceed with installation of joint sealants until contaminants capable of interfering with their adhesion are removed from joint substrates.

1.06 WARRANTY

A. Exterior Sealants: Furnish a written warranty against leaks or other defects of materials and workmanship for a period of 10-years. Defects include but are not limited to changes in the structural, physical or chemical properties of the sealant materials that impair function or require abnormal maintenance, changes in surface finish, color or texture, failure in adhesion, weather resistance or durability, failure to prevent entry of water, or failure to comply with specified requirements.

B. This warranty shall not cover formation of cracks or defects in substrate materials adjacent to the seal, joint movement exceeding movement rating of sealant, or physical damage caused by others.

C. Repair or replace defective materials and workmanship during warranty period without expense to Owner, including removal and replacement of other items as required.

D. This warranty shall be in addition to and not a limitation of other rights the Owner may have against the Contractor under the Contract Documents.

PART 2 - PRODUCTS

2.01 MATERIALS, GENERAL

A. Provide color of exposed joint sealants as selected by Architect. Custom colors will be used.

B. Provide joint sealers, joint fillers and other materials that are compatible with one another and with joint substrates, as demonstrated by testing and field experience.

2.02 ELASTOMERIC JOINT SEALANTS

A. Exterior Paintable Building Sealant: Bostik Findley, Inc. “Pro MS-50”, BASF “Master Seal NP 150 Premium Sealant” or approved equal latex hybrid sealant.

B. Exterior Building Sealant at Exposed Concrete, Storefront Framing and Areas where Sealant is Unpainted: Dowsil “795 Silicone” or approved equal

C. Interior Sanitary Sealant: One-part mildew-resistant silicone; ASTM C920 Type S; Grade NS; Class 25; Uses NT, G, A and O; formulated with fungicide for sealing interior joints with nonporous substrates around ceramic tile, showers, sinks and plumbing fixtures; Dowsil "786 Mildew Resistant", General Electric Co. "Sanitary 1700", Sonneborn Building Product Div. "Sonolastic Omniplus", Tremco Tremsil 200 or approved equal.

D. Horizontal Joint Sealant: Two-part pourable urethane; ASTM C920, Type M; Grade P; Class 25; Uses T, M, A and O; Pecora Corp. "NR-200 Urexpan", Sonneborn "Sonolastic Paving Joint Sealant", Tremco, Inc. "THC-900/901" or approved equal. Horizontal joint sealant shall have a minimum Shore A hardness of 30.

2.03 LATEX JOINT SEALANTS

A. Interior Building Sealant: Acrylic-emulsion; one-part, non-sag, mildew-resistant, complying with ASTM C834, formulated to be paintable; Pecora Corp. "AC-20", Sonneborn "Sonolac", Tremco Inc. "Tremco Acrylic Latex 834" or approved equal.

2.04 JOINT FILLERS FOR CONCRETE PAVING

A. Joint Filler: Preformed cork strips complying with ASTM D1752 for Type II or preformed sponge rubber strips complying with ASTM D1752 for Type I.

2.05 JOINT SEALANT BACKING

A. General: Provide sealant backings which are non-staining; are compatible with joint substrates, sealants, primers and other joint fillers; and are approved by sealant manufacturer.

B. Backer Rod at Exterior Locations: ASTM C1330, Type C, closed cell backer rods.

C. Plastic Foam Joint-Fillers: Preformed, compressible, resilient, non-waxing, non-extruding strips of plastic foam, of size, shape and density to control sealant depth.

D. Bond-Breaker Tape: Polyethylene tape or other plastic tape as recommended by sealant manufacturer. Provide self-adhesive tape where applicable.

2.06 MISCELLANEOUS MATERIALS

A. Primer: As recommended by joint sealant manufacturer for adhesion of sealant to joint substrates.

B. Cleaners for Nonporous Surfaces: Non-staining, chemical cleaner of type acceptable to manufacturer of sealant and sealant backing materials which are not harmful to substrates and adjacent nonporous materials.

C. Masking Tape: Non-staining, non-absorbent type compatible with joint sealants and to surfaces adjacent to joints.

PART 3 - EXECUTION

3.01 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants.

1. Remove foreign material from joint substrates which could interfere with adhesion of joint sealant, including dust, paints, oil, grease, waterproofing, water repellents, water, and surface dirt.

2. Clean porous surfaces, by brushing, grinding, blast cleaning, mechanical abrading, or acid washing to produce a clean, sound substrate. Remove loose particles remaining from cleaning operations by vacuuming or blowing out joints.

3. Remove laitance and form release agents from concrete.

4. Clean non-porous surfaces by chemical cleaners or other means which are not harmful to substrates or leave residues capable of interfering with adhesion of joint sealants.

B. Joint Priming: Prime joint substrates where recommended by joint sealant manufacturer. Apply primer to comply with joint sealant manufacturer's recommendations. Confine primers to areas of joint sealant bond, do not allow spillage or migration onto adjoining surfaces.

C. Masking Tape: Use masking tape where required to prevent contact of sealant with adjoining surfaces. Remove tape immediately after tooling without disturbing joint seal.

3.02 INSTALLATION OF JOINT SEALANTS

A. General: Comply with joint sealant manufacturers' printed installation instructions applicable to products and applications indicated, except where more stringent requirements apply. Provide temporary ventilation during installation of interior joint sealants.

B. Sealant Installation Standard: Comply with recommendations of ASTM C1193 for use of joint sealants as applicable to materials, applications and conditions indicated.

C. Installation of Sealant Backings: Install sealant backings to comply with the following requirements:

1. Install joint-fillers to provide sealant support for optimum performance cross-sectional shapes and depths.

a. Do not leave gaps between ends of joint-fillers.

b. Do not stretch, twist, puncture or tear joint-fillers.

c. Remove absorbent joint-fillers which have become wet prior to sealant application and replace with dry material.

2. Install bond breaker tape between sealants and joint-fillers, compression seals or back of joints where required to prevent third-side adhesion of sealant to back of joint.

D. Installation of Sealants: Install sealants by proven techniques to contact and full wet joint substrates, completely filling recesses provided for each joint configuration and providing uniform, optimum performance cross-sectional shapes and depths.

E. Tooling of Non-sag Sealants: Tool sealants to form smooth, uniform beads of configuration indicated, to eliminate air pockets and to ensure contact and adhesion of sealant with sides of joint. Remove excess sealants from surfaces adjacent to joint. Do not use tooling agents which discolor sealants or adjacent surfaces or are not approved by sealant manufacturer.

3.03 PROTECTION AND CLEANING

A. Protect joint sealants during and after curing period from contact with contaminating substances or from damage.

B. Cut out and remove damaged or deteriorated joint sealers and reseal joints with matching new materials.

C. Clean off excess sealants or sealant smears adjacent to joints as work progresses by methods and with cleaning materials approved by sealant manufacturer.

END OF SECTION

SECTION 07 92 19

ACOUSTICAL JOINT SEALANTS

PART 1 - GENERAL

1.01 DESCRIPTION

A. This Section describes the requirements for furnishing and installing acoustical joint sealants.

1.02 SUBMITTALS

A. Product Data: Manufacturer's technical data for each product required, including instructions for joint preparation and sealant application. Include certification by joint sealant manufacturer that sealants, primers, and cleaners comply with local regulations controlling the use of volatile organic compounds (VOC).

B. Samples: Manufacturer's bead samples of actual products showing full range of colors available, for each product exposed to view.

C. Certificates: Manufacturer's certification that joint sealants comply with specified requirements and are suitable for uses indicated.

1.03 QUALITY ASSURANCE

A. Installer's Qualifications: Completion of at least 3 installations similar in type and size to this Project.

B. Obtain joint sealant materials from a single manufacturer for each product required unless otherwise approved.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in the unopened, original containers or unopened packages with manufacturer's name, labels, product identification, color, expiration period, curing time and mixing instructions for multi-component materials.

B. Store materials in the original, unopened containers or packages, and under conditions recommended by manufacturers.

1.05 PROJECT CONDITIONS

A. Environmental Conditions: Do not install sealants when ambient and substrate temperature conditions are outside limits permitted by joint sealant manufacturer, or to wet joint substrates.

B. Joint Width Conditions: Do not install sealants when joint widths are less than permitted by sealant manufacturer.

C. Joint Substrate Conditions: Do not proceed with installation of joint sealants until contaminants capable of interfering with their adhesion are removed from joint substrates.

PART 2 - PRODUCTS

2.01 ACOUSTICAL JOINT SEALANTS

A. Acoustical Sealant at Concealed Locations: Non-skinning, non-hardening, flexible sealant, capable of spanning 1/2-inch wide x 3/8-inch deep gaps. Synthetic rubber-based products comply with ASTM D217 and acrylic rubber-based products comply with ASTM C834. Tremco, USG “Acoustical Sealant”, Pecora “AC-20 FRT” or approved equal.

B. Acoustical Sealant at Exposed Locations: Non-oxidizing, skinnable, paintable, gunnable sealant recommended for sealing interior exposed joints to reduce transmission of airborne sound; Pecora Corp. “AC-20 FTR Acoustical and Insulation Sealant” or approved equal.

2.02 MISCELLANEOUS MATERIALS

A. Sheet Caulking for Junction Boxes: Lowry’s Electrical Box Sealer, Tremco Sheet Caulking or approved equal.

B. Sheet Caulking for Junction Boxes at Fire-Rated Assemblies: Hevi-duty/Nelson “Firestop Putty Pads”, Specified Technologies, Inc., Hilti CP-617 or approved equal.

C. Backing Rod: Closed-cell, neoprene rod or polyethylene foam.

D. Expanding Foam Sealant: UL Class 1 fire-retardant. Macklanburg Duncan “Polycell Expanding Foam”, Dow “Great Stuff Pro – Gaps & Cracks” or approved equal.

E. Cementitious Sealant: GCP Applied Technologies “Monokote Z-147” or approved equal.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Comply with manufacturer's instructions for installation conditions.

B. Acoustical Sealant Application Standard: Comply with recommendations of ASTM C919 for use of joint sealants in acoustical applications as applicable to materials, applications and conditions indicated. Install sealants in accordance with manufacturer’s instructions.

C. Install sheet caulking to seal the back and sides of junction boxes recessed in sound rated partitions.

D. Install acoustical sealant as a continuous bead along gypsum board face layer at all head and sill conditions of sound-rated partitions and around the perimeter of resilient ceilings.

E. Install cementitious foam sealant where indicated and where multiple pipes or conduits penetrate sound-rated construction.

3.02 PROTECTION

A. Protect installed insulation from harmful exposures and from physical damage.

END OF SECTION

SECTION 08 11 13

HOLLOW METAL (STEEL) DOORS AND FRAMES

PART 1 - GENERAL

1.01 DESCRIPTION

A. This Section describes the requirements for furnishing and installing steel doors, door frames, and associated accessories.

1.02 SUBMITTALS

A. Product Data: Furnish for each type of door and frame, including details of construction, materials, dimensions, hardware preparation, core, label compliance, profiles, and finishes.

B. Shop Drawings: Include details of each frame type, elevations of door types, conditions at openings, details of construction, location and installation requirements of finish hardware and reinforcements, and details of joints and connections. Show anchorage and accessory items.

C. Door Schedule: Furnish schedule of doors and frames using same reference numbers for details and openings as those on the drawings.

1.03 QUALITY ASSURANCE

A. Steel doors and frames shall comply with ANSI A250.8 "Recommended Specifications Standard Steel Doors and Frames" and the specified requirements.

B. Fire-Rated Doors: Provide hollow metal doors and frames that comply with California Building Code (CBC) Chapter 7; are identical in materials and construction to units tested in door and frame assemblies in accordance with NFPA 252 or UL 10C; and are labeled and listed by UL, Warnock Hersey, or other testing and inspection agency acceptable to authorities having jurisdiction. Labels shall comply with NFPA 80 and be permanently affixed to the door.

C. Hollow metal doors and frames shall comply with positive pressure test requirements of NFPA 252 or UL 10C and shall be labeled accordingly by the door and frame manufacturer in a manner approved by authorities having jurisdiction. Door label shall include hourly rating followed by the letter “S” indicating conformance with air leakage resistance testing, serial number, and the listing agency’s certification mark.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Deliver doors and frames cardboard-wrapped or crated to provide protection during transit and job storage.

B. Inspect doors and frames upon delivery for damage. Minor damage may be repaired provided finish items are equal to new work and acceptable to Architect; otherwise remove and replace damaged items as directed.

C. Store doors and frames at building site under cover. Place units on minimum 4-inch high wood blocking. Avoid use of non-vented plastic or canvas shelters which could create humidity chamber. If cardboard wrapper on door becomes wet, remove carton immediately. Provide 1/4-inch space between stacked doors to promote air circulation.

PART 2 - PRODUCTS

2.01 APPROVED MANUFACTURERS

A. Assa Abloy / Ceco Door Products, Assa Abloy / Curries Company, Assa Abloy / Security Metal Products, Republic Doors and Frames, Allegion / Steelcraft or approved equal. Manufacturer shall be a SDI Certified Manufacturer.

2.02 MATERIALS

A. Hot-Rolled Steel Sheets and Strip: Commercial quality carbon steel, pickled and oiled, complying with ASTM A569.

B. Cold-Rolled Steel Sheets: Commercial quality carbon steel, complying with ASTM A366, commercial quality or ASTM A620, drawing quality.

C. Galvanized Steel Sheets: Zinc-coated carbon steel complying with ASTM A526, commercial quality, or ASTM A642, drawing quality, hot dipped galvanized in accordance with ASTM A525, A60 or G60 coating designation, mill phosphatized.

D. Supports and Anchors: Fabricate of not less than 18-gauge, galvanized where used with galvanized frames.

E. Inserts, Bolts and Fasteners: Manufacturer's standard units. Where items are built into exterior walls, hot-dip galvanize in accordance with ASTM A153, Class C or D as applicable.

F. Shop-Applied Primer: Rust-inhibitive enamel or paint, either air-drying or baking, suitable as a base for specified finish paints.

G. Galvanizing Repair Paint: High zinc dust content paint for regalvanizing welds in galvanized steel; Rust-Oleum Corp. "Zinc-Rich Cold Galvanizing Compound", Tnemec 90-93, ZRC Worldwide "Galvalite" or approved equal.

2.03 DOORS

A. Provide metal doors of ANSI A250.8 grades and models specified.

1. Interior Flush Doors: Level 2, heavy duty, Model 2, minimum 16-gauge cold-rolled sheet steel faces. Provide galvanized steel sheets where scheduled.

2. Exterior Flush Doors: Level 3, extra heavy duty, Model 2, minimum 16-gauge galvanized steel faces.

B. Internal Construction: Manufacturer's standard honeycomb, polyurethane, polystyrene, unitized steel grid, vertical steel stiffeners, or rigid mineral fiber core with internal sound deadener on inside of face sheets where appropriate, in accordance with ANSI A250.8 requirements.

C. Clearance: Not more than 1/8-inch at jambs and heads, except not more than 1/4-inch between non-fire-rated pairs of doors. Not more than 3/4-inch at bottom.

1. Fire Doors: Provide clearances according to NFPA 80.

D. Edges:

1. General: Beveled latch stile for single doors, and meeting stile for pair doors; square elsewhere.

2. Stile Edges: No seams are allowed on vertical stile edges.

3. Top and Bottom Edges: Reinforced with 16-gauge steel channels; both edges flush and made watertight for exterior doors, top edge flush for interior doors.

2.04 DOOR FRAMES

A. Provide metal frames for doors, transoms, sidelights, and mullions and other openings, of types and styles indicated. Conceal fastenings unless otherwise indicated.

B. One-Piece Welded Frames: 14-gauge. Fabricate frames with mitered or coped and continuously welded corners.

C. Anchors:

1. Provide a jamb anchor for each 2'-6" of door or window height or fraction thereof.

2. Fabricate from minimum 16-gauge sheet steel.

3. Vary anchor types to provide positive fastening to adjacent construction.

4. Secure a metal clip angle at bottom of each jamb member for anchoring to floor, with a minimum of two fasteners.

5. Items to be built into exterior walls shall be hot-dip galvanized after fabrication in accordance with ASTM A153, Class B.

D. Door Silencers: Except on weatherstripped or smoke gasketed frames, drill stops to receive 3-silencers on strike jambs of single-swing frames and 2-silencers in heads of double-swing frames.

E. Plaster Guards: Provide 26-gauge steel plaster guards or mortar boxes at back of hardware cutouts.

2.05 FABRICATION

A. Fabricate steel doors and frames to be rigid, neat in appearance and free from defects, warp or buckle. Wherever practicable, fit and assemble units in manufacturer's plant. Clearly identify work that cannot be permanently factory-assembled before shipment, to assure proper assembly at Project site. Comply with ANSI A250.8 requirements.

B. Fabricate exposed faces of doors, including stiles and rails of non-flush units, from cold-rolled steel.

C. Tolerances: Comply with SDI-117, "Manufacturing Tolerances Standard Steel Doors and Frames".

D. Fabricate frames, concealed stiffeners, reinforcement, edge channels, louvers and moldings from either cold-rolled or hot-rolled steel.

E. Fabricate exterior doors and frames and interior doors and frames where scheduled from galvanized sheet steel. Close top and bottom edges of exterior doors as integral part of door construction or by addition of minimum 16-gauge inverted steel channels with channel webs placed even with top and bottom edges. Seal joints in top edges of doors against water penetration.

1. Touch-up abraded areas of galvanized coating, including welds, with specified galvanized repair paint applied in the shop.

F. Exposed Fasteners: Unless otherwise indicated, provide countersunk flat or oval heads for exposed screws and bolts.

G. Hardware Preparation: Prepare doors and frames to receive mortised and concealed hardware in accordance with final door hardware schedule and templates provided by hardware supplier. Comply with applicable requirements of ANSI A250.6 for door frame preparation for hardware.

1. For concealed overhead door closers, provide space, cutouts, reinforcing and provisions for fastening in top rail of doors or head of frames, as applicable.

H. Reinforce doors and frames to receive surface-applied hardware. Drilling and tapping of surface-applied hardware may be done at Project site.

I. Locate hardware as indicated on final shop drawings or in accordance with Door Hardware Institute (DHI) "Recommended Locations for Builder's Hardware on Standard Steel Doors and Frames".

J. Shop Painting: Clean, treat, and paint exposed surfaces of steel door and frame units, including galvanized surfaces except as otherwise indicated or specified.

1. Clean steel surfaces of mill scale, rust, oil, grease, dirt, and other foreign materials before application of paint.

2. Apply galvanized repair paint to abraded areas of galvanized coatings, including welds, as specified.

3. Apply shop coat of prime paint of even consistency to provide a uniformly finished surface ready to receive paint finish.

PART 3 - EXECUTION

3.01 INSTALLATION

A. General: Install steel doors, frames, and accessories in accordance with the manufacturer's instructions, the requirements of ANSI/SDI, and reviewed Shop Drawings.

B. Placing Frames: Comply with provisions of ANSI A250.8 and SDI-112 unless otherwise indicated. Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is completed, remove temporary braces and spreaders, leaving surfaces smooth and undamaged.

1. Except for frames located in concrete, place welded frames before constructing enclosing walls or ceilings.

2. In masonry construction, install at least 3 wall anchors per jamb adjacent to hinge location on hinge jamb and at corresponding heights on strike jamb. Acceptable anchors include masonry wire anchors and masonry T-shaped anchors.

3. At concrete construction, install at least 3 completed opening anchors per jamb adjacent to hinge location on hinge jamb and at corresponding heights on strike jamb. Set frames and secure to adjacent construction with bolts and masonry anchorage devices.

4. In stud partitions, install at least 3 wall anchors per jamb at hinge and strike levels. Attach wall anchors to studs with screws.

5. Install fire-rated frames according to their listings.

6. Install head anchors at mid span for openings exceeding 48-inches.

C. Door Installation: Fit hollow metal doors accurately in frames, within specified clearances.

1. Fire-Rated Doors: Install with clearances specified in their listings.

2. Smoke-Control Doors: Comply with NFPA 105.

3.02 ADJUST AND CLEAN

A. Immediately after installation, sand smooth rusted or damaged areas of prime coat and apply touch-up of compatible air-drying primer.

1. Remove rust before touch-up is applied.

2. Touch-up shall not be obvious.

B. Repair damaged galvanizing with a high zinc dust content galvanizing repair paint.

C. When complete, exposed surfaces and edges shall be clean, straight, and free from dents, scratches, and other damage and defects.

D. Doors and finish hardware shall operate smoothly, quietly, and free from bind.

END OF SECTION

SECTION 08 31 13

ACCESS DOORS AND FRAMES

PART 1 - GENERAL

1.01 DESCRIPTION

A. This Section describes the requirements for furnishing and installing access doors at all required locations.

1.02 SUBMITTALS

A. Product Data: Manufacturer's technical data and installation instructions for each type of access door assembly, including setting drawings, templates, instructions and directions for installation of anchorage devices. Include complete schedule including types, general locations, sizes, wall and ceiling construction details, finishes, latching or locking provisions and other data pertinent to installation.

B. Location Drawing: Required access doors may not be indicated on the Drawings. Show proposed location of every required access door with dimensions in plan and elevation. Verify locations with the Architect. Access doors shall be located within walls and ceilings for access including but not limited to the following: automatic valves, automatic dampers, air terminal units, and fire/smoke dampers. Show location of adjacent materials, trim pieces, and hardware required to complete the work. Do not begin installation until location is approved. Submit access door locations superimposed on piping layout and duct layout shop drawings.

1.03 QUALITY ASSURANCE

A. Fire-Rated Door Assemblies: Units shall comply with NFPA 80, be identical to door and frame assemblies tested for fire-test-response characteristics, and are labeled and listed by UL, Warnock Hersey, or other testing and inspecting agency acceptable to authorities having jurisdiction.

1.04 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver and store access doors in manufacturer's standard protective packaging.

B. Do not remove protective packaging until ready for installation.

C. Follow manufacturer's instructions for storage and handling.

PART 2 - PRODUCTS

2.01 MATERIALS AND FABRICATION

A. Furnish access doors of proper size for access to concealed equipment. Unless otherwise indicated, minimum size shall be 12-inch x 12-inch for hand access and minimum 18-inch x 18-inch for valve and actuator access and 24-inch x 24-inch for equipment access.

B. Non-Fire-Rated Access Doors with Exposed Trim at Non-public Areas:

1. Approved Manufacturers: J.L. Industries, Karp Associates, Milcor, Nystrom Building Products or approved equal.

2. Door Design: Flush panel.

3. Material: Commercial grade cold-rolled steel with 16-gauge frame and 14-gauge door.

4. Finish: Phosphate dipped with baked-on rust-inhibitive gray primer.

5. Exposed Trim: 1-inch flange overlapping surfaces surrounding door frame.

6. Hinge: Manufacturer's standard concealed pin hinge mechanism or continuous piano hinge.

7. Latch/Lock: Flush screwdriver operated stainless steel cam latch. Provide standard keyed locks at access doors located in public areas.

C. Non-Fire-Rated Access Doors with Exposed Trim in Custodial Rooms, and other Wet Areas:

1. Approved Manufacturers: J.L. Industries, Karp Associates, Milcor, Nystrom Building Products or approved equal.

2. Door Design: Flush panel.

3. Material: Stainless steel, 16-gauge frame and 14-gauge door.

4. Finish: Satin polish finish.

5. Exposed Trim: Flange integral with frame, 1-inch wide, overlapping surrounding finished surface.

6. Hinge:

   a. Areas Exposed to Public View: Concealed pin hinge mechanism. Exposed piano hinges are not acceptable.

   b. Other Areas: Manufacturer's standard concealed pin hinge mechanism or continuous piano hinge.

7. Latch/Lock: Flush screwdriver operated stainless steel cam latch. Provide standard keyed locks at access doors located in public areas.

8. Provide insulated doors in insulated or acoustically rated construction.

D. Non-Fire-Rated Recessed Access Doors in Public Areas:

1. Approved Manufacturer: Access Panel Solutions Bauco-Plus II or approved equal

2. Features:

   a. Concealed aluminum frame and hardware.

   b. Concealed mechanical touch latch.

   c. Lift-out doors with safety cables.

   d. Perimeter gasket for air and smoke tight fit.

3. Door Design: Touch-latch recessed panel to receive gypsum wallboard or other finish material as indicated.

4. Frame: Recessed aluminum extrusion. Frame acts as corner bead for finishing with 1/16-inch gape between frame and door.

5. Hinge: Free-pivoting hinge.

6. Latch: Concealed touch latch. Provide keyed lock where doors are within public reach.

7. Finish: Phosphate dipped with baked-on rust inhibiting primer for field painting as specified in Section 09 91 00.

8. Provide insulated doors in insulated or acoustically rated construction.

E. UL Fire-Rated Access Doors with Exposed Trim in Non-public Areas:

1. Approved Manufacturers: J.L. Industries, Karp Associates, Milcor, Nystrom Building Products or approved equal.

2. Door Design: Flush panel.

3. Material: Commercial grade cold-rolled steel with 16-gauge frame and 20-gauge door.

4. Finish: Phosphate dipped with baked-on rust inhibiting primer.

5. Insulation: 2-inch thick fire-rated insulation sandwiched between two pieces of 20-gauge steel.

6. Exposed Trim: Flange integral with frame, 1-inch wide, overlapping surrounding finished surface.

7. Hinge: Manufacturer's exposed piano hinge.

8. Continuous Closer: Automatic spring closer to automatically close and latch door.

9. Latch/Lock: Ball bearing cylinder lock operated by a recessed flush standard key lock. Panels shall have interior latch release mechanism allowing the door to be unlocked from the inside. Provide standard keyed locks at access doors located in public areas.

F. UL Fire-Rated Access Doors with Exposed Trim at Custodial Rooms, and Other Wet Areas:

1. Approved Manufacturers: J.L. Industries, Karp Associates, Milcor, Nystrom Building Products or approved equal.

2. Door Design: Flush panel.

3. Material: Stainless steel, 16-gauge frame and 20-gauge door.

4. Finish: Satin polish finish.

5. Insulation: 2-inch thick fire-rated insulation sandwiched between two pieces of 20-gauge steel.

6. Exposed Trim: Flange integral with frame, 3/4-inch wide, overlapping surrounding finished surface.

7. Hinge: Manufacturer's exposed piano hinge.

8. Continuous Closer: Automatic spring closer to automatically close and latch door.

9. Latch/Lock: Ball bearing cylinder lock operated by a recessed flush standard key lock. Panels shall have interior latch release mechanism allowing the door to be unlocked from the inside.

G. UL Fire-Rated Recessed Access Doors in Public Areas:

1. Approved Manufacturers: J.L. Industries, Karp Associates, Milcor, Nystrom Building Products or approved equal.

2. Door Design: Recessed to receive gypsum board or other finish material as indicated.

3. Material: Cold Rolled sheet steel, 16-gauge, recessed 5/8-inch.

4. Frame: 16-gauge cold rolled sheet steel with 22-gauge galvanized perimeter drywall bead.

5. Hinge: Manufacturer's exposed piano hinge.

6. Continuous Closer: Automatic spring closer to automatically close and latch door.

7. Latch/Lock: Ball bearing cylinder lock operated by a recessed flush standard key lock. Panels shall have interior latch release mechanism allowing the door to be unlocked from the inside. Provide standard keyed locks at access doors located in public areas.

8. Finish: Phosphate dipped with baked-on rust inhibiting primer for field painting as specified in Section 09 91 00.

H. Trimless Access Panels in Gypsum Board Ceilings:

1. Approved Manufacturer: Bauco Access Panel Solutions "baucoplus-II series" or approved equal.

2. Material: Extruded aluminum allow 6063-T6 frame and supports with moisture- and mold-resistant gypsum board inlay and galvanized internal steel corner reinforcing.

3. Door: Fabricate using 2.8 mm thick extruded aluminum alloy 6063-T6 frame, screwed in place gypsum board inlay. Exposed top edge of frames shall have a concave meniscus rise of 0.5 mm thick to accept finishing compound.

4. Frame: Recessed aluminum framing providing an edge like drywall bead.

5. Hinge: Concealed, galvanized steel free pivot hinge allowing door to open 120-degrees.

6. Latching/Locking Device: Concealed touch latch.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install access doors in accordance with manufacturer's instructions.

B. Coordinate installation with work of other Sections.

C. Set frames accurately in position and securely attach to supports with face panels plumb and level in relation to adjacent finish.

D. Frames, doors and trim pieces shall not vary from straightness or snug contact fit by more than 1/16-inch.

E. Coordinate location of access doors in hung ceilings, furred spaces and walls to provide access to concealed work items requiring maintenance and/or adjustment. Obtain approval of the Architect for the locations of such access doors.

F. Locate and group equipment requiring access doors. Coordinate location of equipment with other trades to minimize number of access doors in one area.

G. Provide access doors for maintenance or adjustment purposes for mechanical system components, including but not limited to the following:

1. Valves.

2. Dampers.

3. Concealed equipment.

3.02 ADJUST AND CLEAN

A. Adjust hardware and panels after installation for proper operation.

B. Remove and replace panels and frames that are warped, bowed, dented, or otherwise damaged.

END OF SECTION

SECTION 08 71 00

DOOR HARDWARE

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: Hardware for hollow metal (steel) doors.

1.02 SUBMITTAL

A. Shop Drawings: Indicate locations and mounting heights of hardware. Supply templates to door and frame manufacturers for proper and accurate sizing and locations of cutouts for hardware.

B. Product Data: Submit catalog cuts for each type of hardware.

1. Keying schedule: Coordinate directly with Owner's representative.

C. Samples. Submit physical samples of types and finish of hardware substituted if requested by Architect. Both the specified items and item submitted for substitution. Only written approvals and written acceptance will be allowed. Verbal approvals will not be permitted on substitutions.

D. Closeout Submittal: Record actual locations of installed cylinders and master key codes on Project Record Documents.

1.03 QUALITY ASSURANCE

A. Single Source Responsibility: Obtain each type of hardware (latchsets, locksets, hinges, pivots, and closers, trim) from a single manufacturer, unless otherwise noted in the hardware groups.

B. Access for Persons with Disabilities: Comply with California Code of Regulations, Title 24, and Americans with Disabilities Act Accessibility Guidelines (ADA-AG).

C. Supplier: Recognized builders' hardware supplier with minimum 5-years successful experience in scheduling and furnishing hardware.

D. Pre-Installation Conference: Convene not less than one week prior to commencing work of this section; include persons involved with installation of doors, frames, and hardware.

1.05 DELIVERY, STORAGE AND HANDLING

A. Deliver hardware in manufacturer's original packages, marked for intended opening and use.

B. Pack complete with necessary screws, bolts, keys, instructions, and installation template, if necessary, for spotting mortising tools.

C. Upon delivery, furnish complete list of hardware for checking, clearly marked to correspond with marking on each package.

1. Review list for completeness and accuracy.

PART 2 - PRODUCTS

2.01 PRODUCTS

A. Acceptable Manufacturers

1. Provide items in Hardware Schedule complete to function as intended. Every attempt should be made to match existing hardware. Items specified are for function and bidding.

2. Listed manufacturers are intended to establish a level of quality. Equal products by other manufacturers will be considered as a substitution.

2.02 HARDWARE TYPES LIST

A. Hardware Items

1. Hinges and Butts: Comply with following unless otherwise indicated.

a. Doors 1-3/4" thick and up to 41" wide: 4" heavy weight.

b. Doors 1-3/4" thick and up to 48" wide: 4" extra heavy weight.

c. Doors 2" thick or over 48" wide: 5" extra heavy weight or oilite bearing.

d. Provide widths sufficient to clear trim projections when door swings 180 degrees.

e. Provide 3 hinges to 90" high, 1 hinge for each 18" above 90" high for each door leaf, unless otherwise indicated.

f. Provide ball bearing or oilite hinges at doors with closers.

g. Provide 4” x 4” ball bearing template butt hinges on high traffic doors, stairwell doors, and exterior doors.

2. Locksets and Latchsets: Provide of metal matching specified finish; interior parts of steel and zinc-dichromatic plating, to resist rusting and corrosion; do not supply plastic, die-cast or aluminum mechanisms.

a. Type: Grade 1 Cylindrical

b. Lock Design: Schlage AL Series

c. Backset: 2 ¾”

d. Strikes: Furnish standard strikes with extended lips where required to protect trim from being marred by latch bolt; verify type of cutouts provided in metal frames.

3. Keying (if required):

a. Hardware manufacturers shall provide for grand master, master key, keyed alike or keyed different keying as directed by Owner/Architect.

b. Provide construction keying or construction cylinders for doors requiring locking during construction; construction inserts or cylinders shall be removed just prior to owner occupancy.

c. Furnish (10) master keys per master key group, (5) construction keys, (1) extractor keys, (1) emergency keys, (100) blank keys), and (2) change keys per cylinder. Stamp all keys "DO NOT DUPLICATE".

d. Tag all keys with location and schedule heading number and submit keys for final use to owner.

e. Hardware manufacturers shall key and register lock cylinders and shall keep complete and accurate records for future expansion and reference purposes.

4. Door Stops: See Door Schedules for reference.

5. Kick Plates: Height x 2" less door width x .050, beveled 4 sides.

6. Silencers: Furnish hollow metal door frames with door silencers; three at single doors and four at pairs.

7. Door Closers: LCN or Norton surface mounted or concealed closers. Surface mounted closers shall be heavy duty model with adjustable power, latch speed, swing speed and back check settings.

B. Finishes:

1. Provide following finishes unless otherwise indicated.

2. Provide 626 Satin Chrome as indicated in the hardware groups.

3. Other items: Provide manufacturers standard finishes to match locks on same door and maintain acceptable finish considering anticipated use.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify Site Conditions.

B. Verify doors and frames are ready to receive work and dimensions are in conformance with Contract Documents.

3.02 INSTALLATION

A. Install finish hardware specified under this Section; coordinate with manufacturer of doors and frames.

B. Fit hardware prior to painting, then removed for painting of doors and frames before final installation of hardware.

C. Install hardware in accordance with manufacturer's instructions.

D. No extra cost will be allowed because of changes or corrections necessary to facilitate installation of hardware.

3.03 MOUNTING POSITIONS

A. Heights are centerline heights from finished floor.

B. Comply with recommendations of Builders Hardware Manufacturers Association, subject to approval, for height of items not indicated; height is to center unless otherwise noted. Must be within ADA requirements.

1.	Locks and Latches:	36" to center of lever.
2.	Top Hinge:	To jamb manufacturer's standard, but not greater than 10" from head of frame to centerline of hinge.
3.	Bottom Hinge:	To jamb manufacturer's standard, but not greater than 12 1/2" from floor to center of hinge.
4.	Intermediate Hinges:	Equally spaced between top and bottom hinges and from each other.
5.	Other items:	Comply with recommendations of Builders Hardware Manufacturers Association (BHMA), subject to approval, for heights of items not indicated.

3.04 ADJUSTMENT

A. Prior to acceptance or occupancy, make final check and adjustment of all hardware items. Clean operating items as necessary to restore proper function and finish of hardware and doors. Adjust door control devices to compensate for final operation of heating and ventilating equipment.

B. Instruct Owner's Representative in proper adjustment and maintenance of hardware and hardware finishes during the final adjustment of hardware.

3.05 HARDWARE SCHEDULE

A. The Hardware Schedule established a type and standard of quality.

B. Examine drawings and specifications and furnish proper hardware for door openings, whether listed or not.

C. Bring omissions to attention of Architect prior to bid opening for instructions; otherwise, list will be considered complete; no extras will be allowed.

Hardware Schedule

Set: 1.0

Hinges	Ives 5BB1HW-626 5” x 4.5”	626
Latchset	Schlage AL Series F75 x Saturn	626
Door Stop	Hager 241F	626
Kick Plates	Hager 190S-8x34	630
Silencers	Ives SR64	GRY

END OF SECTION

SECTION 08 80 00

GLAZING

PART 1 - GENERAL

1.01 DESCRIPTION

A. This Section describes the requirements for exterior bullet-resistant panels.

1.02 SUBMITTALS

A. Product Data: Manufacturer's technical data for each glazing material and fabricated glass product required, including installation and maintenance instructions. Furnish calculations performed to determine if heat strengthened exterior glass is required.

B. Samples: 12-inch square samples of each type of glass indicated and specified except for clear single pane units, and 12-inch long samples of each type of sealant or gasket exposed to view.

C. Shop Drawings: Show dimensions of existing doors and windows to receive bullet-resistant glass panels.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Protect materials during delivery, storage, and handling; comply with manufacturer's directions and as required to prevent edge damage to glass, and damage to glass and glazing materials from effects of moisture, temperature changes, direct exposure to sun and from other causes.

1.05 PROJECT CONDITIONS

A. Do not proceed with glazing when ambient and substrate temperature conditions are outside the limits permitted by glazing material manufacturer or when glazing channel substrates are wet.

B. Install glazing sealants at ambient and substrate temperatures above 40-deg. F.

PART 2 - PRODUCTS

2.01 GLASS TYPES

A. Bullet-Resistant Glazing Panels: ACE “Polymatrix” or approved equal.

1. Material: Composite clear ballistic panel providing UL Level 1 (124 grain, 9mm, 1293 fps ammunition) when installed on ¼-inch thick annenaled glass.

2.03 ELASTOMERIC GLAZING SEALANTS

A. General: Comply with recommendations of sealant and glass manufacturer's for selection of glazing sealants with performance characteristics suitable for applications indicated and conditions at time of installation.

1. Compatibility: Select sealants with proven compatibility with other materials with which they will come into contact, including glass products, seals of insulating glass units, and glazing channel substrates, under conditions of installation and service, as demonstrated by testing and field experience.

2. Suitability: Comply with recommendations of sealant and glass manufacturers for selection of glazing sealants which have performance characteristics suitable for applications indicated and conditions at time of installation.

3. Colors: Color of exposed sealant as selected by Architect; custom colors may be used.

B. Silicone Glazing Sealant: One-part elastomeric silicone sealant complying with ASTM C920, Type S, Grade NS, Class 25, Uses NT, G, A and 0 as applicable; Dowsil “790”, GE "Silpruf", Tremco "Spectrum 1" or approved equal.

PART 3 - EXECUTION

3.01 INSPECTION

A. Inspect work for compliance with manufacturing and installation tolerances, including those for size, squareness, offsets at corners; presence and functioning of weep system on framing having weeps; existence of minimum required face or edge clearances; and for effective sealing of joinery. Do not proceed with work until unsatisfactory conditions have been corrected.

3.02 BULLET-RESISTANT GLAZING PANELS

A. Install over existing glazing where indicated and in accordance with manufacturer’s instructions.

B. Apply silicone sealant around the perimeter of the panel, covering 1/8-inch gap.

3.03 PROTECTION AND CLEANING

A. Protect glass from breakage. Do not apply markers to surfaces of glass. Remove nonpermanent labels and clean surfaces.

B. Protect glass from contact with contaminating substances. Remove immediately by methods recommended by glass manufacturer.

C. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction for build-up of dirt, scum, alkali deposits or staining. Remove as recommended by glass manufacturer.

D. Remove and replace glass which is broken, chipped, cracked, abraded or damaged during construction, including natural causes, accidents and vandalism.

E. Wash glass on both faces not more than 4-days prior to date scheduled for inspection for Substantial Completion. Use methods recommended by glass manufacturers.

END OF SECTION

SECTION 09 22 16

NON-STRUCTURAL METAL FRAMING

PART 1 - GENERAL

1.01 DESCRIPTION

A. This Section describes the requirements for furnishing and installing light-gauge non-load bearing wall framing systems, including metal studs, wall furring, and backing plates.

1.02 DESIGN AND PERFORMANCE REQUIREMENTS

A. General: Where stud gauge and spacing is not indicated, engineer non-structural metal framing to comply with the following requirements.

B. Stud Systems: Select steel studs in accordance with manufacturer's standard load tables and the following deflection criteria, based on stud depth and spacing indicated and partition height required:

1. Partitions to Receive Gypsum Board: L/240.

2. Partitions to Receive Tile Backer Board: L/360.

3. Framed Ceilings: L/360.

C. Structural supports and blocking for light fixtures and miscellaneous wall- or ceiling-mounted items shall be designed and engineered by Contractor to comply with California Building Code (CBC).

1.03 SUBMITTALS

A. Product Data: Manufacturer's specifications and installation instructions for each type of metal support system, including provisions for fixture and equipment anchorage.

B. Shop Drawings: Show provision for fixture and equipment anchorage to stud systems different from typical systems or details indicated.

1.04 QUALITY ASSURANCE

A. Tolerances: Provide metal studs and furring installations that are plumb, true, straight, and rigid.

B. Welder's Qualifications: AWS D1.1 and 1.3 as applicable.

C. Fire-Test-Response Characteristics: Provide components that comply with rating requirements specified for fire-rated assemblies under UL 2079 for non-load bearing wall systems.

1. Deflection Clips and Firestop Track: Connections and/or top runner provided in fire-resistance-rated assemblies shall be certified by UL 2079 for cyclic movement requirements.

1.05 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Deliver products in the original unopened packages, containers, or bundles with manufacturer's label intact and legible.

B. Remove products delivered in broken, damaged, rusted or unlabeled condition from the Project site immediately.

C. Protect products from rusting and other sources of damage.

PART 2 - PRODUCTS

2.01 APPROVED MANUFACTURERS

A. ClarkDietrich Building Systems., Consolidated Systems, Inc., SCAFCO, The Steel Network Inc. or approved equal.

2.02 MATERIALS

A. Metal Studs:

1. Material: Mill-certified galvanized steel conforming to ASTM A653, G40 coating, minimum yield strength 33,000-psi.

2. Construction: Formed C-channel section conforming to ASTM C645.

3. Size and Thickness: As indicated on drawings or as required for specified deflection criteria, based on stud depth and spacing indicated and partition height required. If stud spacing is not indicated, space studs at 16-inches on center.

B. Runner Tracks:

1. Material: Mill-certified galvanized steel conforming to ASTM A653, G40 coating, minimum yield strength 33,000-psi.

2. Construction: Formed channel section conforming to ASTM C645.

3. Size: Minimum 1-inch flange width; web depth matching studs.

4. Thickness: Same as studs.

C. Vertical Slotted Deflection and Drift Track: ClarkDietrich “MaxTrak 2D (SLT/H) or approved equal head-of-wall deflection track allowing for vertical live load movement and horizontal seismic drift.

1. Code Criteria: Meet required head of wall connection criteria as required by CBC and as indicated in UL2079 for cyclic wall movement.

2. Yield Strength: Grade 33ksi.

3. Coating: G60.

4. Material Thickness: 43 mils (18-gauge) unless heavier gauges are indicated.\

5. Leg Depth: 3-inches, designed for a total vertical movement of 2-inches.

D. Metal Channels: Mill-certified galvanized steel conforming to ASTM C653, G40 coating, minimum yield strength 33,000-psi.

1. Framing, Furring, and Stiffening:

Size, Inches	Pounds per 1,000 Lineal Feet
3/4 cold rolled	300
1-1/2 cold rolled	475
2 cold rolled	590

2. Furring Channels: Minimum 20-gauge galvanized steel with knurled faces; hat-shaped or Z-section as required.

E. Tie Wire: No. 16-gauge, galvanized, single-strand annealed steel or No. 18-gauge, galvanized, double-strand annealed steel.

F. Screws: ASTM C1002, Type S, pan head sheet metal screws, minimum 1/2-inch length.

G. Runner Track Fasteners: Powder-actuated tempered-steel pins with corrosive resistant plating or coating, 9/64-inch diameter, minimum 1-1/8-inch penetration. The use of powder-actuated anchors is not permitted in concrete where the actual concrete strength exceeds the concrete strength at which the anchor has been tested to provide the required capacity unless the anchor capacity is verified by field testing.

H. Backing Plates: Provide backing plates as indicated.

I. Compression or Isolation Strips: Fiberglass, 1/2-inch nominal thickness, width equal to width of tracks or studs where used; density such that material will compress to one-half or less of loose thickness.

PART 3 - EXECUTION

3.01 INSPECTION AND PREPARATION

A. Verify that conditions are satisfactory for the installation of metal support systems. Do not commence the installation until unsatisfactory conditions have been corrected.

B. Coordinate installation of metal support systems with the installers of other related work. Review areas of potential interference and conflicts, and coordinate layout and support provisions for interfacing work.

3.02 GENERAL INSTALLATION REQUIREMENTS

A. Install non-load-bearing steel framing members in accordance with ASTM C754, and as specified.

B. Cutting:

1. General: Cut framing components squarely or on angle as required to fit tightly with proper bearing against abutting members.

2. Cutting Studs: If stud web is cut more than 50-percent, or stud flanges are cut, restore stud to original strength by wire-tying, or welding on steel reinforcement.

C. When studs extend to the underside of structural slabs, secure at top with a slip connection to accommodate slab deflection.

3.03 NON-LOAD-BEARING VERTICAL METAL FRAMING

A. Runner Tracks: Align at floor and ceiling with partition layouts. Secure to structure with specified fasteners located 2-inches from each end and spaced not to exceed 24-inches on center.

1. Coordinate installation of continuous isolation strips or acoustical sealant at acoustical partitions with installation of top and bottom runner tracks.

2. Where partition comes to underside of profile metal deck, create an acoustic seal to fill the profile. Use either metal plate or fiberglass and acoustic sealant, as indicated.

3. Notch runner tracks as required for curved partitions.

4. Where studs extend to structure above, provide vertical deflection accommodating devices where each stud connects to structural members above.

B. Installation of Metal Studs:

1. Install studs spaced 16-inches on center unless otherwise indicated. Screw-fasten framing connections using a minimum of 2 screws for each connection.

2. At partition corners and intersections, provide a minimum of 3 studs.

3. Splice studs where required, by nesting with a minimum lap of 8-inches; fasten laps with 2 screws through each flange.

4. Unless otherwise indicated, frame door openings with double 16-gauge vertical studs securely attached to each jamb of door frame.

    a. At head, install runner track; cut flanges at ends, bend web 90-degrees and screw attach to jamb studs.

    b. Install jack studs over door opening, spaced same as full-height studs.

    c. Where control joints extend upward from door jambs, install a jack stud spaced 1/2-inch from each jamb stud. Space next full-height stud not more than 6-inches from each jamb stud.

    d. Attach jamb studs to metal door frames with metal clips, each with 2 screws into jamb stud.

    e. Attach jamb studs to wood door frames with pairs of wood screws, spaced 24-inches on center.

5. Frame openings other than door openings in the same manner as for doors and install framing below sills of openings to match framing required above door heads.

6. Frame both sides of expansion and control joints with a separate stud; do not bridge the joint with framing components.

7. Install continuous horizontal stiffeners in partitions where recommended by stud manufacturer for partition height, stud gauge, stud spacing, number of layers of gypsum board used, and anticipated stud deflection.

8. Stiffen openings with horizontal channels. Provide one channel continuous across head of openings extending to third stud beyond on each side. Provide one channel at each frame anchor extending to third stud beyond. Wire-tie or weld horizontal channels to each stud.

C. Chase-Wall Framing:

1. Align two parallel rows of floor and ceiling runners according to partition layout.

2. Position steel studs vertically in runners with flanges in same direction, with studs on opposite sides of chase directly across from each other. Anchor to runners in accordance with manufacturer's instructions.

3. Cross brace chase studs with 12-inch wide gypsum wallboard gussets or minimum 2-1/2-inch steel studs. Attach web-to-web with screws. If chase wall studs are not opposite, brace with horizontal runners and braces.

D. Wall Furring, Direct Attachment:

1. Attach hat-shaped metal furring channels either vertically or horizontally. For furring positioned horizontally, attach a furring member not more than 4-inches from both the floor and ceiling. Secure with fasteners placed on alternate channel flanges, spaced on 16-inch centers.

2. Attach Z-shaped metal channels vertically, spaced 16-inches on center unless otherwise indicated, with fasteners spaced 24-inches on center.

3.04 BACKING PLATES

A. Install as indicated and specified for support of wall-hung cabinets, toilet partitions and accessories, and other items to be mounted on vertical surfaces.

B. Welding shall comply with AWS D1.3.

C. Paint welds with a rust-inhibitive paint.

3.05 HORIZONTAL FRAMED SURFACES

A. Joist frame with studs of size, gauge and spacing indicated or as determined from manufacturer's standard tables based on specified deflection criteria.

B. Provide runner channels to receive studs at ceiling and walls of same gauge as studs. Secure with mechanical fasteners at 24-inches on center maximum.

C. Secure studs to channels with screws.

D. Provide furring channels in resilient sound isolation clips as indicated.

3.06 SOUND CONTROL WORK

A. Specified requirements apply to framing for interior partitions indicated as sound partitions.

B. Isolate top and bottom runners from direct contact with structure by installing over either:

1. Continuous compression or isolation strips as specified, or

2. Two continuous 1/4-inch beads of acoustical sealant specified in Section 07 92 19 applied at quarter points of track width.

C. Studs at terminal ends of partitions abutting intersecting walls or partitions, and studs that would otherwise contact intermediate structural columns shall be similarly installed over strips or sealant.

3.07 INSTALLATION TOLERANCES

A. Variation from Plumb: Maximum 1/8-inch in 10-feet, non-cumulative.

B. Variation from Level: Maximum 1/8-inch in 10-feet, non-cumulative.

C. Variation from True Plane: Maximum 1/8-inch in 10-feet, non-cumulative.

D. Variation from True Position: Maximum 1/4-inch, non-cumulative.

E. Variation of Member from Plane: Maximum 1/8-inch, non-cumulative.

END OF SECTION

SECTION 09 22 26

METAL SUSPENSION SYSTEMS

PART 1 - GENERAL

1.01 DESCRIPTION

A. This Section describes the requirements for furnishing and installing metal ceiling suspension systems, including suspended system for gypsum board ceilings.

1.02 SUBMITTALS

A. Product Data: Manufacturer's specifications and installation instructions for each type of suspension system, including provisions for fixture and equipment anchorage.

1. Include ICC-ES test reports showing proposed hanger and bracing wire fasteners can support specified loads.

1.03 QUALITY ASSURANCE

A. Ceiling-support system shall limit deflection of finished ceilings to less than L/360.

1.04 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver products in the original unopened packages, containers, or bundles with manufacturer's label intact and legible.

B. Remove products delivered in broken, damaged, rusted, or unlabeled condition from Project site immediately.

C. Protect products from rusting and other sources of damage.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Metal Channels: ASTM C645, galvanized in accordance with ASTM A653, G60 coating designation.

1. Framing, Furring, and Stiffening:

Size, Inches	Pounds per 1,000 Lineal Feet
3/4 cold rolled	300
1-1/2 cold rolled	475
2 cold rolled	590

2. Furring Channels: Minimum 20-gauge galvanized steel with knurled faces; hat-shaped or Z-section as required.

B. Hanger Wire: Galvanized, soft, mild annealed steel; 8-gauge, unless otherwise indicated, complying with ASTM A641.

C. Diagonal Bracing Wire: Galvanized, soft, mild annealed steel; 12-gauge, unless otherwise indicated, complying with ASTM A641.

D. Tie Wire: No. 16-gauge, galvanized, single-strand annealed steel or No. 18-gauge, galvanized, double-strand annealed steel.

E. Screws:

1. General: ASTM C1002, corrosion resistant, for attachment to metal framing 25-gauge and lighter; ASTM C954 for attachment to metal framing 20-gauge and heavier.

2. Thread and head designs and lengths as recommended by manufacturer for uses and materials involved.

F. Hanger and Bracing Wire Fasteners:

1. Hanger Wires: Connection device capable of carrying not less than 100-pounds.

2. Bracing Wires: Connection device capable of carrying not less than 200-pounds or the actual design load, whichever is greater, with a safety factor of 2 without yielding.

G. Furring Channel Clips: Fabricated from galvanized wire, for attaching furring channels to cold-rolled channels.

H. Compression Stiffeners: 20-gauge channel studs, 1-1/2-inches.

PART 3 - EXECUTION

3.01 SUSPENDED CEILING SUSPENSION FRAMING

A. Space 8-gauge hanger wires 48-inches on center along carrying channels and within 6-inches of ends of carrying channels.

B. Install 1-1/2-inch cold rolled carrying channels 48-inches on center and within 6-inches of walls. At splices, interlock flanges, overlap ends 12-inches, and wire-tie with double loops of No. 16-gauge wire.

C. Install 3/4-inch cold rolled channels at right angles to carrying channels, spaced 24-inches on center and within 6-inches of walls. Provide one-inch clearance between furring channels and abutting walls and partitions. Attach to carrying channels by saddle-tying around carrying channels with one strand of No. 16 or two strands of No. 18-gauge tie wire. At splices, nest furring channels with a minimum 8-inch overlap and wire-tie each end with double loops of No. 16-gauge wire.

D. Install 4-way 45-degree diagonal bracing wires at 12'-0" x 12'-0" within 6-inches of walls. Diagonal bracing wires shall be located at the intersection of main runner and cross-furring member. Provide connection between diagonal wires and main runner to prevent slipping for a 200-pound approximate seismic load.

E. Install hanger and bracing wire anchors so the direction of the wire aligns as closely as possible with the direction of the forces acting on the wire.

F. Separate ceiling hanging and bracing wires at least 6-inches from unbraced ducts, pipes, and conduit.

G. Fasten wires with not less than 4 tight turns. Make all tight turns within 1-1/2-inches.

H. Install uplift stiffener for each 144-square feet of ceiling, consisting of a vertical metal stud occurring at the junction of the carrier and furring channel. Wire tie to carrier or screw to channel and secure to overhead structure.

I. At control joints, provide discontinuous lap in main runners occurring over joints. Do not bridge joints with cross furring where joints run perpendicular to furring. Where joints run parallel to furring, provide furring to support each side of joint.

J. Provide recesses and openings where indicated for lighting fixtures, registers, access panels, and other items to be installed in ceilings; provide additional furring channels where required by opening.

K. Recessed or drop-in light fixtures shall be supported directly by main runners or by supplemental framing which is supported by main runners.

L. Surface mounted fixtures shall be attached to a main runner with a positive clamping device made of material with a minimum of 14-gauge. Rotational spring catches are not acceptable.

END OF SECTION

SECTION 09 29 00

GYPSUM BOARD

PART 1 - GENERAL

1.01 DESCRIPTION

A. This Section describes the requirements for furnishing and installing the following:

1. Gypsum board and associated accessories.

1.02 SUBMITTALS

A. Product Data: Manufacturer's specifications and installation instructions for each type of gypsum board and accessory required.

B. Shop Drawings: Furnish layout drawing showing proposed location of control joints.

1.03 QUALITY ASSURANCE

A. Gypsum board work shall comply with ASTM C840 and California Building Code (CBC) Section 2508 unless otherwise indicated or specified.

B. Installation and finishing of gypsum board shall comply with GA-216. Installation of fire-rated gypsum board shall comply with their listing descriptions indicated on the Drawings.

C. Fire-Resistance Ratings: Where gypsum board systems with fire-resistance ratings are indicated, provide materials and installations identical with those of applicable assemblies tested in accordance with ASTM E119 by fire testing laboratories acceptable to authorities having jurisdiction.

1. Provide fire-resistance-rated assemblies identical to those indicated by reference to GA File No's. in GA-600 "Fire Resistance Design Manual" or to design designations in UL "Fire Resistance Directory" or in listing of other testing and agencies acceptable to authorities having jurisdiction.

D. Allowable Tolerances:

1. Gypsum board surfaces shall have no measurable variation in any 2-foot direction and a maximum variation of 1/8-inch in 10-feet when a straightedge is laid on the surface in any direction. Specified tolerances apply to both plumbness of walls and levelness of ceilings.

2. Shim work as required to comply with specified tolerances.

3. Do not exceed 1/16-inch offset between planes of abutting sheets at edges or ends.

E. Mock-up: Install mock-up using approved gypsum products, including fasteners and related accessories, in accordance with manufacturer’s instructions and recommendations.

1. Size: 100-square feet.

2. Prepare mock-up for each level of exposed gypsum board finish.

3. Approved mock-up may remain as part of the work.

1.04 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Delivery:

1. Deliver materials to the Project site in original package containers or bundles with manufacturer's labels intact and legible.

2. Deliver fire-rated materials bearing the testing agency's label and classification identification.

B. Storage:

1. Store materials indoors in a dry area, under cover, and stacked flat off the floor.

2. Stack gypsum boards so that long lengths are not over short lengths.

C. Handle gypsum board to avoid damaging face and edges of sheets.

D. Protect metal corner beads and trim from being bent or damaged.

1.05 PROJECT CONDITIONS

A. Establish and maintain environmental conditions for application and finishing gypsum board to comply with ASTM C840 and with gypsum board manufacturer's recommendations.

B. Minimum Room Temperatures: For non-adhesive attachment of gypsum board to framing, maintain not less than 40-deg. F. For adhesive attachment and finishing of gypsum board, maintain not less than 50-deg. F. for 48-hours prior to application and continuously thereafter until drying is complete.

C. Ventilate building spaces to remove water not required for drying joint treatment materials. Avoid drafts during dry, hot weather to prevent materials from drying too rapidly.

D. Provide for continuous ventilation during installation, using as close to 100-percent outside air as possible.

E. Protect workers and HVAC system from gypsum dust.

F. Remove and replace all gypsum board products that are exposed to water and display mold and mildew. Removal shall occur as soon as possible after exposure to water.

PART 2 - PRODUCTS

2.01 GYPSUM BOARD

A. Gypsum Board: United States Gypsum “SHEETROCK SW” or approved equal with tapered rounded edge to minimize ridging or beading and other joint imperfections.

1. ASTM C1396, regular type except where Type X fire-resistant type is indicated or required to meet UL assembly types.

2. Thickness: 5/8-inch or as indicated or required to match existing.

3. Provide Firecode C core panels where required for fire-rated assemblies in Gypsum Association Fire Resistance Design Manual.

B. Mold- and Moisture-Resistant Gypsum Board: United States Gypsum “SHEETROCK Mold Tough” or approved equal noncombustible, moisture- and mold-resistant gypsum core encased in moisture- and mold-resistant, 100-percent recycled face and back papers. Panels shall have a tapered long edge.

1. ASTM C1396, regular type except where Type X fire-resistant type is indicated or required to meet UL assembly types.

2. Thickness: 5/8-inch.

3. Provide Firecode C core panels where required for fire-rated assemblies in Gypsum Association Fire Resistance Design Manual.

2.02 GYPSUM BOARD ACCESSORIES

A. Screws: ASTM C954 or ASTM C1002.

1. Use Type S screws for gypsum board attachment to light steel framing.

2. Use Type S-12 screws for gypsum board attachment to 20-gauge and heavier steel framing.

3. Use Type G screws for gypsum board attachment to gypsum board.

4. Use Type W screws for gypsum board attachment to wood framing.

B. Metal Trim: Galvanized steel, 26-gauge minimum; profiles and dimensions indicated.

1. Corner Beads: United States Gypsum “Dur-A-Bead” or approved equal.

2. Casing Beads: United States Gypsum or approved equal.

3. Control Joints: Roll-formed zinc with perforated flanges, 1-3/4-inch wide with 1/4-inch wide center channel with removable tape strip over channel.

C. Reveals: Extruded aluminum alloy 6063-T5, profiles indicated, finish as selected by the Architect.

D. Drywall L Molding Trim: Fry Reglet “L” Trim Molding, 6063-T5, size as required, finish as selected by the Architect, or approved equal.

E. Joint-Treatment Materials: ASTM C475.

1. Drying-type (ready mixed): United States Gypsum “SHEETROCK” all-purpose joint compound or approved equal.

2. Setting-type (chemically hardening): United States Gypsum “SHEETROCK” setting-type joint compound or approved equal.

3. Low-Dust Emission Type: United States Gypsum “SHEETROCK” Plus 3 ready-mixed lightweight all-purpose joint compound with dust control or approved equal.

F. Reinforcing Joint Tape: ASTM C475, 2-inch nominal width.

G. Acoustical Sheet Sealant Pad: Harry A. Lowry & Associates, 3M or approved equal.

H. Resilient Channels: Unimast “RC Deluxe”, Cemco “RC-1”, Dale/Incor RFC-1”, Dietrich “RCSN” or approved equal.

I. Laminating Adhesive: Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrate.

J. Primer/Surfacer: United States Gypsum “SHEETROCK” Tuff-Hide” primer-surfacer or approved equal.

PART 3 - EXECUTION

3.01 INSPECTION

A. Verify that conditions are satisfactory for the installation of gypsum board and accessories.

1. Check framing for accurate spacing, alignment, plumbness, and levelness. Verify that both new and existing framing members will result in gypsum board surfaces complying with specified tolerances.

2. Verify spacing of installed framing does not exceed maximum allowable for thickness of board to be used.

3. Verify door frames are set for thickness of board to be used.

4. Repair protrusions of framing, twisted framing members, or unaligned members before installation of gypsum board commences.

B. Do not commence the installation until unsatisfactory conditions have been corrected.

3.02 APPLICATION OF GYPSUM BOARD

A. Apply materials in conformance with ASTM C840, the manufacturer's instructions, and as indicated.

B. When gypsum board is to be applied to both walls and ceilings, apply to ceilings first.

C. Resilient Framing:

1. Partitions: Apply resilient channels at right angles to framing. Position bottom channel with resilient channel attachment flange either up or down; position other channels with resilient channel attachment flanges down. Attach with 1-1/4-inch screws. Locate resilient channels 2-inches from floor, within 6-inches of ceiling, and not more than 24-inches on center.

2. Ceilings: Apply resilient channels at right angles to framing. Attach with 1-1/4-inch screws driven through channel attachment flange. For fire-rated, double-layer assembly, apply channels over base layer and attach with 1-7/8-inch screws driven through channel flange and base layer into joist. Fasten channels to joists at each intersection.

D. For partitions, apply full height sheets with long dimension parallel to framing members with abutting edges over supports. Where ceiling heights exceed 10'-0" and where required by fire resistive ratings, apply sheets with long dimension perpendicular to framing members. For ceilings, apply sheets with long dimension either perpendicular or parallel to framing members to result in fewest joints. For fire-rated assemblies, apply gypsum board in accordance with CBC Chapter 7.

E. Use sheets of maximum lengths to minimize end joints.

F. Neatly fit and stagger end joints.

G. Locate joints on different studs at opposite sides of partition.

H. Cut and fit neatly around outlets and switches. Back-to-back wall penetrations shall be at least two stud spaces apart for acoustic isolation.

I. Double-Layer Application:

1. Apply base layer with long dimension perpendicular to and centered on framing; apply face layer parallel to framing. Apply base layer parallel to framing where required by fire-resistive ratings.

2. Stagger sheets of each layer so that joints of each layer are 16-inches apart.

J. Isolation of Gypsum Board from Other Construction:

1. Provide perimeter relief where gypsum board abuts structural decks, ceilings, vertical structural elements, or window sections.

2. Finish gypsum board edge with corner bead.

3. Seal space between casing bead and structure with continuous sealant bead.

4. Seal around electrical boxes and conduit and pipe penetrations.

5. Seal at base of gypsum board sheets.

K. Acoustic Control Requirements for Sound Walls:

1. Leave a 1/8- to 1/4-inch space between gypsum board and adjacent construction to provide a space for acoustical sealant.

2. Seal airtight with acoustical sealant material specified in Section 07 92 19.

3. Seal penetrations through walls, or cuts in one face of walls, with a full bead of sealant at perimeter; this includes provisions for electrical outlet and switch boxes, pipes, ducts, and similar items.

4. Seal electrical boxes at the back with specified sheet sealant pad. Where wires enter the boxes, seal the openings airtight around the wires and knockout openings.

5. Install mild steel sleeves where required, fiberglass packing between sleeve or framing service and cover plates. Seal on both sides to render airtight.

6. Tolerance: 1/8-inch between wall boarding and sleeve, 3/8- to 5/8-inch between sleeve and service.

L. Installation of Fasteners:

1. Do not locate fasteners less than 3/8-inch from edges or ends of sheets. Do not locate fasteners less than one-inch from edges or ends in horizontal applications.

2. Fire-Rated Partitions: Install fasteners in accordance with the more restrictive of either CBC Chapter 7 or the Underwriters' Laboratories assemblies as denoted on partition schedule.

3. Non-Fire-Rated Partitions: Install fasteners in accordance with GA-216 and ASTM C840.

4. Fire-Rated Ceilings: Install fasteners in accordance with CBC Chapter 7.

5. Non-Fire-Rated Ceilings: Install fasteners spaced not more than 12-inches on center.

6. Install screws using powered screw guns with adjustable screw-depth control head. Drive shank perpendicular to gypsum board surface. Do not hammer screws.

7. Set fastener heads slightly below surface of gypsum board, but do not break or strip paper face around fastener.

8. Stagger fasteners opposite each other on adjacent ends and edges.

9. Omit fasteners at edges where metal edge trim will be installed.

M. Installation of Accessories:

1. Install corner trim at vertical and horizontal external corners and angles, and edge trim at junctions of gypsum board and other materials and at exposed edges.

2. Control Joints:

a. Ceilings: Maximum area for ceilings with perimeter relief shall be 2,500-sq. ft.; maximum area for ceilings without perimeter relief shall be 900-sq. ft. Do not exceed 50-feet between control joints in ceilings with perimeter relief; 30-feet between control joints in ceilings without perimeter relief.

b. Walls and Partitions: Maximum spacing between control joints shall not exceed 30-feet.

c. Control joint locations shall occur only where indicated on reviewed layout drawings.

3.03 TAPING AND FINISHING

A. Finish Levels: Provide levels of gypsum board finish for locations as follows, in accordance with Gypsum Association GA 214 “Recommended Specification: Levels of Gypsum Board Finish”.

1. Level 0: In areas of temporary construction, no taping or accessories are required.

2. Level 1: Ceiling plenum areas and concealed areas. Provide higher level of finish as required to comply with fire-resistance ratings and acoustical ratings.

3. Level 2: Not used.

4. Level 3: Not used.

5. Level 4: Gypsum board surfaces, except where another finish level is specified.

6. Level 5: Gypsum board surfaces where required to match existing.

B. Interior Gypsum Board Finishing:

1. Taping (Level 1):

a. Use taping or all-purpose compound.

b. Butter taping compound into inside corners and joints.

c. Center tape over joints and press down into fresh compound.

d. Remove excess compound. Tape joints of gypsum board above suspended ceilings.

2. First Coat (Level 2):

a. Use taping or all-purpose drying-type compound or setting-type joint compound.

b. Immediately after bedding tape, apply skim coat of compound over body of tape and allow to dry completely in accordance with manufacturer’s instructions.

c. Apply first coat of compound over flanges of trim and accessories, and over exposed fastener heads and finish level with board surface.

3. Second Coat (Level 3):

a. Use all purpose or topping drying type joint compound.

b. After first coat treatments is dried, apply second coat of compound over tape and trim, feathering compound 2-inches beyond edge of first coat.

4. Third Coat (Level 4):

a. Use all purpose or topping drying type joint compound.

b. After second coat has dried, sand surface lightly and apply thin finish coat to joints, fasteners and trim, feathering compound 2-inches beyond edge of second coat.

c. Allow third coat to dry. Apply additional compound, and touch-up and sand, to provide surface free of visual defects, tool marks, and ridges, ready for application of finish.

5. Skim Coat (Level 5):

a. Apply skim coat of all-purpose drying-type compound over exposed surfaces of gypsum board.

b. After skim coat has dried, touch-up and sand to provide surface free of visual defects, tool marks, and ridges, and ready for application of finish.

C. Cut edges and openings around pipes and fixtures shall be caulked flush with sanitary sealant as specified in Section 07 92 00.

D. In the completed installation, gypsum board shall have plumb and straight surfaces with no waves or buckles. Joints, fastener heads, and trim flanges shall be invisible after finishing. Surfaces shall be uniformly smooth and ready for painting or other decoration.

E. Primer/Surfacer: Complete gypsum board surface to Level 4 before applying primer-surfacer. Machine-apply with airless sprayer in conformance with manufacturer's instructions to a wet film thickness of 15- to 20-mils. Allow to dry overnight before painting.

3.04 PROTECTION OF FINISHED WORK

A. Maintain temperature and humidity conditions as required to protect the installation.

B. Protect completed gypsum board from damage or deterioration until final acceptance of the work.

END OF SECTION

SECTION 09 51 13

ACOUSTICAL PANEL CEILINGS

PART 1 - GENERAL

1.01 DESCRIPTION

A. This Section describes the requirements for the materials and installation of acoustical ceiling panels.

1.02 SUBMITTALS

A. Product Data: Manufacturer's descriptive and technical data and illustrations. Include MSDS data sheets.

B. Material Samples: Duplicate sets of full-size panels for each type and size of acoustical unit required.

C. Warranty.

D. Certifications: Manufacturer's certifications that products comply with specified requirements, including laboratory reports showing compliance with specified tests and standards. For acoustical performance, each carton of material shall carry an approved independent laboratory classification of NRC, CAC and AC.

1.03 EXTRA MATERIALS

A. In addition to acoustical panels for completing installations required, furnish additional units, in typical field sizes, for each type of unit used in the work.

B. Furnish quantities equal to not less than 3-percent of total installed area of each type of unit or greater to result in full carton lots for each type, except not less than one full carton for any one type of unit.

C. Supply extra units from production lots or color runs the same as for units used in the work, and supply in cartons as factory packaged and labeled. Also identify cartons with Project name and type of ceiling panel.

D. Deliver materials to project premises just prior to substantial completion, and store at location as directed.

1.04 WARRANTY

A. Warrant acoustical ceiling panels to be free from visible sag and against mold, mildew and bacteria for a period of 1-year from Date of Substantial Completion. This warranty shall be in addition to and not a limitation of other rights the Owner may have against the Contractor under the Contract Documents.

PART 2 - PRODUCTS

2.01 ACOUSTICAL CEILING PANELS

A. Acoustical Ceiling Panels (ACT-1): CertainTeed “Baroque Fine Fissured BQCL-224”, USG “Radar Illusion 2848”, Armstrong “Cortega Second Look 2767” or approved equal.

1. Size: 24-inch x 48-inch with scoring to simulate 24-inch x 24-inch panels.

2. Thickness: ¾-inch.

3. Edges: Reveal.

4. NRC: 0.55.
5. CAC: 35.
6. Recycled Content: 33-percent.
7. Light Reflectance: 0.83.
8. Color: White.
9. Grid System: Exposed wide face grid system specified in Section 09 53 23.

B. Acoustical Ceiling Panels (ACT-2): CertainTeed “Symphony m” 1222BB-75-1 and 1220BB 75-1, LUSG “Mars” 86785 and 88785, Armstrong “Cirrus High NRC” 556 and 551 or approved equal.

1. Size: 24-inch x 24-inch and 24-inch x 48-inch, as indicated.
2. Thickness: ¾-inch.
3. Edges: Reveal.
4. NRC: 0.75.
5. CAC: 36.
6. Light Reflectance: 0.90.
7. Color: White.
8. Grid System: Exposed wide face grid system specified in Section 09 53 23.

C. Acoustical Ceiling Panels (ACT-3): CertainTeed “Ecophon Focus DS” 3542 1511, USG “Acoustic SF” 659853, Armstrong “Calla Vector” 2814 or approved equal.

1. Size: 24-inch x 24-inch.
2. Thickness: 3/4-inch.
3. Edges: Fully Concealed.
4. NRC: 0.85.
5. CAC: 25.
6. Light Reflectance: 0.85.
7. Color: As selected by the Architect.
8. Grid System: Concealed wide face grid system specified in Section 09 53 23.

PART 3 - EXECUTION

3.01 AMBIENT CONDITIONS

A. Building shall have been entirely enclosed and heated not less than 10-days before start of suspended-ceiling work.

B. Before installation, acoustical units shall have been stored within the spaces where they are to be used for not less than 3-days, and with cartons opened and stripped sufficiently to permit units to stabilize to ambient conditions.

C. Remove and replace acoustical panel ceiling products that are exposed to water and display mold and mildew. Removal shall occur as soon as possible after exposure to water.

3.02 INSTALLATION

A. Acoustical Ceiling Panels:

1. Install acoustical panels in suspended grid system in accordance with manufacturer's instructions.

2. Field-cut edges of tegular edge acoustical panels shall be routed to match the edge profile of uncut panels so that panels lay in grid system flush with adjacent un-cut panels and edges of cut panels match the appearance of uncut panels.

3. Touch-up edges to match factory cut panels.

3.03 COMPLETION

A. Acoustical panels shall rest uniformly on their supporting members and shall be flat and free from twist and warp.

B. Exposed surfaces of acoustical units shall be clean and free from scratches, dents, tool marks, stains, discoloration, fingerprints, and other defects and damage

END OF SECTION

SECTION 09 53 23

METAL ACOUSTICAL CEILING SUSPENSION ASSEMBLIES

PART 1 - GENERAL

1.01 DESCRIPTION

A. This Section describes the requirements for the materials and installation of acoustical suspension systems for acoustical panels.

B. Work under this Section includes furnishing and installing safety hanger wires for mechanical and electrical equipment to extent specified. Connecting safety wires to such equipment is not included.

1.02 SUBMITTALS

A. Shop Drawings:

1. Indicate ceiling-system layouts and general and atypical conditions and details.

2. Include details of bracing, special features and joints, perimeters, relationship to adjacent construction, and anchorage and connections to structures.

B. Product Data: Manufacturer's descriptive and technical data and illustrations, marked to identify product materials, types, and variations.

C. Material Samples: Duplicate sets of 10-inch-long pieces of grid system and perimeter trim members with one end as factory fabricated, and connection and fastening accessories and devices.

1.03 QUALITY ASSURANCE

A. Installer's Qualifications: Regularly providing installation of assemblies of the types required.

B. Suspension systems shall be designed, fabricated, and installed to meet requirements of ASTM C635, C636, and E580, Section 5. Comply with DSA IR 25-2.10.

C. Ceiling system components shall comply with ASTM C635 and Section 5.1 of ASTM E580.

D. The ceiling grid system shall be rated heavy duty as defined by ASTM C635.

E. Main runners, cross runners, splices, expansion devices, and intersection connectors shall be designed to carry a mean ultimate test load of not less than 180-lbs. in compression and tension per ASTM D580, Section 5.1.2.

PART 2 - PRODUCTS

2.01 EXPOSED WIDE FACE GRID SYSTEM

A. Approved Manufacturers: CertainTeed “EZ Classic Stab 15/16”, Armstrong “Prelude XL HRC”, USG, Inc. “Donn DX / DXL HRC” or approved equal.

B. Material: Hot dipped galvanized steel made from USA produced recycled steel.

C. Main Runners: 15/16-inch flange, 1-11/16-inch high, double web construction.

D. Cross Runners: 15/16-inch flange, double web construction.

E. Wall Angle, Reveals, and Miscellaneous Trim: Roll-formed from electrogalvanized steel strip to profiles indicated.

E. Finish: Factory-applied white low gloss enamel.

F. Structural Classification: Heavy duty meeting the requirements of ASTM C635.

G. Provide seismic clips for grid system connections to 7/8-inch wall angle.

H. Recycled Content:

1. Total Content: 66-percent.

2. Total Post-Consumer Content: 56-percent.

2.02 CONCEALED GRID SYSTEM

A. Approved Manufacturers: CertainTeed “15/16” Classic Stab”, Armstrong “Prelude Concealed Tee Grid”, USG, Inc. “DX/DXL” or approved equal.

B. Material: Hot-dipped galvanized steel.

C. Main Runners: 15/16-inch flange, 1-11/16-inch high, double web construction.

D. Cross Runners: 15/16-inch flange, double rotary-stitched, double-web construction.

E. Provide Tee splines, concealed angles, access hooks, clips and other accessories required for accessible sections. Locate accessible sections where indicated or directed by the Architect.

F. Wall Angle, Reveals, and Miscellaneous Trim: Roll-formed from electrogalvanized steel strip to profiles indicated.

G. Finish: Factory-applied white low gloss enamel.

H. Structural Classification: Heavy duty meeting the requirements of ASTM C635.

I. Provide seismic clips for grid system connections to 7/8-inch wall angle.

2.03 SUSPENSION MATERIALS AND FASTENINGS

A. General: Comply with requirements of ASTM C635.

B. Wire:

1. General: ASTM A641, galvanized steel with class 1 coating, soft annealed; factory pre-straightened units.

2. Hanger and Safety Wires: 12-gauge.

3. Hanger and safety wires shall have a minimum tensile strength of 70-ksi and the maximum allowable tension load for wire shall be 350-lbs.

a. Four turns of the wire with 1.5-inches will develop the wire allowable load.

b. Three turns of the wire within 3-inches ss assumed to develop no more than 50-percent of wire allowable load.

C. Wire Connections to Overhead Structures:

1. Hanger Wires: Connection device capable of carrying not less than 100-pounds.

2. Bracing Wires: Connection device capable of carrying not less than 200-pounds or the actual design load, whichever is greater, with a safety factor of 2 without yielding.

D. Fastenings for Accessories:

1. Bolts or screws of adequate size, in types appropriate for conditions and materials involved, made of corrosion-resistant materials or coated as approved.

2. Concealed only, unless otherwise indicated or approved.

E. Compression Stiffeners: Minimum 20-gauge metal stud with 7/8-inch flange up to 4-feet in length; minimum 25-gauge metal stud with 1-5/8-iinch flange and lips up to 8-feet in length. Provide structural calculations for compression stiffeners greater than 8-feet in length.

PART 3 - EXECUTION

3.01 INSTALLATION REQUIREMENTS

A. Installations shall be accordance with ASTM C636 and Section 5.2 of ASTM E580. Comply with the additional requirements specified in DSA IR 25-2.13.

B. Anchor hanger and bracing wire anchors so that the direction of the wire aligns as closely as possible with the direction of the forces acting on the wire. Hanger wires shall not be more than 1 (horizontal) in 6 (vertical) out of plumb.

C. Provide 12-gauge hanger wires at the ends of all main and cross runners within 8-inches from the support or within 1/4 of the length of the end tee, whichever is least, for the perimeter of the ceiling area. Perimeter wires are not required when the length of the end tee is 8-inches or less.

1. 12-gauge hanger wires may be used for up to and including a 4-foot x 4-foot grid spacing and shall be attached to main runners. Splices in hanger wires shall develop 50-percent of the wire allowable load.

D. Provide trapeze or other supplementary support members at obstructions to main hanger spacing. Provide additional hangers, struts or braces as required at all ceiling breaks, soffits or discontinuous areas. Hanger wires more than 1 in 6 out of plumb shall have counter-sloping wires.

E. Ceiling grid members shall be attached to not more than 2 adjacent walls in accordance with ASCE 7, Section 13.5.6.2(b). Ceiling grid members shall be at least 3/8-inch and not more than 3/4-inch free of other walls. If walls run diagonally to ceiling grid system runners, one end of main and cross runners shall be free, and a minimum of 3/4-inch clear of wall.

F. Ceiling grid members shall be attached to two adjacent walls per ASTM E580, Section 5.2.3. Ceiling grid members shall be at least 3/4-inch clear of other walls. If walls run diagonally to ceiling grid system runners, one end of main and cross runners shall be free, and a minimum of 3/4-inch clear of wall.

G. The width of the perimeter supporting closure angle shall be not less than 2-inches. Use of angles with smaller widths in conjunction with proprietary perimeter clips may be acceptable if in accordance with Section 5 of IR 24-2.13.

H. At the perimeter of the ceiling area, where main or cross runners are not connected to the adjacent wall, provide interconnection between the runners at the free end to prevent lateral spreading. A metal stabilizer or a 16-gauge wire with a positive mechanical connection to the runner may be used and placed within 8-inches of the wall. Where the perpendicular distance from the wall to the first parallel runner is 8-inches or less, the stabilizer or 16-hgauge wire is not required.

I. Expansion joints shall be provided in the ceiling at intersections of corridors and at junctions of corridors with lobbies or other areas.

J. Lateral force bracing assemblies consisting of a compression strut and four 12-gauge splayed wires oriented 90-degrees from each other are required for all ceiling areas.

1. Lateral force bracing may be omitted for suspended acoustical ceiling systems with a ceiling area not to exceed 144-sq. ft., for all values of S_{DS} when perimeter support is provided in accordance with Section 2.2 of IR 25-2.13.

2. Lateral force bracing assemblies shall be spaced per Table 1 for all values of the component importance factor (I_p) of the ceiling.

3. There shall be a brace assembly a distance of not more than one half of the above spacing from each surrounding wall, expansion joint and at the edges of any ceiling vertical offset.

4. The slope of bracing wires shall not exceed 45-degrees from the horizontal plane and wires shall be taut. Splices in bracing wires shall develop the wire allowable load.

5. Compression struts shall meet the following requirements:

   a. The strut shall be sized to adequately resist the vertical component force induced by the ceiling bracing wires and have a maximum kl/r not to exceed 300. The struts listed in Appendix A of IR 25-2.13 meet this requirement.

   b. The strut shall not be more than one (horizontal) in six (vertical) out of plumb.

K. Attachment of Hanger and Bracing Wires:

1. Fasten hanger wires with not less than three tight turns in 3-inches. Hanger wire loops shall be tightly wrapped and sharply bent to prevent any vertical movement or rotation of the member within the loops. Refer to ASTM E580, Section 5.2.7.2.

2. Fasten bracing wires with not less than four tight turns in 1-1/2-inches.

3. Hanger and bracing wire anchorage to the structure shall be installed in such a manner that the direction of the anchorage aligns closely with the direction of the wire.

4. Separate all ceiling hanger and bracing wires at least 6-inches from all unbraced ducts, pipes, conduit, etc.

5. Hanger and bracing wires shall not attach to or bend around obstructions including but not limited to: piping, ductwork, conduit and equipment. Provide trapeze or other supplementary support members at obstructions to allow typical hanger spacing. Brace assemblies shall be configured and/or located in order to avoid obstructions in addition to maintaining the required brace assembly spacing.

6. Provide additional hangers, struts and brace assemblies as required at all ceiling breaks, soffits, or discontinuous areas.

7. Hanger wires that are more than one (horizontal) in six (vertical) out of plumb shall have counter-sloping wires.

8. Attachment of the bracing wires to the structure above and to the main runners shall be adequate for the imposed load. The weight shall be taken as not less than 4-psf for calculating seismic forces.

9. Post-installed anchors shall have a current Evaluation Report acceptable to DSA in accordance with IR A-5.

10. Powder-actuated fasteners in concrete are not permitted for bracing wires.

11. DSA approval of a construction plan is required prior to installing post-installed anchors in pre-stressed concrete. The construction plan shall demonstrate how the location of existing pre-stressing tendons and strands will be located and denoted as necessary to avoid interference.

L. Expansion Joints, Seismic Separation Joints:

1. Expansion joints shall be provided in the ceiling at intersections of corridors and at junctions of corridors and lobbies or other similar areas.

2. For ceiling areas exceeding 2,500-sq. ft., a seismic separation joint shall be provided to divide the ceiling into areas not exceeding 2,500-sq. ft. in accordance with ASTM E580, Section 5.2.9.

M. Testing of Concrete Anchors:

1. When drilled-in concrete anchors or shot-in anchors are used in reinforced concrete for hanger wires, 1 out of 10 shall be field tested for 200-pounds of tension.

2. When drilled-in concrete anchors are used for bracing wires, 1 out of 2 shall be field tested for 440-pounds in tension. Shot-in anchors in concrete are not permitted for bracing wires.

N. Ceiling Fixtures, Terminals, and Devices:

1. All fixtures, terminals, and other devices shall be mounted in a manner that will not compromise ceiling performance in accordance with Section 13.5.6.2.2 Item 5 of ASCE 7 as amended by CBC Section 1616A.20 and ASTM E580 Sections 5.3 and 5.4.

2. Ceiling panels shall not support any light fixtures, air terminals or devices.

3. Penetrations through the ceiling sprinkler heads and other similar devices that are not integrally tied to the ceiling system in the lateral direction shall have a 2-inch oversized ring, sleeve or adapter through the ceiling panel to allow free movement of 1-inch in all horizontal directions. Alternatively, per ASTM E580, Section 5.2.8.5, a flexible sprinkler hose fitting that can accommodate 1-inch of ceiling movement is permitted to be used in lieu of the oversized ring, sleeve, or adapter.

4. Slack safety wires shall be considered hanger wires for installation and testing requirements.

O. Light Fixtures:

1. Light fixtures shall be positively attached to the ceiling suspension systems by mechanical means per CEC Article 410.36 to resist a horizontal force equal to the weight of the fixture. A minimum of two screws or approved fasteners are required at each light fixture, per ASTM E580, Section 5.3.1.

2. Surface-mounted light fixtures shall be attached to the main runner with a least two positive clamping devices on each fixture. The clamping device shall completely surround the supporting ceiling runner and be made of steel with a minimum thickness of 14-gauge. Rotational spring catches do not comply. A 12-gauge slack safety wire shall be connected from each clamping device to the structure above. Provide additional supports when light fixtures are 8-feet or longer or exceed 56-pounds. Maximum spacing between supports shall not exceed 8-feet.

3. Light fixtures weighing less than or equal to 10-pounds shall have a minimum of one 12-gauge slack safety wire connected from the fixture housing to the structure above.

4. Light fixtures weighting more than 10-pounds but less than or equal to 56-pounds may be supported directly on the ceiling runners but they shall have a minimum of two 12-gauge slack safety wires connected from the fixture housing at diagonal corners to the structure above.

    a. Light fixtures greater than 2-feet x 4-feet weighing less than 56-pounds shall have a 12-gauge slack safety wire at each corner.

5. All light fixtures weighing more than 56-pounds shall be independently supported by not less than four taut 12-gauge hanger wires (one at each corner) attached from the fixture housing to the structure above or other approved hangers. The four taut 12-gauge wires or other approved hangers, including their attachment to the structure above, shall be capable of supporting four times the weight of the fixture.

P. Services within the Ceiling:

1. Flexible sprinkler hose fitting mounting brackets, ceiling-mounted air terminals or other services shall be positively attached to the ceiling suspension systems by mechanical means to resist a horizontal force equal to the weight of the component. Screws or approved fasteners are required. A minimum of two attachments are required at each component.

2. Ceiling-mounted air terminals or other services weighing less than or equal to 20—pounds shall have one 12-gauge slack safety wire attached from the terminal or service to the structure above.

3. Flexible sprinkler hose fittings, ceiling-mounted air terminals or other services weighing more than 20-pounds but less than or equal to 56-pounds shall have two 12-gauge slack safety sires (at diagonal corners) connected from the terminal or service to the structure above.

4. Flexible sprinkler hose fittings, ceiling-mounted air terminals or other services weighing more than 56-pounds shall be support4ed directly from the structure above by not less than four taut 12-gauge hanger wires attached from the terminal or service to the structure above or other approved hangers. The four taut 12-gauge wires or other approved hangers, including their attachment to the structure above, shall be capable of supporting four times the weight of the unit.

Q. Other Devices within the Ceiling: All lightweight miscellaneous devices, such as strobe lights, occupancy sensors, speakers, exit signs, etc. shall be attached to the ceiling grid as specified. In addition, devices weighing more than 10-pounds shall have a 12-gauge slack safety wire anchored to the structure above. Devices weighing more than 20-pounds shall be supported from the structure above.

R. Pendent Mounted Light Fixtures:

1. Where pendent mounted light fixtures are to be installed in areas with a suspended ceiling, comply with IR 24-2.13 and DSA IR 16-9.

2. Support pendant-mounted light fixtures directly from the structure above with hanger wires or cables passing through each pendant hanger and capable of supporting 2 times the weight of the fixture.

3. If a pendant mounted light fixture is directly and independently braced below the ceiling, then a bracket assembly is not required above the ceiling.

4. If a pendant mounted light fixture is free to swing 45-degrees from vertical in all directions and is not directly and independently braced below the ceiling, then a bracing assembly is only required where the pendant hanger penetrates the ceiling. Special details are required to attach the pendant hanger to the bracing assembly to transmit the horizontal and vertical forces.

a. Where the weight of the fixture is less than 20-pounds, the vertical component of the brace force need not be considered so no compression strut/post is required.

5. Rigid conduit shall not be used for attachment of fixtures.

S. Installation Tolerances:

1. Bottom surface plane of each assembly shall be within plus or minus 1/8-inch of ceiling-height level required.

2. Bottom surface plane of each assembly shall be level and true to plane within 1/8-inch in 12-feet.

3.02 PERIMETER TRIM

A. Provide in longest lengths available and combinations of lengths to minimize number of joints required.

B. Do not use pieces shorter than 48-inches.

C. Miter joints at corners.

D. Install to neatly close with adjoining vertical surfaces.

3.03 COMPLETION

A. Adjust hangers as required. Addition of kinks or bends in hanger are not acceptable; take up in ties only.

B. When complete, grid members of each assembly shall be mutually parallel/square, accurately aligned, with joints neatly formed and closely fitted and aligned flush; each assembly shall be securely anchored and braced to structure to prevent movement.

C. Exposed surfaces of grids shall be clean and free from scratches, dents, tool marks, stains, discoloration, fingerprints, and other defects and damage.

END OF SECTION

SECTION 09 65 13

RESILIENT BASE AND ACCESSORIES

PART 1 - GENERAL

1.01 DESCRIPTION

A. This Section includes the following:

1. Resilient wall base.

2. Resilient flooring accessories.

1.02 SUBMITTALS

A. Product Data: Submit for each type of product specified.

B. Samples: Samples for verification purposes in manufacturer's standard sizes, but not less than 12-inches long, of each different color and pattern of product specified.

1.03 QUALITY ASSURANCE

A. Fire Performance Characteristics: Provide products with the following fire performance characteristics as determined by testing products per ASTM test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.

1. Critical Radiant Flux: 0.45-watts per sq. cm or more per ASTM E648.

2. Smoke Density: Less than 450 per ASTM E662.

B. All materials shall comply with the requirements of Air Quality Management District (AQMD) Rule 1168 governing the emission of Volatile Organic Compounds.

1.04 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver products to Project site in original manufacturer's unopened cartons and containers, each bearing names of product and manufacturer, Project identification, and shipping and handling instructions.

B. Store products in dry spaces protected from the weather with ambient temperatures maintained between 50- and 90-deg. F.

C. Move products into spaces where they will be installed at least 48-hours in advance of installation.

1.05 PROJECT CONDITIONS

A. Maintain a minimum temperature of 70-deg. F. in spaces to receive products specified in this Section for at least 48-hours prior to installation, during installation, and for not less than 48-hours after installation. After this period, maintain a temperature of not less than 55-deg. F.

B. Do not install products until they are at the same temperature as that of the space where they are to be installed.

C. Close spaces to traffic during installation of products specified in this Section.

D. Provide for continuous ventilation during installation using as close to 100-percent outside air as possible.

1.06 SEQUENCING AND SCHEDULING

A. Sequence installing products specified in this Section with other construction to minimize possibility of damage and soiling during remainder of construction period.

1.07 EXTRA MATERIALS

A. Deliver extra materials to Owner. Furnish extra materials matching products installed as described below, packaged with protective covering for storage, and identified with labels clearly describing contents.

1. Furnish not less than 10-linear feet for each 500-linear feet or fraction thereof of each different type and color of resilient wall base installed.

PART 2 - PRODUCTS

2.01 RESILIENT WALL BASE

A. Rubber Wall Base: Johnsonite, Burke, Flexco, VPI, Roppe or equal complying with ASTM F1861, Type TS or TP.

1. Style: Cove with top-set toe.

2. Height: 4-inches.

3. Lengths: Coils in lengths standard with manufacturer but not less than 100-feet.

4. Exterior Corners: Pre-molded.

5. Interior Corners: Pre-molded.

6. Ends: Pre-molded.

7. Color: To be selected by the Architect from manufacturer’s standards.

2.02 RESILIENT ACCESSORIES

A. Provide rubber cap for cove vinyl sheet flooring, carpet edge for glue down applications, reducer strip for resilient flooring, and tile/carpet transition strips.

B. Profile and Dimensions: As indicated.

C. Color: As selected by the Architect from manufacturer's standards.

2.03 INSTALLATION ACCESSORIES

A. Concrete Slab Primer: Non-staining type as recommended by flooring manufacturer.

B. Trowelable Underlayments and Patching Compounds: Latex-modified, portland-cement-based formulation provided or approved by flooring manufacturer for applications indicated.

C. Adhesives: Provide VOC-compliant type and brands of solvent free water-resistant adhesive as recommended by manufacturer of resilient wall base and accessories for conditions of installation.

PART 3 – EXECUTION

3.01 PREPARATION

A. Comply with manufacturer's installation specifications for preparing substrates indicated to receive products indicated.

B. Use trowelable leveling and patching compounds per manufacturer’s directions to fill cracks, holes, and depressions in substrates.

C. Broom or vacuum clean substrates to be covered immediately before installing products specified in this Section. Following cleaning, examine substrates for moisture, alkaline salts, carbonation, or dust.

3.02 INSTALLATION

A. Install products specified in this Section using methods indicated according to manufacturer's installation directions.

B. Apply resilient wall base to walls, columns, pilasters, casework, and other permanent fixtures in rooms and areas where base is required. Install wall base in lengths as long as practicable. Tightly adhere wall base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.

1. Install inside and exterior corners before installing straight pieces.

C. Place resilient accessories so they are butted to adjacent materials of type indicated and bond to substrates with adhesive. Install reducer strips at edges of flooring that otherwise would be exposed.

3.03 CLEANING AND PROTECTION

A. Perform the following operations immediately after completing installation:

1. Remove visible adhesive and other surface blemishes using cleaner recommended by manufacturers of resilient product involved.

2. Damp-mop resilient accessories to remove black marks and soil.

B. Clean products specified in this Section not more than 4 days prior to dates scheduled for inspections intended to establish date of Substantial Completion in each area of Project. Clean products using method recommended by manufacturer.

END OF SECTION

SECTION 09 65 19

RESILIENT TILE FLOORING

PART 1 - GENERAL

1.01 DESCRIPTION

A. This Section includes resilient tile flooring.

1.02 SUBMITTALS

A. Product Data: Submit for each type of product specified. Include certification by tile manufacturer that products supplied for tile installation comply with local regulations controlling use of volatile organic compounds (VOC's).

B. Samples: For verification purposes in full-size tiles of each different color and pattern of resilient floor tile specified, showing full range of variations expected in these characteristics.

C. Maintenance data for resilient floor tile, to include in Operating and Maintenance Manual.

D. MSDS data sheets for adhesive.

1.03 QUALITY ASSURANCE

A. Single-Source Responsibility for Floor Tile: Obtain each type, color, and pattern of tile from a single source with resources to provide products of consistent quality in appearance and physical properties without delaying progress of the work.

B. Fire Performance Characteristics: Provide resilient floor tile with the following fire performance characteristics as determined by testing products per ASTM test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.

1. Critical Radiant Flux: 0.45-watts per sq. cm or more per ASTM E648.

2. Smoke Density: Less than 450 per ASTM E662.

C. All materials shall comply with the requirements of Air Quality Management District (AQMD) Rule 1168 governing the emission of Volatile Organic Compounds.

1.04 REGULATORY REQUIREMENTS

A. Slip Resistant Surfaces: Conform to the more restrictive provisions of Title III of the Americans with Disabilities Act or with California Building Code (CBC).

1. Resilient flooring shall have a coefficient of friction of at least 0.6 per ASTM D2047.

1.05 PRODUCCT DELIVERY, STORAGE, AND HANDLING

A. Deliver tiles and installation accessories to Project site in original manufacturer's unopened cartons and containers each bearing names of product and manufacturer, Project identification, and shipping and handling instructions.

B. Store flooring materials in dry spaces protected from the weather with ambient temperatures maintained between 50-deg. F. and 90-deg. F.

C. Store tiles on flat surfaces. Move tiles and installation accessories into spaces where they will be installed at least 48-hours in advance of installation.

1.06 PROJECT CONDITIONS

A. Maintain a minimum temperature of 70-deg. F. in spaces to receive tiles for at least 48-hours prior to installation, during installation, and for not less than 48-hours after installation. After this period, maintain a temperature of not less than 55-deg. F.

B. Do not install tiles until they are at the same temperature as the space where they are to be installed.

C. Close spaces to traffic during tile installation.

D. Provide for continuous ventilation during installation using as close to 100-percent outside air as possible.

1.07 SEQUENCING AND SCHEDULING

A. Install tiles and accessories after other finishing operations, including painting, have been completed.

B. Do not install tiles over concrete slabs until the slabs have cured and are sufficiently dry to bond with adhesive as determined by tile manufacturer's recommended bond and moisture test.

1.08 EXTRA MATERIALS

A. Deliver extra materials to Owner. Furnish extra materials matching products installed as described below, packaged with protective covering for storage and identified with labels clearly describing contents.

1. Furnish not less than one box for each 50 boxes or fraction thereof, of each class, wearing surface, color, pattern and size of resilient floor tile installed.

PART 2 - PRODUCTS

2.01 RESILIENT TILE FLOORING

A. Resilient Tile Flooring: To be selected by the Architect.

2.02 INSTALLATION ACCESSORIES

A. Concrete Slab Primer: Non-staining type as recommended by flooring manufacturer.

B. Trowelable Underlayments and Patching Compounds: Latex-modified, portland-cement-based formulation provided or approved by tile manufacturer for applications indicated.

C. Adhesives: Provide VOC-compliant type and brands of solvent free water-resistant adhesive as recommended by manufacturer of resilient wall base and accessories for conditions of installation.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine areas where installation of tiles will occur, with Installer present, to verify that substrates and conditions are satisfactory for tile installation and comply with tile manufacturer's requirements and those specified in this Section.

B. Concrete Subfloors: Verify that concrete slabs comply with ASTM F710 and the following:

1. Slab substrates are dry and free of curing compounds, sealers, hardeners, and other materials whose presence would interfere with bonding of adhesive. Determine adhesion and dryness characteristics by performing bond and moisture tests recommended by tile manufacturer and as specified in Section 09 61 43.

2. Subfloors are free of cracks, ridges, depressions, scale, and foreign deposits of any kind.

C. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. General: Comply with manufacturer's installation specifications to prepare substrates indicated to receive tile.

B. Use trowelable leveling and patching compounds per tile manufacturer's directions to fill cracks, holes, and depressions in substrates.

C. Remove coatings, including curing compounds, and other substances that are incompatible with flooring adhesives and that contain soap, wax, oil, or silicone, by using a terrazzo or concrete grinder, a drum sander, or a polishing machine equipped with a heavy-duty wire brush.

D. Broom or vacuum clean substrates to be covered by tiles immediately before tile installation. Following cleaning, examine substrates for moisture, alkaline salts, carbonation, or dust.

E. Apply concrete slab primer, if recommended by flooring manufacturer, prior to applying adhesive. Apply according to manufacturer's directions.

3.03 INSTALLATION

A. General: Comply with tile manufacturer's installation directions and other requirements indicated that are applicable to each type of tile installation included in Project.

B. Lay out tiles from center marks established with principal walls, discounting minor offsets, so tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths at perimeter that equal less than one-half of a tile. Install tiles square with room axis, unless otherwise indicated.

C. Match tiles for color and pattern by selecting tiles from cartons in same sequence as manufactured and packaged, if so numbered. Cut tiles neatly around all fixtures. Discard broken, cracked, chipped, or deformed tiles.

1. Lay tiles with grain running in one direction unless otherwise indicated or directed by the Architect.

D. Scribe, cut, and fit tiles to butt tightly to vertical surfaces, permanent fixtures, built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings.

E. Extend tiles into toe spaces, door reveals, closets, and similar openings.

F. Maintain reference markers, holes, or openings that are in place or plainly marked for future cutting by repeating on finish flooring as marked on subfloor. Use chalk or other nonpermanent marking device.

G. Adhere tiles to flooring substrates without producing open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, or other surface imperfections in completed tile installation.

H. Use full spread of adhesive applied to substrate in compliance with tile manufacturer's directions including those for trowel notching, adhesive mixing, and adhesive open and working times.

I. Hand roll tiles where required by tile manufacturer.

3.04 CLEANING AND PROTECTION

A. Perform the following operations immediately after completing tile installation:

1. Remove visible adhesive and other surface blemishes using cleaner recommended by tile manufacturers.

2. Sweep or vacuum floor thoroughly.

3. Do not wash floor until after time period recommended by resilient floor tile manufacturer.

4. Damp-mop tile to remove black marks and soil.

B. Protect flooring against mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period. Use protection methods recommended by tile manufacturer.

1. Cover tiles with undyed, untreated building paper until inspection for Acceptance of Work.

2. Do not move heavy and sharp objects directly over tiles. Place plywood or hardboard panels over tiles and under objects while they are being moved. Slide or roll objects over panels without moving panels.

C. Clean flooring not more than 4-days prior to dates scheduled for final acceptance. Clean tiles using method recommended by manufacturer.

END OF SECTION

SECTION 09 66 23

EPOXY RESIN TERRAZZO FLOORING

PART 1 - GENERAL

1.01 DESCRIPTION

A. This Section describes the requirements for furnishing and installing epoxy resin terrazzo flooring.

1.02 SUBMITTALS

A. Shop Drawings: Indicate joint and strip layouts and pattern locations, layouts, and details.

B. Color/Finish Samples:

1. Duplicate sets of 12-inch-square panels for each terrazzo system color and finish required, based upon preliminary selections determined in cooperation with Architect.

2. Duplicate sets of base and other divider units, and 12-inch lengths of each type of metal strip.

C. Product Data:

1. Manufacturer's descriptive and technical data for proprietary type products.

2. Manufacturer's instructions for precautions and handling of products classified as noxious, toxic, or otherwise hazardous.

D. Maintenance Recommendations: NTMA cleaning and maintenance recommendations applicable to types of terrazzo systems required.

E. Mock-up: Construct a mock-up on a waste slab at the site, where directed by the Architect.

1. Make mock-up a minimum 6-feet square, full thickness. Install border and field divider strip located approximately 12-inches from one edge, and at the center of the mock-up. Finish as specified.

2. Remove unsatisfactory mock-up and construct new panels until approved.

3. Retain and protect approved mock-up until its removal is directed. The approved mock-up will be used as a standard of quality for all terrazzo work on the Project.

1.03 QUALITY ASSURANCE

A. Installer:

1. Regularly providing work of types required, for not less than 5-years.

2. Contracting member of NTMA or certified to perform work in accordance with NTMA standards.

3. Furnish with initial submittals satisfactory evidence of compliance with experience requirements.

4. Approved by manufacturer of epoxy terrazzo system.

B. Materials: Suppliers shall provide materials in accordance with NTMA standards.

C. Certification: Furnish Certificates of Compliance indicating that terrazzo materials supplied for the work comply with specified requirements.

1.04 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Provide factory wrapping, packaging, and other means necessary to prevent damage or deterioration of products during shipment, handling, and storage.

B. Store products inside enclosed storage facilities or closed building, supported above grade and slabs-on-grade.

C. Maintain storage spaces and products in dry condition and within temperature extremes recommended by manufacturer.

1.05 COORDINATION

A. Prior to construction of a substrate to support terrazzo, furnish instructions for substrate texture and condition required for each type of terrazzo work.

B. Prior to installing terrazzo work, review details with Architect, and incorporate minor adjustments determined necessary.

C. Coordination schedule for installation with installation of other finishes to minimize possibility of damage.

1.06 PROTECTION

A. Provide barriers and signs as required and maintain until terrazzo work operations have been completed.

B. Protect surfaces adjacent to, around, or below those receiving terrazzo against damage. Repair or refinish adjacent surfaces stained, discolored, or otherwise damaged as directed.

C. Drain waste and washing water into established drainage facilities as directly as possible. Do not permit to run into planting areas or across finishes previously placed where avoidable. Where not avoidable, run off surfaces or areas shall be thoroughly washed off using adequate amounts of clean, fresh water; and brooming where necessary to remove laitance and debris.

1.07 PROJECT CONDITIONS

A. Substrate temperature shall be between 60- and 90-deg. F., and a minimum of 5-deg. F. above dew point.

B. Application shall not occur while temperature is falling to lessen off-gassing.

C. Do not apply epoxy terrazzo in direct sunshine.

PART 2 - PRODUCTS

2.01 EPOXY TERRAZZO MATERIALS

A. Approved Manufacturer General Polymers / Sherwin Williams “Thin-Set Epoxy Terrazzo #1100 System” or approved equal.

B. Flooring Systems: High solids, pigmented, epoxy resin with colored marble, granite chips or other approved aggregates in a troweled mortar system, ground and polished.

C. Primer: General Polymers / Sherwin Williams 3579.

D. Crack-Bridging Membrane: General Polymers / Sherwin Williams 3356.

E. Binding Resin: General Polymers / Sherwin Williams 3520.

F. Grout: General Polymers / Sherwin Williams 3520.

G. Seal Coat: General Polymers / Sherwin Williams 4401.

2.02 METAL STRIPS

A. General:

1. Standard patterns designed for terrazzo work of types required; Manhattan American Terrazzo Strip Co., or approved equal, in types as specified by product name.

2. Metal: White alloy zinc.

3. Strip Tops: 1/8-inch wide.

4. Strip Depths: Suitable for installation system.

5. Unit Length: Longest available and to meet specified standards.

B. Typical Field Dividers: Heavy top strip.

C. Base Strips: To suit coved base profile indicated, with continuous top-edge strip.

D. Edge Transitions: Edging strip; lug depth 1/8-inch at resilient flooring.

E. Fastenings: Provide in types and quantities as necessary to securely fix into place strips not embedded in underbeds.

2.03 MIXES

A. Epoxy Terrazzo:

1. Colors: As selected by the Architect.

2. Proportions: Mix epoxy terrazzo in accordance with resin supplier's recommendations.

3. Mixing: Charge and mix marble chips, glass fragments, stainless steel chunks, and epoxy resin in accordance with supplier's recommendations

PART 3 - EXECUTION

3.01 INSPECTION

A. Verify that conditions are satisfactory for terrazzo work. Do not commence installation until unsatisfactory conditions have been corrected.

B. Concrete subfloor shall not vary more than 1/4-inch from true plane in 10-feet.

C. Verify that floor drains or other frame rims have been set to proper elevation and are securely fixed in place.

D. Surface Preparation for Epoxy Terrazzo:

1. Abrasive blast concrete to remove surface contaminants and laitance. Prepared concrete shall have a surface profile of CSP 3-5.

2. Inspect concrete for bug holes, voids, fins, and other imperfections. Grind smooth protrusions; fill voids with filler material recommended by epoxy terrazzo manufacturer.

3.02 EPOXY TERRAZZO INSTALLATION

A. Membrane: Mix resin and hardener in proportions recommended by epoxy terrazzo manufacturer until uniform in consistency. Pour mixed material on the substrate and apply with a v-notched red rubber squeegee at 40-mils wet film thickness. Periodically verify thickness with wet mil gauge to verify proper application thickness. Allow material to cure overnight at 75-deg. F.

B. Primer: Mix resin and hardener in proportions recommended by epoxy terrazzo manufacturer until uniform in consistency and apply with spray, roller, or brush at the rate of 250-sq. ft. per gallon to yield 5- to 8-mils wet film thickness. Allow primer to become tacky before applying mortar. If primer is not to be topped within open time, broadcast silica sand into resin tightly but uniformly and allow to cure overnight.

C. Mortar: Mix resin and hardener in proportions recommended by epoxy terrazzo manufacturer until uniform in consistency. Add aggregate blend and continue mixing until aggregates are wet out. Pour mixed material onto the substrate and hand or power trowel in place. Allow material to cure 18- to 24-hours minimum.

D. Rough Grinding: Grind with 24 and 80 grit stones or with comparable diamond plugs.

E. Grout Coat: Mix resin and hardener in proportions recommended by epoxy terrazzo manufacturer until uniform in consistency. Apply using a red rubber squeegee or spring-steel trowel to completely fill voids. Allow to cure 18- to 24-hours.

F. Fine Grinding: Grind with a minimum 80 – 120 grit stone until all grout is removed from surface. Upon completion, terrazzo shall show a minimum of 70- to 75-percent of aggregate chips. Repeat rough grinding and grout coat steps if a high number of large voids exist.

G. Seal Coat: Apply using a lambs wool applicator. Apply at a spread rate of 500- to 750-sq. ft. per gallon evenly with no puddles making sure of uniform coverage. Allow to cure 2- to 4-hours before applying a second coat. Allow 24-hours before opening to traffic.

3.03 PROTECTION

A. Protect the finished terrazzo surfaces against discoloration, defacement and other damage until final acceptance of the work.

3.04 COMPLETION

A. When complete, terrazzo color and finish shall be uniform in appearance throughout the work and shall be clean and free from stains, discoloration, and other damage and defects.

END OF SECTION

SECTION 09 67 13

ELASTOMERIC LIQUID FLOORING

PART 1 - GENERAL

1.01 DESCRIPTION

A. This Section describes the requirements for furnishing and installing elastomeric liquid flooring at mechanical equipment rooms over finished spaces below.

1.02 SUBMITTALS

A. Samples: 12-inch square samples of fully cured exposed finish materials, in standard colors for the Architect's selection.

B. Product Data: Elastomeric liquid flooring manufacturer's application specifications, maintenance instructions, and locations of 5 installations applied by factory-trained applicators.

C. Warranty.

1.03 QUALITY ASSURANCE

A. Regulatory Requirements:

1. Elastomeric liquid flooring shall be UL rated Class A, in conformance with ASTM E108, and approved by the California State Fire Marshal's Office.

2. Comply with applicable codes, regulations, and ordinances regarding use and application of coating systems that contain volatile organic compounds (VOC).

B. Manufacturer: Provide elastomeric liquid flooring produced by a single manufacturer with not less than 5-years' prior production and installation of specified materials.

C. Installer: Materials shall be installed by an applicator approved and trained by the materials manufacturer.

1.04 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver and store materials in manufacturer's unopened containers and packaging, identified with manufacturer's name, and name and type of material. Containers shall contain UL label.

B. Follow additional instructions of the manufacturer.

1.05 JOB CONDITIONS

A. Proceed with work only after substrate construction and penetrating work have been completed.

B. Weather Conditions: Proceed with installation when weather conditions comply with manufacturer's recommended limitations.

C. Pre-Installation Conference: Meet at Project site prior to commencement of work and review requirements for work and conditions which could interfere with successful performance. Where required for warranty, require manufacturer's technical representative to participate in conference.

1.06 WARRANTY

A. Furnish manufacturer's warranty signed by the applicator and authorized representative of manufacturer, warranting elastomeric liquid flooring materials for 3-years against failures resulting from normal exposure, excluding failures due to unusual weather, failure of substrate, or abuse. This warranty shall be in addition to and not a limitation of other rights the Owner may have against the Contractor under the Contract Documents.

PART 2 - PRODUCTS

2.01 APPROVED MANUFACTURER

A. Carlisle Coatings and Waterproofing “CCW-5113 Mechanical/Equipment Room System” as specified, Crossfield Products “Dex-O-Tex ME Floor” or approved equal.

2.02 PRODUCTS

A. Base Membrane: Carlisle Coatings and Waterproofing CCW-501, single-component, VOC-compliant, high adhesion, moisture cured, liquid polyurethane, complying with the following performance properties:

Property	Typical Value	Test Method
Composition	Aromatic urethane	
Solids by weight	85%	
Hardness, Shore A	63	ASTM D2240
Tensile strength	900 psi	ASTM D412
Ultimate elongation	625%	ASTM D412
Tear resistance	150 lb/in	ASTM D624
Adhesion to concrete	30 pli	ASTM D903
Low temp. flexibility	-65 deg. F.	ASTM D522

B. Top Coat: Carlisle Coatings and Waterproofing CCW-503, single-component, VOC-compliant, high tensile strength, abrasion-resistant and weather-resistant aliphatic elastomeric polyurethane, complying with the following performance properties:

Property	Typical Value	Test Method
Composition	Aromatic urethane	
Solids by weight	72%	
Hardness, Shore A	94	ASTM D2240
Tensile strength	4000 psi	ASTM D412
Ultimate elongation	200%	ASTM D412
Tear resistance	300 lb/in	ASTM D624
Low temp. flexibility	-50 deg. F.	ASTM D522
Weather resistance	No chalking at 2000 hrs.	ASTM D822
Water permeability (system)	<1.0 perm	ASTM E96
Abrasion resistance (system)	<50 mg	ASTM C501
Fire resistance (system)	Class A	UL 790

C. Surface Primer: Two-component epoxy primer or as recommended by coating manufacturer for each substrate surface.

D. Detail Coat: Single-component, moisture cured polyurethane membrane.

E. Sand Aggregate: 30-65 mesh silica sand.

F. Sealant: One-component or two-component polyurethane approved by coating manufacturer.

G. Backing Rod: Closed-cell polyurethane foam rod.

H. Flexible Flashing: As recommended by coating manufacturer.

PART 3 - EXECUTION

3.01 INSPECTION

A. Examine surfaces to receive traffic coating. Notify the Architect of any conditions detrimental to the application of coating system.

B. Condition of Concrete Surfaces:

1. Concrete shall be sound with a steel trowel and fine broom finish, free of fins, ridges, voids or entrained air holes.

2. Concrete shall be cured by water curing method for 28-days. Curing compounds, if used, shall be approved by coating manufacturer.

3. Repair voids, rock pockets, and excessively rough surfaces with an approved non-shrink grout or ground to match unrepaired areas.

3.02 SURFACE PREPARATION

A. Concrete:

1. Concrete shall be clean, dry, and free from surface contaminants or cleaning residue.

2. Install a 1-inch face, 45-degree cant of sealant at angle changes, including projections through the deck, walls, and curbs.

3. Cracks over 1/16-inch in width and moving cracks under 1/16-inch in width shall be saw cut to ¼-inch minimum width and depth. Saw cut ¼-inch x ¼-inch kerf around drain flanges. Clean, prime and fill saw cuts with polyurethane sealant.

4. Moving cracks over 1/16-inch wide and expansion joints less than 1-inch wide shall be cleaned, primed, fitted with a backing rod and sealed with polyurethane sealant.

5. Allow sealant to cure prior to applying traffic coating.

6. Prime areas to receive detail coats in accordance with manufacturer’s instructions. Extend primer 2-inches beyond area to receive detail coat to allow primer tie-in during coating application.

7. Apply 6-inch wide stripe-coat of detail coat material 30-mils thick centered over sealed cracks, hairline cracks, sealant cants, control and cold joints, and expansion joints less than ½-inch wide.

3.03 APPLICATION

A. Priming:

1. Mix primer in accordance with manufacturer's instructions.

2. Apply primer at a rate of 250- to 300-sq. ft. per gallon. Avoid puddles or ponding and do not apply over stripe coats.

3. Allow primer to dry for 1- to 8-hours or until sufficiently dry. If coating is not applied with the maximum time, reprime.

B. Base Membrane: Apply in one uniform coat at the rate of 1-gallon minimum per 50-sq. ft. or as required to obtain a minimum thickness of 32 wet mills. Allow to cure 16- to 48-hours.

C. Top Coat: Apply in one uniform coat at the rate of 1-gallon per 100-sq. ft. or as required to obtain a minimum thickness of 16 wet mils. Immediately broadcast sand aggregate into the wet material at a rate of 8- to 10-lbs. Per 100-sq. ft and back-roll. Allow the membrane to cure 16- to 48-hours.

3.04 CLEANUP AND PROTECTION

A. Remove spilled and splattered materials immediately as work progresses.

B. Protect installation as required to ensure that work will be without damage or deterioration at time of final acceptance and after completion of other construction work.

C. Do not permit traffic during the first 24-hours after application. Do not allow cart or heavy foot traffic for 48-hours after application. Increase time periods as required during cool weather for the traffic coating to properly cure. Do not allow any traffic on completed coating system until approved by the Architect.

END OF SECTION

SECTION 09 68 13

TILE CARPETING

PART 1 - GENERAL

1.01 DESCRIPTION

A. This Section describes the requirements for furnishing and installing tile carpeting.

1.02 SUBMITTALS

A. Product Data: Include the following:

1. Reports documenting the results of tests by a NVLAP approved laboratory for electrostatic propensity and flooring radiant panel test.

2. Catalog data and product physical characteristics.

3. Manufacturer’s printed installation instructions, surface preparation, seaming techniques, recommended adhesives and other installation accessories.

4. Statement verifying environmental requirements.

5. Maintenance instructions including recommended cleaning equipment and materials, spot removal information, and cleaning methods.

B. Samples:

1. For verification purposes, two full size tiles of each color and pattern selected.

2. 12-inch long sample of carpet accessories.

C. Layout Drawings: Show layout of each area to be covered for approval of pattern, and any pertinent installation details.

D. Maintenance Materials:

1. Furnish the Owner with a minimum of 5-percent of each different material and color used in this Project from same dye lot or production run for compatibility with the installed materials.

2. Furnish materials in securely wrapped packages or factory sealed packing with the manufacturer's standard labels and the material and color designation used in these specifications.

3. Deliver material to the Owner's on-site designated storage place, unloaded and positioned in place per Owner's instructions.

4. Furnish a signed receipt indicating materials and quantities upon delivery.

E. Warranty.

1.03 QUALITY ASSURANCE

A. Requirements of Regulatory Agencies: Carpet tiles shall be approved by applicable jurisdictions.

B. Fire Hazard Classification: Class I floor finish. Minimum critical flux limit of 0.45-watts/square centimeter when tested in accordance with NFPA 253.

C. Static electricity generation of installed carpet shall not exceed 3.5 KV at 70-deg. F and 20-percent R.H. for life of carpet tile.

D. Installer's Qualifications: Installer shall be approved by carpet tile manufacturer, and shall have regularly been providing installations of the types required for no less than five years.

E. Visually perceptible deviations in color at sides and end seams shall not be acceptable.

F. Indoor Air Quality: Carpet tile shall meet or exceed the minimum standards contained in the Carpet and Rug Industry (CRI) Institute consumer information label.

G. Comply with CRI – Carpet and Rug Institute Indoor Air Quality Green Label Testing Program.

1. All carpet tile products shall comply with the VOC limit established by the Carpet and Rug Institute (CRI) Green Label Indoor Air Quality Test Program.

1.04 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Deliver and store packaged materials in original containers labels intact until time for use, with seals unbroken and store rolls in a flat position. Protect from damage, dirt, stains and moisture.

B. Do not store carpet tile near products that can off gas harmful substances.

1.05 PROJECT CONDITIONS

A. Sequencing Schedule: Do not install carpet tiles until building is entirely closed in, wet work and painting is completed, and heating system is in operation.

B. Use adhesives in strict compliance with manufacturer's recommendations and ventilate area with maximum outside air for a minimum of 48-hours after installation.

C. Test substrates to ensure that no dusting will occur through installed carpet tile. Apply sealer on porous concrete surfaces where required to prevent dusting.

1.06 INDOOR AIR QUALITY

A. Pre-ventilate carpet tile in well ventilated, uninhabited space for a few days prior to installation.

B. Provide maximum ventilation during installation.

C. Isolate area of installation from remainder of building.

D. Clean new carpet tile thoroughly with a high-efficiency particulate air (HEPA) filtration vacuum.

1.07 WARRANTY

A. Warrant the carpet tile to be free of defects for a period of 5-years from date of Substantial Completion. This warranty shall be in addition to and not a limitation of other rights the Owner may have against the Contractor under the Contract Documents.

PART 2 - PRODUCTS

2.01 CARPET TILE

A. General: Carpet tile shall comply with CRI Green Label Plus requirements.

B. Manufacturer, Pattern and Color: Bentley “Burnish” 4BRT80AA1K”.

2.02 ACCESSORIES

A. Adhesive: Acrylic emulsion, solvent-free, VOC-compliant, meeting or exceeding CRI “Green Label” requirements, as recommended by carpet tile manufacturer.

B. Crack Filler: Latex base type.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine areas to receive carpet tiles and verify that surfaces are suitable for installation.

B. Test concrete floors for moisture with suitable moisture meter. Moisture shall not exceed adhesive manufacturer's recommendations, as specified in Section 09 61 43.

C. Do not begin installation until unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Subfloor:

1. Prior to installation, repair minor floor irregularities and thoroughly clean floor, leaving no dirt or grit.

2. Fill cracks exceeding 1/16-inch in width with crack filler and sand smooth.

3. Confirm compatibility of adhesive with sealers or curing agents on concrete floors.

3.03 INSTALLATION

A. Apply carpet tiles in strict accordance with manufacturer's instructions.

B. Install carpet tiles in accordance with the recommendations contained in the Carpet and Rug Institute (CRI) “CRI Carpet Installation Standard 2011” http://www.carpet-rug.org/pdf_word_docs/CRI_Carpet_Installation_Standard_2011.pdf.

C. Cement carpet tiles directly to floor. Remove excess cement with approved solvent.

D. Cut evenly along walls, cut and fit evenly around projections, corners, pipes, electrical outlets, floor air or heating elements, and trim strips.

E. Securely fasten carpet edging strips to floor wherever carpet tiles meet different floor materials and no threshold or other divider is noted.

F. Extend carpet tile materials under all open-bottomed and raised-bottom obstructions, and under removable flanges of obstructions. Extend carpet tiles into closets and alcoves of rooms indicated to receive carpeting unless another material is specifically identified to be used in that space. Carpet tile shall be installed under all movable furniture and equipment.

G. Finish installation shall be free from visual defects.

H. The Owner may review carpet tile scraps and retain any he chooses. Remove remainder of scraps from site.

I. Leave carpet base and walls clean and free from stains, blemishes and other foreign material. Remove loose threads and vacuum clean.

J. Installation shall not receive furniture or heavy traffic for 48-hours after installation.

3.04 CLEAN UP

A. After completion of the carpet tile installation, remove all waste and excess materials, tools and equipment. The complete installation shall be thoroughly vacuumed, using an upright, commercial grade, beater type cleaner, and left in a clean condition.

END OF SECTION

SECTION 09 81 00

ACOUSTIC INSULATION

PART 1 - GENERAL

1.01 DESCRIPTION

A. This Section describes the requirements for furnishing and installing acoustic insulation.

1.02 SUBMITTALS

A. Product Data: Manufacturer's specifications for each type of insulation required.

1.03 QUALITY ASSURANCE

A. Fire Ratings: Comply with fire-resistance and flammability ratings specified.

B. Acoustic insulation shall be Green Guard Children & Schools Certified.

1.04 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Protect insulation from physical damage and from becoming wet or soiled. Comply with manufacturer's recommendations for handling, storage and protection during installation.

1.05 INDOOR AIR QUALITY

A. Protect ducts and HVAC system from loose insulation particulates.

B. Provide temporary ventilation of building areas where building insulation is being installed.

PART 2 - PRODUCTS

2.01 ACOUSTIC INSULATION

A. Formaldehyde-Free Unfaced Mineral/Glass Fiber Blanket/Batt Acoustical Insulation: Acoustical insulation produced by combining glass fibers with formaldehyde-free thermosetting resins to comply with ASTM C665, Type I.

1. Surface Burning Characteristics: Maximum flame-spread and smoke developed values of 25 and 50 when tested in accordance with ASTM E84.

2. Approved Manufacturers: Johns Manville "Formaldehyde-Free Sound Control Fiber Glass Batts", Owens Corning "QuietZone Acoustic Batts" or approved equal.

3. Thickness: As indicated.

B. Mineral Wool Insulation: Mineral wool batt insulation complying with ASTM C665, Type 1.

1. Surface Burning Characteristics: Maximum flame-spread and smoke developed values of 0 and 0 when tested in accordance with ASTM E84.

2. Approved Manufacturer: Rockwool "AFB Acoustical Fire Batt Insulation" or approved equal.

3. Thickness: As indicated.

C. Safing: Owens Corning "Thermafiber SAFB" mineral wool or approved equal.

D. Acoustic Board Insulation: Owens Corning Fiberglass "SelectSound Black Acoustic Board" or approved equal.

1. Surface Burning Characteristics: Maximum flame-spread and smoke developed values of 25 and 50 when tested in accordance with ASTM E84.

2. Compressive Strength, ASTM C165: 25-pcf @ 10% deformation; 90-pcf @ 25% deformation.

3. Water Vapor Sorption, ASTM C1104: <3% by weight.

4. Fungi Resistance, ASTM C1338: Pass.

5. Density, ASTM C303: 3.0-pcf.

6. Thickness: As indicated.

2.02 MISCELLANEOUS MATERIALS

A. Mechanical Anchors: Gemco, Inc. “Insulation Hangers” or approved equal. Provide protective covers or an approved un-pointed clip for all areas. Provide adhesive for securing mechanical clip anchors to required substrates. Black color.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Comply with manufacturer's instructions for installation conditions.

B. Do not install insulation until building is sufficiently enclosed or protected against absorption of moisture by the insulation, and do not install insulation unless supporting framing and construction is in a thoroughly dry condition.

C. Install in partitions and ceilings indicated as sound rated.

1. Install snugly between framing members with ends snugly fitted between units and against adjacent construction.

2. Install batts around perimeter of piping and electrical boxes in sound-rated wall/ceiling cavities.

3. Install safing insulation at duct and pipe penetrations of sound-rated construction.

D. Carefully cut and fit insulation around pipes, conduit, and other obstructions and penetrations.

E. Where door and window frames occur in framing, cut additional strips of insulation and hand-pack as required to fill voids in and around such frames.

F. Acoustical Board Insulation:

1. Install black-faced acoustical insulation on ceilings of electrical rooms, boiler rooms, mechanical rooms, elevator machine rooms and where indicated.

2. Install black-faced acoustical insulation on walls behind pegboard panels where indicated.

3. At ceilings, install over insulation fasteners as indicated. Where required, install insulation fasteners prior to application of sprayed-on fireproofing.

a. Space fasteners and secure in a full bed of adhesive as recommended by manufacturer.

b. Lay out insulation for minimum of joints, and with no single pieces less than 24-inches wide nor less than 48-inches long, unless otherwise approved.

c. Offset intermediate end joints in adjacent panels not less than 48-inches.

d. Do not install insulation until clip adhesive is set.

e. Install insulation fully bearing against substrates, with tightly fitted joints.

f. Provide 100-percent insulation coverage of indicated items.

g. Install fastener caps firmly against insulation face without compressing the material. Bend clip prongs flat against caps.

4. At walls, adhered insulation in place using adhesive in accordance with manufacturer's instructions.

5. Do not paint installed insulation.

3.02 PROTECTION

A. Protect installed insulation from harmful exposures and from physical damage.

END OF SECTION

SECTION 09 91 00

PAINTING

PART 1 - GENERAL

1.01 DESCRIPTION

A. This Section describes the requirements for painting and finishing of interior and exterior exposed items and surfaces.

1. Surface preparation, priming and coats of paint specified are in addition to shop-priming and surface treatments specified in other Sections.

2. Work includes painting exposed pipes and ducts, hangers, exposed steel and iron, and primed metal surfaces of Mechanical and Electrical equipment, and general sheet metal work, except as otherwise indicated or specified.

3. Work includes painting hardware specified as primed (USP or 600).

4. Work includes sanding shop-primed surfaces and applying specified primer and finish coats.

5. "Paint" means coating systems materials, including primers, emulsions, enamels, stains, sealers and fillers, and other applied materials whether used as prime, intermediate or finish coats.

B. Surfaces Not to Be Painted:

1. Pre-finished items, including but not limited to acoustic materials, casework, and finished mechanical and electrical equipment, including light fixtures, switchgear and distribution cabinets.

2. Concealed surfaces such as walls or ceilings in concealed areas and inaccessible areas, furred areas, pipe spaces, and duct shafts.

3. Finished metal surfaces such as anodized aluminum, stainless steel, chromium plate, copper, bronze and similar finished materials, exterior aluminum entrances, storefronts, and windows.

4. Prefinished metal panels and formed metal fabrications.

5. Moving parts of operating units, mechanical and electrical parts, such as valve and damper operators, linkages, sensing devices, motor and fan shafts.

C. Following categories of work are included under other Sections:

1. Shop priming ferrous metal items including structural steel, metal fabrications, hollow metal work and similar items. The work of this Section includes sanding and applying specified primer on all shop-primed surfaces exposed to view in the completed work.

2. Shop priming of fabricated components such as architectural woodwork, wood casework and shop-fabricated or factory-built mechanical and electrical equipment or accessories.

3. Piping identification is specified in Division 22.

D. Do not paint over code-required labels, equipment identification, performance rating, name, or nomenclature plates.

1.02 SUBMITTALS

A. Certification: Furnish certification by the paint manufacturer that products supplied comply with local regulations controlling the use of volatile organic compounds (VOCs).

B. Samples: Furnish samples of each color and material to be applied, with texture to simulate actual conditions, on representative samples of the actual substrate.

1. Provide stepped samples, defining each separate coat, including block fillers and primers. Use representative colors when preparing samples for review. Resubmit until required sheen, color, and texture is achieved.

2. Furnish samples on the following substrates for review of color and texture only:

a. Painted Wood: Two 12-inch square samples of each color and material on hardboard.

b. Stained or Natural Wood: Two 4-inch x 8-inch samples of natural and stained wood finish on actual wood samples.

C. Product Data: Specified paint systems are those of Benjamin Moore, Dunn Edwards, Kelly Moore, Sherwin Williams and Vista. If other paint manufacturers are proposed and accepted by the Architect, furnish product comparison charts showing that proposed paint systems are equal to the specified materials in number of coats, type of paint, and sheen.

1.03 QUALITY ASSURANCE

A. Applicators Qualifications: Engage an experienced applicator who has completed painting system applications similar in material and extent.

B. Single Source Responsibility: Provide primers and other undercoat paint produced by same manufacturer as finish coats. Use thinners approved by paint manufacturer and use within recommended limits.

C. Coordination of Work: Review other Sections in which prime paints are to be provided to ensure compatibility of coatings system for various substrates. Upon request, furnish information or characteristics of finish materials to be used.

D. Requirements of Regulatory Agencies: Comply with applicable rules and regulations of governing agencies for air quality control.

1. Comply with current applicable regulations of the local air quality district, California Air Resources Board (CARB) and the Environmental Protection Agency (EPA).

2. Regulatory changes may affect the formulation, availability, or use of specified coatings. Confirm availability of coatings to be used prior to start of painting.

E. Field Samples: On interior wall surfaces provide full-coat finish samples on at least 100-sq. ft. of surface, as directed, until required sheen, color and texture is obtained; simulate finished lighting conditions for review of in-place work. Approved samples will be used as a standard for the Project.

1.04 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to job site in original, new and unopened packages and containers bearing manufacturer's name, batch number, color, and directions.

B. Store materials in tightly covered containers. Maintain containers in a clean condition, free of foreign materials and residue.

C. Keep storage area neat and orderly. Remove oily rags and waste daily. Ensure that workers and work areas are adequately protected from fire hazards and health hazards resulting from handling, mixing and application of paints.

1.05 JOB CONDITIONS

A. Apply water-base paints when temperature of surfaces to be painted and surrounding air temperatures are between 50-deg. F. and 90-deg. F., unless otherwise permitted by paint manufacturer's printed instructions.

B. Apply solvent-thinned paints only when temperature of surfaces to be painted and surrounding air temperatures are between 45-deg. F. and 90-deg. F., unless otherwise permitted by paint manufacturer's printed instructions.

C. Do not apply paint in rain, fog or mist, when relative humidity exceeds 85-percent, or when temperature is less than 5-deg. F. above dew point, or to damp or wet surfaces, unless otherwise permitted by paint manufacturer's printed instructions.

D. Provide adequate ventilation during interior painting using as close to 100-percent outside air as possible.

1.06 EXTRA MATERIALS

A. In addition to materials for completion of the work, furnish 5-gallons of additional materials for each type and color of opaque paint used.

B. Furnish extra materials from same production lots or color runs used in the work. Furnish in containers factory sealed and labeled. Identify each container with Project name and type of material.

C. Deliver materials and an inventory list just prior to Substantial Completion and store where directed by Owner.

PART 2 - PRODUCTS

2.01 APPROVED MANUFACTURERS

A. Benjamin Moore, Dunn Edwards, Kelly Moore, Sherwin Williams, Vista or approved equal.

2.02 MATERIALS

A. Material Compatibility: Provide block fillers, primers, finish coat materials, and related materials that are compatible with one another and the substrates indicated under conditions of service and application.

B. Material Quality: Provide best quality grade of coatings as regularly manufactured by acceptable paint materials manufacturers. Materials not displaying manufacturer's identification as a standard, best-grade product will not be acceptable. Each product within any one paint system shall be from the same manufacturer.

2.03 COLORS

A. Colors shall match color chips furnished by the Architect.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates and conditions under which painting is to be applied. Surfaces receiving paint shall be thoroughly dry before paint is applied.

1. Provide barrier coats over incompatible primers or remove and re-prime as required. Notify Architect prior to applying barrier coats.

2. Clean surfaces before applying paint or surface treatments. Remove oil and grease prior to mechanical cleaning.

3. Start of painting will be construed as the applicator's acceptance of surfaces and conditions within a particular area.

3.02 PROTECTION

A. Protection: Protect work of other Sections against damage by painting and finishing work. Correct damage by cleaning, repairing or replacing, and repainting, as acceptable to Architect.

1. Provide "Wet Paint" signs as required to protect newly painted finishes. Remove temporary protective wrappings provided by others for protection of their work, after completion of painting operations.

2. Remove or protect hardware, hardware accessories, machined surfaces, plates, lighting fixtures, and similar items in place and not to be finish-painted or provide surface-applied protection prior to surface preparation and painting. Following completion of painting, reinstall removed items.

3. At completion of work of other Sections, touch-up and restore damaged or defaced painted surfaces.

3.03 SURFACE PREPARATION

A. Concrete and Masonry:

1. Prepare surfaces to be painted by removing surface contaminates.

a. Remove efflorescence with stiff bristle brush, wire brushing, wiping, sandblasting or acid washing and rinsing. Allow to dry.

b. Remove chalk, dust, dirt, asphalt, tar or excessive mortar by scraping or wire brushing.

c. Remove rust, grease or oil by solvent cleaning or sandblasting.

d. Treat concrete surfaces which are highly glazed or where traces of form release agents are present with a preparation of one-part concentrated muriatic acid, 4-parts water and one-part detergent or as recommended by parting compound manufacturer. Remove acid with water. Allow to dry.

e. Remove stains on concrete resulting from weathering or corroded metals, with a solution of 2-oz. sodium methasilicate in one-gallon water. Wet stained areas with water before application of solution. Allow to dry.

B. Plaster:

1. Clean surfaces free from grit, loose plaster and surface irregularities.

2. Determine alkalinity and moisture content by performing appropriate tests. Do not paint over surfaces where moisture content exceeds that permitted in manufacturer's literature or where pH exceeds 10.

C. Wood: Clean surfaces of dirt, oil, and other foreign substances with scrapers, mineral spirits, and sandpaper, as required. Sand surfaces exposed to view smooth and dust off.

1. Scrape and clean small, dry, seasoned knots, and apply a thin coat of white shellac or other recommended knot sealer before applying primer. After priming, fill holes and imperfections in finish surfaces with putty or plastic wood filler. Sand smooth when dry.

2. Prime, stain, or seal wood to be painted immediately upon delivery. Prime edges, ends, faces, undersides, and backsides of wood, including cabinets, counters, cases, and paneling.

3. When transparent finish is required, back-prime with spar varnish.

4. Back-prime paneling on interior partitions where masonry, plaster, or other wet wall construction occurs on backside.

5. Seal tops, bottoms, and cutouts of unprimed wood doors with a heavy coat of varnish or sealer immediately upon delivery.

D. Ferrous Metal: Clean ungalvanized ferrous metal surfaces that have not been shop-coated; remove oil, grease, dirt, loose mill scale, and other foreign substances. Use solvent or mechanical cleaning methods that comply with recommendations of The Society for Protective Coatings (SSPC).

1. Blast surfaces clean as recommended by the paint system manufacturer and according to requirements of SSPC specification SSPC-SP 10.

2. Treat bare and sandblasted or pickled clean metal with a metal treatment wash coat before priming.

3. Sand shop-applied prime coats to a smooth surface, ready to receive specified primer and finish coats.

E. Galvanized Metals:

1. Clean galvanized metal with an appropriate metal prep and passivator remover.

2. Perform the following test to ensure passivator removal:

a. With a 5-percent copper sulfate solution, place a swab or droplets on the prepared area. If the copper sulfate causes the galvanized coating to blacken, passivator has been removed and the surface is ready for paint application.

b. If the copper sulfate has no effect on the galvanized coating, continue with metal prep solution, prepared in accordance with SSPC-SP 16 “Brush-Off Blast Cleaning of Coated and Uncoated Galvanized Steel, Stainless Steels, and Non-Ferrous Metals” or use a scotch pad to abrade it, being careful not to remove the galvanizing.

3. Document the process and successful passivator removal with photographs.

4. Prepare weathered galvanized metals that have developed a layer of white rust by wire brushing or scrubbing with a stiff brush or abrasive pad to remove the white rust.

F. Gypsum Board: Clean surfaces of dust, dirt, grease, oil and other foreign matter and dust clean.

G. Existing Surfaces to be Repainted: Thoroughly clean and de-gloss surfaces to be repainted by sanding or other means prior to painting. Patched and bare areas shall be shop-primed with same alkyd primer as specified for new work.

3.04 MATERIALS PREPARATION

A. Mix and prepare painting materials in accordance with manufacturer's directions.

B. Maintain containers used in mixing and application of paint in a clean condition, free of foreign materials and residue.

C. Stir materials before application to produce a mixture of uniform density and stir as required during application. Do not stir surface film into material. Remove film and strain material before using.

D. Use thinners approved by paint manufacturer and only within recommended limits.

E. Tinting: Tint each undercoat a lighter shade to facilitate identification of each coat where multiple coats of the same material are applied. Tint undercoats to match the color of the finish coat but provide sufficient differences in shade of undercoats to distinguish each separate coat.

3.05 APPLICATION

A. General: Apply paint in accordance with manufacturer's directions. Use applicators and techniques best suited for substrate and type of material being applied.

1. Provide finish coats compatible with prime coats.

2. The number of coats required is the same regardless of the application method. Do not apply following coats until the previous coat has cured as recommended by the manufacturer. Sand between applications where required to produce a smooth even surface.

3. Apply additional coats when undercoats, stains or other conditions show through final coat, until paint film is of uniform finish, color and appearance. Edges, corners, crevices, welds, and exposed fasteners shall receive a dry film thickness equivalent to that of flat surfaces.

4. Paint surfaces behind movable equipment and furniture.

5. Paint surfaces behind permanently-fixed equipment or furniture with prime coat before final installation of equipment.

6. Paint visible surfaces of ducts where visible through registers or grilles with a flat, non-specular black paint.

7. Paint back sides of access panels, and removable or hinged covers to match exposed surfaces.

8. Finish doors on top, bottom and side edges same as faces. Where openings into rooms have different finishes, finish door edges as directed by the Architect.

9. Omit primer on metal surfaces that have been shop-primed and touch-up painted, unless otherwise indicated.

B. Scheduling Painting: Apply first-coat material to surfaces that have been cleaned, pretreated or otherwise prepared for painting as soon as practicable after preparation.

1. Allow sufficient time between successive coatings to permit proper drying.

C. Application Procedures: Apply paints and coatings by brush, roller, spray, or other applicators according to manufacturer's instructions.

1. Brushes: Use brushes best suited for the material applied.

2. Rollers: Use rollers of carpet, velvet back, or high-pile sheep's wool as recommended by the manufacturer for the material and texture required.

3. Spray Equipment: Use airless spray equipment with orifice size as recommended by the manufacturer for the material and texture required.

D. Minimum Coating Thickness: Apply materials at not less than manufacturer's recommended spreading rate.

E. Mechanical and Electrical Work: Painting mechanical and electrical work is limited to items exposed in mechanical equipment rooms and in occupied spaces. Finish to match adjoining wall or ceiling surfaces.

1. Mechanical items to be painted include, but are not limited to, piping, hangers, and supports; heat exchangers; tanks; ductwork; insulation; supports; motors and mechanical equipment; air grilles and diffusers; and accessory items.

2. Electrical items to be painted include, but are not limited to conduit and fittings, panels, and switchgear.

F. Block Filler: Apply block fillers to concrete masonry block at a rate to ensure complete coverage with pores filled flush, free of pinholes. Provide multiple coats if required.

G. Prime Coats: Before applying finish coats, apply a prime coat. Re-coat primed and sealed surfaces where there is evidence of suction spots or unsealed areas to assure a finish coat with no burn-through or other defects.

H. Pigmented (Opaque) Finishes: Completely cover to provide an opaque, smooth surface of uniform finish, color, appearance and coverage. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness and other surface imperfections will not be acceptable.

I. Transparent (Clear) Finishes: Use multiple coats to produce glass-smooth surface film of even luster. Provide a finish free of laps, cloudiness, color irregularity, runs, brush marks, orange peel, nail holes, or other surface imperfections.

J. Completed Work: Match approved samples for color, texture and coverage. Remove, refinish or repaint work not in compliance with specified requirements.

3.06 CLEANING

A. Clean-Up: During progress of work, remove discarded paint materials, rubbish, cans and rags at end of each workday.

B. Upon completion of painting work, clean window glass and other paint-spattered surfaces. Remove spattered paint by washing and scraping; do not scratch or damage finished surfaces.

3.07 EXTERIOR PAINT SCHEDULE

		BENJAMIN MOORE	DUNN-EDWARDS	KELLY-MOORE	SHERWIN WILLIAMS	VISTA	MPI CATEGORY
A. Ferrous Metal, 100% Acrylic Semigloss							
	First Coat	Acrylic Metal Primer M04	BRPR00 Series Bloc-Rust	5725 DTM Acrylic Primer/Finish	ProCryl B66-310 Acrylic Primer	9600 Protec Metal Primer	107
	Second Coat	Aura Exterior Semi-Gloss #632	SSHL50 Spartashield SG	1215 Premium Professional SG	A-100 A8 Selmigloss	7000 Acriglo Semi Gloss	11
	Third Coat	Aura Exterior Semi-Gloss #632	SSHL50 Spartashield SG	1215 Premium Professional SG	A-100 A8 Semigloss	7000 Acriglo Semi Gloss	11
B. Galvanized and Zinc Alloy Metal, 100% Acrylic Semigloss							
	Pretreatment	Etch	ME-01 Krud Kutter Metal Clean & Etch	Krud Kutter Metal Clean & Etch	B71Y1 DTM Wash Primer	Krud Kutter Metal Etch	
	First Coat	Fresh Start Acrylic Primer #023	ULGM00 Ultrashield Galvanized Metal Primer	5725 DTM Acrylic Primer/Finish	ProCryl B66-310Primer	4800 Metal Pro Primer	134
	Second Coat	Aura Exterior Semi-Gloss #632	SSHL50 Spartashield SG	1215 Premium Professional SG	A-100 A8 Semigloss	7000 Acriglo Semi Gloss	11
	Third Coat	Aura Exterior	SSHL50	1215	A-100 A8	7000 Acriglo	11

		Semi-Gloss #632	Spartashield SG	Premium Professional SG	Semigloss	Semi Gloss	
C. Plaster, 100% Acrylic Flat							
	First Coat	Fresh Start Acrylic Primer N023	ESPR00 Eff-Stop Premium Primer	247 Acry-Shield	A24W300 Loxon Primer	4600 Uniprime II	3
	Second and Third Coats	Aura Exterior Flat 629	SSHL10 Spartashield Flat	1200 Premium Professional Flat	A-100 A6 Flat	2800 Acriglo	10
D. Concrete, 100% Acrylic Flat							
	First Coat	Fresh Start Acrylic Primer N023	ESPR00 Eff-Stop Premium Primer	247 Acry-Shield	A24W300 Loxon Primer	4600 Uniprime II	3
	Second and Third Coats	Aura Exterior Flat 629	SSHL10 Spartashield Flat	1200 Premium Professional Flat	A-100 A6 Flat	2800 Acriglo	10
	Second and Third Coats	Moorlastic Low Lustre 055	GE7100 Elast-O-Kote Elastomeric Coating	1119 ElastaKote	ConFlex XL	500 Solotex	113
E. Concrete Block, 100% Acrylic Flat							
	First Coat	Latex Block Filler 244	SBSL00 Smooth Blocfil Select	521 Premium Professional Filler	B25W25 Prep Rite Block Filler	040 Acrylic Block Filler	4
	Second and Third Coats	Aura Exterior Flat 629	SSHL10 Spartashield Flat	1200 Premium Professional Flat	A-100 A6 Flat	2800 Acriglo	10
F. Wood, 100% Acrylic Semigloss							
	First Coat	Fresh Start Acrylic Primer N023	EZPR00 EZ-Prime Premium	255 Acry-Shield	B42W81 Exterior Latex Primer	4200 Terminator II	6
	Second and Third Coats	Aura Exterior Semi-Gloss 632	SSHL50 Spartashield SG	1215 Premium Professional SG	A-100 A8 Semigloss	7000 Acriglo Semi Gloss	11
G. Wood, Acrylic Semi-Transparent Stain							
	First and Second Coats	Moorewood Acrylic ST Stain 98	ZIN-OK 700 Series Okon Weather Pro	1288 Acry-Shield	A15T5 WoodScapes	Monopole Aquaseal Stain	156

3.08 INTERIOR PAINT SCHEDULE

		BENJAMIN MOORE	**DUNN-EDWARDS**	**KELLY-MOORE**	**SHERWIN WILLIAMS**	**VISTA**	**MPI CATEGORY**
A. Wood, 100% Acrylic Low Odor/Zero VOC Semigloss							
	First Coat	Eco Spec WB Primer N372	UGSL00 Ultra-Grip Select	973 Acry-Plex	ProMar 200 Zero B28-200 Primer	5001 V-Pro Primer	46
	Second and Third Coats	Eco Spec Latex Semi-Gloss N376	SZRO50 Spartazero Semi-Gloss	1050 Premium Professional SG	ProMar 200 Zero B31-2600 Semi-Gloss	5400 V-Pro Semi Gloss	---
B. Wood, Clear Satin Urethane Finish							
	First Coat	Benwood Quick Dry Sanding Sealer 413	Defthane Polyurethane Gloss	Old Masters Masters Armor Satin	A68V91 Wood Classics WB Polyurethane Varnish GL	Defthane Polyurethane Gloss	---
	Second and Third Coats	Benwood Acrylic Polyurethane Low Lustre 423	Defthane Polyurethane Satin	Old Masters Masters Armor Satin	A68 Wood Classics WB Polyurethane Varnish SG	Defthane Polyurethane Satin	128
C. Wood, Stain and Satin Urethane Finish							
	First Coat	Lenmar 1 WB Wiping Stain	Old Masters Wiping Stain	Old Masters Wiping Stain	Minwax 250 Oil Stain	Old Masters Wiping Stain	90
	Second Coat	Benwood Quick Dry Sanding Sealer #413	Old Masters Water-Based Sanding Sealer	2783 Woodcraft Clear Vinyl Sealer	A68V91 Wood Classics WB Polyurethane Varnish GL	Old Masters Water-Based Sanding Sealer	---
	Third and Fourth Coats	Benwood	Old Masters Water-Based	Old Masters	A68 Wood	Old Masters Water-Based	128

		Polyurethane Low Lustre 423	Polyurethane Satin	Masters Armor Satin	Classics WB Polyurethane Varnish SG	Polyurethane Satin	
D. Concrete and Plaster, Acrylic Low Odor/Zero VOC Flat							
	First Coat	Eco Spec Latex Primer Sealer N372	Ultra-Grip Select UGSL00	971 Acry-Plex	ProMar 200 Zero B28-2600 Primer	5001 V-Pro Primer	50
	Second and Third Coats	Eco Spec Latex Flat 373	SZRO10 Spartazero Flat	1005 Premium Professional Flat	ProMar 200 Zero B30w2600 Flat	5100 V-Pro Flat	143
E. Concrete and Plaster, 100% Acrylic Low Odor/Zero VOC Low Sheen/Eggshell							
	First Coat	Eco Spec Latex Primer Sealer N372	UGSL00 Ultra-Grip Select	971 Acry-Plex	ProMar 200 Zero B28w2600 Primer	5001 V-Pro Primer	50
	Second and Third Coats	Eco Spec Latex Eggshell Finish N374	SZRO30 Spartazero Eggshell	1010 Premium Professional Eggshell	ProMar 200 Zero B20w2651 Eggshell	5300 V-Pro Eggshell	145
F. Concrete and Plaster, 100% Acrylic Low Odor/Zero VOC Semigloss							
	First Coat	Eco Spec Latex Primer Sealer N372	SBSL00 Smooth Blocfil Select	971 Acry-Plex	ProMar 200 Zero B28-2600 Primer	5001 V-Pro Primer	50
	Second and Third Coats	Eco Spec Latex Semi-Gloss N376	SZRO50 Spartazero Semi-Gloss	1050 Premium Professional Semi-Gloss	HP Acrylic B66w651 Semi-Gloss	5400 V-Pro Semi Gloss	147
G. Concrete Block, Acrylic Low Odor/Zero VOC Flat							
	First Coat	PPG 6-15 Masonry Block Filler	SBSL00 Smooth Blocfil Select	521 Premium Professional Filler	B25W25 PrepRite Block Filler	040 Acrylic Block Filler	4
	Second and Third Coats	Eco Spec Latex Flat 373	SZRO10 Spartazero Flat	1005 Premium Professional Flat	ProMar 200 Zero B30w2600 Flat	5100 V-Pro Flat	143
H. Concrete Block, 100% Acrylic Low Odor/Zero VOC Semigloss							
	First Coat	PPG 6-15 Masonry Block Filler	SBSL00 Smooth Blocfil Select	521 Premium Professional Filler	B25W25 PrepRite Block Filler	040 Acrylic Block Filler	4
	Second and Third Coats	Eco Spec Latex Semi-Gloss N376	SZRO50 Spartazero Semi-Gloss	1050 Premium Professional Semi-Gloss	HP Acrylic B66w651 Semi-Gloss	5400 V-Pro Semi Gloss	147
I. Gypsum Board, Acrylic Low Odor/Zero VOC Flat							
	First Coat	Eco Spec Latex Primer Sealer 372	VNSL00 Vinylastic Select	971 Acry-Plex	ProMar 200 Zero B28w2600 Primer	5100 V-Pro Flat	149
	Second and Third Coats	Eco Spec Latex Flat 373	SZRO10 Spartazero Flat	1005 Premium Professional Flat	ProMar 200 Zero B30w2600 Flat	5100 V-Pro Flat	143
J. Gypsum Board, 100% Acrylic Low Odor/Zero VOC Low Sheen/Eggshell							
	First Coat	Eco Spec Latex Primer Sealer 372	VNSL00 Vinylastic Select	971 Acry-Plex	ProMar 200 Zero B28w2600 Primer	5001 V-Pro Primer	149
	Second and Third Coats	Eco Spec Latex Eggshell Finish 374	SZRO30 Spartazero Eggshell	1010 Premium Professional Eggshell	ProMar 200 Zero B28-2651 Eggshell	5300 V-Pro Eggshell	145
K. Gypsum Board, 100% Acrylic Low Odor/Zero VOC Semigloss							
	First Coat	Eco Spec Latex Primer Sealer 372	VNSL00 Vinylastic Select	971 Acry-Plex	ProMar 200 Zero B28w2600 Primer	5001 V-Pro Primer	149
	Second and Third Coats	Eco Spec Latex Semi-Gloss N376	SZRO50 Spartazero Semi-Gloss	1050 Premium Professional SG	HP Acrylic B66w651 Semi-Gloss	5400 V-Pro Semi Gloss	147
L. Gypsum Board, Epoxy Semigloss							
	Barrier Coat	Zinsser Gardz	Zinsser Gardz	Zinsser Gardz	Zinsser Gardz	Zinsser Gardz	
	First Coat	Eco Spec Latex Primer Sealer 372	Carboline Sanitile 120	971 Acry-Plex	PrepRite 200 Latex Primer	Carboline Sanitile 120	149
	Second and Third Coats	PPG 16-510 WB1 Pitt Glaze Acrylic Epoxy	Carboline Sanitile 255 Semi-Gloss	Tru-Glaze – WB - 4428	K46 Pro Industrial WB Epoxy	Carboline Sanitile 255 Semi-Gloss	115
M. Ferrous Metal, 100% Acrylic Low Odor/Zero VOC Semigloss							

	First Coat	Super Spec Metal Primer P04	BRPR00 Series Bloc-Rust	5725 DTM Acrylic Primer/Finish	ProCryl B66-310 Acrylic Primer	9600 Protec Metal Primer	107
	Second and Third Coats	Eco Spec Latex Semi-Gloss N376	SZRO50 Spartazero Semi-Gloss	1050 Premium Professional SG	HP Acrylic B66w651 Semi-Gloss	7000 Acriglo Semi Gloss	147
N. Non-Ferrous Metal, 100% Acrylic Low Odor/Zero VOC Semigloss							
	Pretreatment	Etch	ME-01 Krud Kutter Metal Clean & Etch	Krud Kutter Metal Etch	B71Y1 Wash Primer	Krud Kutter Metal Etch	
	First Coat	Super Spec Metal Primer P04	ULGM00 Ultrashield Galvanized Metal Primer	5725 DTM Acrylic Primer/Finish	ProCryl B66-310 Acrylic Primer	4800 Metal Pro Primer	107
	Second and Third Coats	Eco Spec Latex Semi-Gloss N376	SZRO50 Spartazero Semi-Gloss	1050 Premium Professional SG	HP Acrylic B66w651 Semi-Gloss	7000 Acriglo Semi Gloss	147

END OF SECTION

SECTION 12 36 61.19

QUARTZ SURFACING COUNTERTOPS

PART 1 - GENERAL

1.01 DESCRIPTION

A. This Section describes the requirements for furnishing and installing quartz surfacing counter tops, splashes, and surrounds.

1.02 SUBMITTALS

A. Product Data:

1. Quartz Surfacing: Manufacturer's product data and fabrication and installation instructions.

2. Accessories: Manufacturer's product data and installation instructions.

B. Shop Drawings: Show field-verified dimensions, quartz surfacing dimensions, locations, and dimensions of cutouts, required locations of support and blocking members, edge profiles, and installation details and methods. Identify colors and finishes.

C. Samples:

1. Stone: Minimum two 10-inch x 10-inch x full thickness of each color and pattern required.

2. Adhesive: Minimum two samples of adhesive joint for each color quartz surfacing. Show color match of adhesive.

D. Warranty.

1.03 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Handle material to prevent chipping, breakage, soiling or other damage.

B. Protect edges of materials with wood or other rigid materials.

C. Store in racks in near-vertical position. Prevent warpage and breakage. Store inside away from direct exposure to sun. Store between 25- and 130-deg. F. Store with finished face toward finished face.

1.04 WARRANTY

A. Warrant quartz surfacing countertops to be free from defects in materials and workmanship for a period of 10-years from Date of Substantial Completion. This warranty shall be in addition to and not a limitation of other rights the Owner may have against the Contractor under the Contract Documents.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Approved Manufacturer: CaesarStone Quartz Surfacing or approved equal.

B. Quartz Surfacing:

1. Composition: 93-percent crushed quartz aggregate combined with resins and pigments and fabricated into slabs using a vacuum vibro-compaction process.

2. Dimensions:

a. Thickness: As indicated but not less than 2 cm.

b. Slab Sizes: Manufacturer's maximum size slabs to minimize joints.

3. Identification: Material shall be labeled with batch number and imprinted on back with manufacturer's identifying mark.

4. Color and Finish: As selected by the Architect.

5. Exposed Edges and Corners:

a. Countertops:

1) Edges: As selected by the Architect.

2) Outside Corners: ¾-inch radius unless otherwise indicated.

b. Backsplash:

1) Edges: Square.

2) Outside Corners: Square butt joints.

C. Adhesives, Grout and Sealants: Adhesive and joint filler materials shall be inconspicuous and shall match the adjacent surface for smoothness.

1. Mounting Adhesive: VOC-compliant structural-grade silicone or epoxy adhesives of type recommended by manufacturer for application and conditions of use. Provide spacers if required, type as recommended by adhesive manufacturer.

2. Stone Adhesive: VOC-compliant epoxy or polyester adhesive of type recommended by manufacturer for application and conditions of use. Adhesive visible in finished work shall be tinted to match quartz surfacing.

3. Joint Sealants: As specified in Section 07 92 00.

D. Solvent: Product recommended by adhesive manufacturer to clean quartz surface.

E. Cleaning Agents: Non-abrasive, soft-scrub type kitchen cleaners.

F. Provide fasteners and other installation accessories required.

2.02 FABRICATION

A. Verify dimension by field measurements before preparation of shop drawings and fabrication.

B. Layout: Layout joints to minimize joints and to avoid L-shaped pieces.

C. Color Match: Materials throughout Project shall be from the same batch and shall bear labels with same batch number. Visually inspect materials to be used for adjacent pieces to assure acceptable color match. Inspect in lighting conditions similar to those on Project.

D. Variation in distribution of aggregates in quartz surfacing which are within manufacturer's tolerances is not a defect.

E. Thickness of material used through the Project shall not vary more than 1/8-inch.

F. Provide holes and sinkages cut or drilled for anchors, fasteners and supports as required to secure countertops and splashes in place.

G. Edge overhangs shall be consistent and ½- to 1-1/4-inch over the outer most cabinet face and finished end, and parallel with the cabinet face or end within +/- 1/8-inch in any 8'-0" run. Countertop ends at appliances shall be flush with cabinets to a maximum of ¼-inch over the cabinet end.

H. Cutouts:

1. Cutouts shall be within +/- 1/8-inch of locations and +1/8-inch to 0-inch for size.

2. Cutouts shall have 3/8-inch minimum inside corner radius. Inside corners shall be reinforced in an acceptable manner to prevent cracking.

3. Were edges of cutout will be exposed in finished work, polish edges.

4. If the remaining material outside a cutout is less than 3-inches wide, reinforce area by laminating it with a strip of quartz surfacing.

I. Laminations: Laminate layers of quartz surfacing as required to create built-up edges, trim and other areas requiring additional thicknesses.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Site Verification:

1. Verify that substrates supporting quartz surfaces are plumb, level, and flat to within 1/16-inch in 10-feet and that necessary supports and blocking are in place.

2. Base cabinets shall be securely fixed to adjoining units and back wall.

B. Inspect finished surfaces for damage. Do not install until damage materials have been repaired in an acceptable manner or replaced.

3.02 PREPARATION

A. Protect finished surfaces against scratches. Apply masking where required. Guard against grit, dust, and damage from other work.

3.03 INSTALLATION

A. Do not use quartz surfacing pieces with chips, cracks, voids, discoloration or other defects which might be visible or cause staining in finished work.

B. Install quartz surfacing with skilled installers; make necessary field cuts as required.

C. Set quartz surfacing in accordance with reviewed shop drawings. Provide anchors, supports, fasteners and other attachments necessary to secure stone in place.

D. Shim and adjust as required for a level installation.

E. Install quartz surfacing with butted joints; grout lines shall be kept to a minimum.

F. Install countertops on neoprene setting blocks where recommended by fabricator or installer.

G. Bottom of countertop build-up and subtop or front rail shall be flush within 1/16-inch, free of glue residue, and sanded or filled smooth with edges eased at knee spaces or cantilevers. Built-up members shall be of the same material as the countertop.

H. Exposed edges shall be finished and eased to remove sharp edges.

I. Cantilevers with or without sub-top shall not exceed 6-inches for 2 cm (13/16-inch) thick stone or 10-inches for 3 cm (1-3/16-inch) thick stone.

J. Scribe quartz countertops to abutting vertical surfaces with uniform 1/8-inch-wide joints filled with color matched joint sealant.

3.04 CLEANING AND PROTECTION

A. Remove and replace quartz pieces that are broken, chipped, stained or otherwise damaged. Provide new units where directed and install in a manner to eliminate evidence of replacement.

B. Clean stone after installing; use procedures by stone fabricator.

C. Provide protective covering where required.

END OF SECTION

SECTION 14 27 00

ELEVATOR CAB INTERIORS

PART 1 - GENERAL

1.01 DESCRIPTION

A. This Section includes pre-engineered elevator interior finish system including the following:

1. Side and rear wall panels.
2. Return wall panels.
3. Handrails.
4. Suspended ceiling.
5. Ceiling lighting.

1.02 SUBMITTALS

A. Product Data: Provide manufacturer's data sheets on each product to be used.

B. Shop Drawings: Details of construction, including relationship with adjacent materials. Include installation and maintenance instructions.

C. Verification Samples: For each finish product specified, two samples, minimum size 2-1/2-inches by 1-1/2-inches.

1.03 QUALITY ASSURANCE

A. Manufacturer Qualifications: Minimum 10 years' experience in manufacture of architectural surface materials and fabrication of elevator cab interiors.

B. Installer Qualifications: Minimum 3 years' experience in the installation of elevators.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to installation site in manufacturer's original packaging. Handle products in accordance with manufacturer's instructions. Store in dry, secure location, protected against direct sunlight and excessive heat. Protect finished surfaces.

1.05 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's limits.

1.06 WARRANTY

A. Warranty: Provide manufacturer's standard three-year warranty against defects and workmanship, from the date of Substantial Completion.

PART 2 - PRODUCTS

2.01 APPROVED MANUFACTURERS

A. SnapCab “Classic I”, QCAB Panel Series Q12, FabaCab “Kingston” or approved equal.

2.02 WALL PANELS AND SUSPENDED CEILING

A. Elevator Interior Wall Panel System, Interlocking Panel Type:

1. Description: Interlocking panel system comprised of removable wall panels with interlocking joints, 1/8-inch black shadow lines set into surface, toe kicks, top caps with sight and vent guards, panel binders at exposed panel edges near doors and corner/flat reveals.

B. Elevator Interior Suspended Ceiling System:

1. Description: Suspended ceiling with adjustable mounting legs and removable panel for access to escape hatch.

2. Ceiling Style: As indicated or as selected by the Architect from manufacturer’s standards.

2.03 MATERIALS

A. Wall Panel Core: Core Type will be determined based on manufacturing standards for face material selection:

1. Wall Panel Core: Fire-rated resin particle board or medium density fiberboard, Class B or better fire rated as per ASTM E84. Panel backer sheet and adhesives as per manufacturer to achieve fire rating as tested.

B. Wall Panel Face:

1. Wood Veneer Face:

a. Smooth surface panels of wood veneer on paper backing. Panel assembly to be Class B or better fire rated as per ASTM E84. Veneer species to be selected by the Architect.

C. Toe Kick and Toe Kick Binder with Concealed Ventilation Gap for Interlocking Panels:

1. Satin No. 4 finish 20-gauge stainless steel toe kick with anodized mill finish aluminum binder.

D. Top Cap: Anodized mill finish aluminum top cap with integrated pad hook channel.

E. Corner and Flat Reveals:

1. Stainless steel, 20-gauge, No. 4 satin finish.

F. Panel Binders: Standard at exposed panel edges near door jambs.

1. Anodized mill finish aluminum.

G. Handrails: Pre-installed on wall panel to measure 32-inches above finished floor unless indicated otherwise.

1. Location: As indicated.

2. Type: As indicated or as selected by the Architect from manufacturer's standards.

H. Protective Pads: Vinyl protective pads for cab walls.

1. Type: Pads with pre-attached pad hooks that lock into integrated pad hook channel in the top cap, eliminating the need for pad buttons.

2. Quantity: Set of 1.

3. Color: As selected from manufacturer's standard product line.

I. Suspended Ceiling: As indicated or as selected by the Architect from manufacturer's standard product line.

J. Ceiling Lights:

1. LED Standard Fixtures Mounted on Suspended Ceiling: Standard LED downlights, low energy, low voltage, warm white (3000 Kelvin), 4 watt bulbs, 127 degree beam spread, up to 50,000 hours of life; integrated tamperproof metal trim ring. Pre-installed dimmer control included.

PART 3 - EXECUTION

3.01 PREPARATION

A. Prepare surfaces using the methods recommended by the manufacturer in printed installation instructions for achieving the best result for the substrate under the project conditions.

B. Protect elevator finishes, fixtures and equipment from damage.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions. Install in proper relationship to adjacent materials.

1. Do not make structural changes to elevator cab.

2. Do not install work in a manner that interferes with the safe operation of the elevator.

3.03 CLEANING AND PROTECTION

A. Clean exposed surface in accordance with manufacturer's instructions.

B. Protect exposed surfaces from damage by subsequent construction.

END OF SECTION

SPECIFICATION 21 00 00
WATER-BASED FIRE-SUPPRESSION SYSTEMS

PART 1 GENERAL

1.01 WORK INCLUDED

A. Work included: Provide all materials, equipment, fabrication, installation and tests as noted in Contract Documents in conformity with applicable codes and authorities having jurisdiction.

B. Other work specified elsewhere:

1. Section 22 0000 Plumbing

2. Division 23 Specifications

C. Provide all work described in Contract Documents.

D. Provide Section 21 00 00 systems for the entire Building, including finished spaces within the Building. System shall comply with NFPA-13 and the Menlo Park Fire Protection District requirements unless stricter requirements are noted within specifications.

E. Remove existing fire sprinkler heads and associated piping to provide access for installation of new work by other trades of work. After other trades of work are installed; provide piping and fire sprinkler heads for complete fire sprinkler coverage.

F. Provide fire sprinklers and associated piping to serve entire building including attic spaces, ceiling spaces, concealed spaces, bathrooms, closets, roof overhangs, underside of balconies, and underside of stairs.

1.02 SCOPE

A. Project Summary

1. Provide materials, equipment, fabrication, installation and tests as required for complete fire sprinkler systems per the Contract Documents.

1.03 SCOPE OF WORK COORDINATION

A. See Coordination Matrix in Section 23 05 01 Basic Mechanical Materials and Methods.

B. Fire Sprinkler Contractor shall arrange (4) Coordination Meetings with the Architect. Architect to establish when within the design process the meetings will occur. All coordination meetings will occur at the Architect's Office. Meetings to occur before the Section 21 00 00 Shop Drawings are submitted.

C. Fire Sprinkler Contractor shall review the documents of other trades, in particular mechanical drawings, prior to bid and include in bid all offsets and other rerouting of Section 21 00 00 piping and devices to avoid conflicts. Where ducts and mechanical piping conflict with Section 21 00 00 piping, Section 21 00 00 piping shall be rerouted as required to resolve the conflict. In no case shall Section 21 00 00 piping penetrate ductwork.

D. Consult all other Sections; determine the extent and character of related work and properly coordinate work specified herein with that specified elsewhere to produce a complete and

operable installation. This section is provided to assist Contractor in coordination of work scope but shall not be construed to limit Contractor's scope of work encompassed by the contract documents.

E. Coordination

1. Work out all "tight" conditions involving Work specified under this Division and Work in other Divisions in advance of installation. If necessary, and before Work proceeds in these areas, prepare supplementary Drawings under this Division for review showing all Work in congested area. Provide supplementary Drawings, additional Work necessary to overcome congested conditions, at no additional cost to the Owner. Piping mains shall be installed tight to structure.

2. Conflicts: Difference or disputes concerning coordination, interference or extent of Work between sections shall be decided as follows

   a. Install mechanical and electrical systems in the following order of preference (those trades listed below another must reroute to resolve the conflict):

      1) Drain piping required by code to be sloped

      2) Supply air and exhaust air ductwork connected to fans

      3) Electrical conduit 4 inches and larger

      4) Hydronic piping connected to pumps

      5) Domestic water piping

      6) Fire sprinkler piping

      7) Electrical conduit smaller than 4 inches

      8) Sprinkler piping

      9) Transfer ducts and other ductwork not connected to fans

      10) Control system piping and wiring

   b. Continued disputes shall be decided by Contractor and Contractor's decision, if consistent with Contract Document requirements, shall be final.

3. Supervision: Personally or through an authorized and competent representative, constantly supervise the work from beginning to completion and, within reason, keep the same foreman and workmen on the Project throughout the Project duration.

4. Provide templates, information and instructions to other Divisions to properly locate holes and openings to be cut or provided.

5. The drawings govern in matters of quantity, and the specifications govern in matters of quality. In the event of conflict within the drawings involving quantities, or within the specifications involving quantities, or within the specifications involving quality, the greater quantity and higher quality shall apply. Such discrepancies shall be noted and

clarified in the Bid. No additional allowances will be made because of errors, ambiguities, or omissions that reasonably should have been discovered during the preparation of the Bid.

1.04 DESCRIPTION OF BID DOCUMENTS

A. Specifications:

1. Specifications, in general, describe design requirements and the quality and character of materials and equipment.

2. In these specifications, attempts have been made to assist the Fire Sprinkler Contractor in coordinating work by subcontractors by assigning specific responsibility for items and areas of work. This in no way shall diminish the Fire Sprinkler Contractor's responsibility to include all material and work required by this section.

B. Drawings:

1. Before proceeding with work check and verify all dimensions in field.

2. Assume all responsibility for fitting of materials and equipment to other parts of equipment and structure.

3. Make adjustments that may be necessary or requested in order to resolve space problems, preserve headroom, and avoid architectural openings, structural members and work of other trades.

4. For exact locations of building elements, refer to dimensional Architectural/Structural drawings.

C. Description of Systems: Supply and install all materials to provide functioning systems in compliance with performance requirements specified.

D. If any part of Specifications or Drawings appears unclear or contradictory, apply to Engineer for an interpretation and decision as early as possible, including during bidding period. Do not proceed with work without Engineer's decision.

1.05 COMPLETION REQUIREMENTS

A. Until the documents required in this section are submitted and approved, the system will not be considered "accepted" and final payment to contractor will not be made.

B. O&M Manual: See Section 1.8D

C. Inspection and Permit: Provide one copy of inspection certificates signed and approved by the Authorities Having Jurisdiction.

D. Record Drawings: Update design/shop drawings to "as-built" conditions. Provide electronic copies of reproducibles. See Section 1.8E

E. General Training: Upon completion of work, provide Owner's operating personnel two instruction periods in operation and maintenance of material and equipment. Both periods shall be 4-hours and cover the fire sprinklered and standpipe systems. The first period shall

be immediately upon completion of the startup and the second period shall be within the warranty period.

1.06 REFERENCE STANDARDS

A. Requirements of Regulatory Agencies:

1. Nothing in Drawings or Specifications shall be construed to permit Work not conforming to applicable laws, ordinances, rules, and regulations.

2. When drawings or Specifications exceed requirements of applicable laws, ordinances, rules and regulations, comply with documents establishing the more stringent requirement.

3. It is not the intent of Drawings or Specifications to repeat requirements of codes except where necessary for completeness or clarity.

4. Applicable codes as listed below, in addition to others specified in individual sections:

a. CBC - Building Code, current version with City of Menlo Park Amendments

b. NFPA-13 - National Fire Protection Association - Installation of Fire Sprinkler Systems

c. The current State of California Codes

d. The current City of Menlo Park Codes and Ordinances

e. Menlo Park Fire Protection District requirements and standards

5. If any of the above requirements are in conflict with one another, or with Specifications' requirements, the most stringent requirement shall govern.

B. Published specifications, standards, tests or recommended method of trade, industry or governmental organizations as listed below apply to all work in this Division, in addition to other standards which may be specified in individual sections:

1. ANSI - American National Standards Institute

2. ASME - American Society of Mechanical Engineers

3. ASTM - American Society for Testing and Materials

4. NEMA - National Electrical Manufacturer's Association

5. NFPA - National Fire Protection Association

6. UL - Underwriters' Laboratories, Inc

7. FM – Factory Mutual

1.07 QUALITY ASSURANCE

A. All equipment and accessories shall be the product of a manufacturer regularly engaged in its manufacture.

B. All items of a given type shall be the products of same manufacturer.

C. Supply all equipment and accessories new and free from defects.

D. Supply all equipment and accessories in compliance with the applicable standards listed in article Section 1.06 of this section with all applicable national, state and local codes.

1.08 SUBMITTALS & SHOP DRAWINGS

A. Submittals:

1. Product data shall be submitted for hose valves, pipe, fittings, valves, pipe supporting devices, sprinkler heads and supervisory switches. Equipment details shall be submitted for coordination with other trades and for review and approval by the Owner and designated representatives prior to purchase. Submittals organized in a tabbed booklet shall be provided in a timely manner to allow sufficient review time without delaying construction. Submittals shall contain descriptive materials such as catalog cuts, diagrams, performance curves and charts published by the manufacturer; model numbers alone will not be acceptable. All literature shall clearly indicate the specified model number, dimensions, weights, arrangement, rating and characteristics of the proposed equipment. All motor driven equipment shall include start-up procedures and tests recommended by the manufacturer. Contractor testing procedures may be considered as an alternative. All powered equipment shall include electrical ratings and wiring information.

B. Shop Drawings:

1. Shop drawings shall be created using REVIT, version 2018 or compatible format, Level of Development 350.

2. Comply with the requirements of the AHJ.

3. Comply with Architect's Clash Detection plan.

4. Include, at minimum the following:

a. Floor plans: scale to match architectural drawings or larger, minimum 1/8" scale.

b. The shop and coordination drawings shall show the complete fire protection piping and sprinkler head layout for all areas to provide full sprinklered coverage at the ceiling and within combustible concealed spaces, ceiling spaces and attic spaces. Include complete computer hydraulic calculations for the sprinklered areas. These drawings shall indicate accurate locations of, piping, floor/zone control valve assemblies, sprinkler heads, drain locations, inspector's test connections, and all other apparatus associated with these systems in respect to architectural conditions, privacy curtains, structural conditions, lighting layouts (surface mounted or recessed), diffuser layouts, plumbing, mechanical, electrical, telephone, and data layouts.

c. Routing of pipe shall be in a neat manner to work with the architectural and structural elements of the Building and the requirements of the Architect. Any pipe routes at exposed ceiling areas are subject to review and approval by the Architect.

5. Center of tile installation is mandatory.

C. Submission Requirements:

1. Submit product data, shop drawings and hydraulic calculations simultaneously to the Authority Having Jurisdiction, Owner's Insurance Carrier, Owner's Representative, and the A/E team for review and approval.

2. Plan submittal to the AHJ shall be per the requirements of the AHJ.

3. Initial submittal to Taylor Engineering:

a. Submit electronic copies of product data and shop drawings.

D. Operating instructions, maintenance manuals and parts lists:

1. Before requesting acceptance of work, submit two sets for review by Engineer.

2. After review and making corrections noted, furnish electronic PDF version. Assemble in chronological order following alphanumeric system used in specification.

3. In addition to the submittal data, the O&M manual shall also include the following information:

a. Manufacturer's name, model number, service manual, spare-parts list, and descriptive literature for all components

b. Installation instructions

c. Maintenance instructions

d. Listing of possible breakdown and repairs

e. Instruction for starting, operation and programming

f. Name, address and phone number of contractors equipment suppliers and service agencies

g. Guarantee period, including start and end period

E. Record Drawings:

1. Record Drawings shall be in REVIT version 2018 or higher.

a. Illustrate all revisions made by all Fire Sprinkler crafts in course of work.

b. Include all field changes, adjustments, variances, substitutions and deletions, including all Change Orders

c. Update shop drawings to reflect revisions, changes, etc…, as noted above.

F. Tables of Submittals Required:

1. Submit product data according to the following table:

   a. "R" indicates required for Menlo Park Fire Protection District (MPFPD), Owner's Insurance Carrier, Owner's Representative and A/E review.

   b. "M" indicates submittal requires additional information as part of operation and maintenance information.

ITEM	SUBMITTAL REQUIRED	INCLUDE IN O&M
PIPE	R	M
PIPE FITTINGS	R	M
PIPE SUPPORTING DEVICES	R	M
FIRE SPRINKLER HEADS	R	M
EQUIPMENT & PIPING IDENTIFICATION	R	M
SEISMIC BRACING	R	M
PRESSURE GAUGES	R	M
SPARE HEAD CABINET	R	M
SUPERVISORY SWITCHES	R	M
VALVES	R	M
SHOP DRAWINGS	R	M

1.09 DEFINITIONS

A. "Provide": to supply, install and connect up complete and ready safe and regular operation of particular work referred to unless specifically noted.

B. "Install": to erect, mount and connect complete with related accessories.

C. "Supply": to purchase, procure, acquire and delivery complete with related accessories.

D. "Work": labor, materials, equipment, apparatus, controls, accessories, and other items required for proper and complete installation.

E. "Piping": pipe, tube, fittings, flanges, valves, controls, strainers, hangers, supports, unions, traps, drains, insulation, and related items.

F. "Wiring": raceway, fittings, wire, boxes and related items.

G. "Concealed": embedded in masonry or other construction, installed in furred spaces, within double partitions or hung ceilings, in trenches, in crawl spaces, or in enclosures.

H. "Exposed": not installed underground or "concealed" as defined above.

I. "Indicated," "shown" or "noted": as indicated, shown or noted on drawings or specifications.

J. "Similar" or "equal": of base bid manufacture, equal in materials, weight, size, design, and efficiency of specified product, conforming to Section PART 2 PRODUCTS.

K. "Reviewed," "satisfactory," or "directed": as reviewed, satisfactory, or directed by or to Architect.

L. "Motor Controllers": manual or magnetic starters (with or without switches), individual pushbuttons or hand-off-automatic (HOA) switches controlling the operation of motors.

1.10 JOB CONDITIONS

A. Examine site related work and surfaces before starting work of any Section.

1. Contractors shall be responsible for any conditions that can be visually observed at jobsite and in unconcealed, accessible areas.

2. Contractor shall not be responsible for any conditions in concealed areas that could not be reasonably anticipated at time of bid. Any additional work caused by these conditions shall be by change order.

B. Parking and special traffic requirements:

1. Contact General Contractor for information and constraints

2. Obtain all City permits and clearances required for hoisting and rigging equipment

1.11 INITIAL OPERATION

A. Warranty shall start upon beneficial use of equipment, including temporary operation.

1.12 PRODUCT DELIVERY, HANDLING AND STORAGE

A. Where necessary, ship in crated sections of size to permit passing through available space

B. Ship equipment in original packages, to prevent damaging or entrance of foreign matter

C. Handle and ship in accordance with manufacturer's recommendations

D. Provide protective coverings during construction as specified herein

E. Replace at no expense to Owner, equipment or material damaged during storage or handling

F. Tag all items with weatherproof tag, identifying equipment by name and purchase order number

G. Include packing and shipping lists

H. Special requirements as specified in individual sections

1.13 PROTECTION OF MATERIALS

A. Protect from damage, water, dust, etc., material, equipment and apparatus provided under this Division, both in storage and installed, until Notice of Completion has been filed.

B. Material, equipment or apparatus damaged because of improper storage or protection will be rejected:

1. Remove from site and provide new, duplicate, material, equipment or apparatus in replacement of that rejected.

C. Cover motors and other moving machinery to protect from dirt and water during construction.

D. Protect premises and work of other Divisions from damage arising out of installation of work of this Division.

1. Repair or replace, as directed by Engineer, materials and parts of premises, which become damaged as a result of installation of work of this Division.

1.14 REVIEW OF CONSTRUCTION

A. Work may be reviewed at any time by representative of Architect or Engineer.

B. Advise Architect and Engineer that work is ready for review at following times:

1. Prior to concealment of work in walls and above ceilings

2. When all requirements of Contract have been completed

C. Do not conceal work without Engineer's consent.

D. Maintain on the job site a set of Specifications and Drawings for use by Engineer's representatives, including all change orders.

1.15 EXISTING SYSTEMS AND UTILITIES SHUTDOWN

A. During the entire course of construction, the existing fire sprinkler systems shall be in operation. Shutting down of these systems shall not be permitted except for designated periods. The date, time, and duration for system shut-downs shall be dictated by the Building Chief Engineer, Owner’s Representative and the Authority Having Jurisdiction and the Contractor shall be advised of same in advance. During these shut-down periods, all connections to existing piping and associated devices shall be made and completed. Piping shall be pre-measured, prefabricated, and pre-tested ready for final connection in order to cut shutdown time to absolute minimum.

B. Provide temporary by-pass piping, whether shown or not, as required to keep systems in continuous operation at times other than the shutdown period, while portions of the systems are being worked on.

C. No system shutdown shall be permitted without the expressed written approval from the owner’s representative, Chief Building Engineer, and the Authority Having Jurisdiction. The Contractor shall plan the shutdowns well in advance. Contractor shall submit to the Chief Building Engineer & Owner’s Representative requests for each shutdown. The request shall state what system is to be shutdown, what areas will be affected, how long the period will be, and what contingency plan is provided if the work cannot be completed within the specified time. This procedure shall be established and followed in order to provide the Owner with least amount of service interruption and the least amount of disturbance for the users of the affected areas.

D. System shutdown shall be coordinated with the Building’s Chief Engineer to occur when the owners/tenants are not occupying the space.

E. Any necessary overtime work, including weekends, evenings and holidays, shall be included in the contractors bid. Overtime work shall be agreed upon by the Building Chief Engineer and the owner's representative.

1.16 SCHEDULE OF WORK

A. Arrange construction work to conform to schedules negotiated.

B. Perform all shutdowns, draining and filling of the sprinkler systems when needed.

C. In scheduling, anticipate means of installing equipment through available openings in structure. Provide openings and weatherproof openings as required to satisfactorily complete the work in this section.

1.17 GUARANTEE

A. Guarantee all new materials, new equipment, apparatus and workmanship shall be free of defective materials and faulty workmanship for period of one year from date of filing of Notice of Completion or beneficial system usage, whichever comes first.

B. Provide new materials, equipment, apparatus and labor to replace that determined by Engineer to be defective or faulty.

C. The Owner reserves the right to make temporary repairs as necessary to keep equipment in operating condition without voiding the guarantees or relieving responsibility during the guarantee period.

D. The warranty shall not include standard maintenance items nor repairs or replacement of equipment damaged as a result of misuse, abuse, or lack of proper maintenance.

E. This guarantee also applies to services including Instructions, Adjusting, Testing, etc.

PART 2 PRODUCTS

2.01 PIPE MATERIALS AND JOINING SYSTEMS

A. Fire Sprinkler and Fire Sprinkler Drain Piping (Inside Building):

1. All piping shall be ferrous and meet the requirements of NFPA-13, and be Schedule 10 or 40, as noted hereinafter.

2. Schedule 10 for rolled grooved pipe and fittings.

3. Schedule 40 for threaded pipe and fittings.

4. Pipe and fittings outside or exposed shall be galvanized steel.

B. Grooved Couplings and Fittings:

1. Victaulic, Gruvlok, or equal

2. UL/FM approved, full flow fittings, malleable or ductile iron conforming to ANSI B-16.1, with rust inhibiting coating. Coupling gasket shall be Elastomer (EPDM) per ASTM D2000. Plain end fittings will not be accepted and shall not be used.

3. Threaded Fittings: Threaded fittings shall be cast iron, rated for 300 psi. cold water working pressure and shall conform to ANSI B16.4, ASTM 126 and ANSI B2.1 NPT.

4. Pipe fittings outside or exposed shall be galvanized steel

C. Adjustable Drop Nipples: Not allowed for this Project.

D. Thread-O-Lets: Shop welded Thread-O-Lets may be used where a certified welder is used, meeting the requirements and qualifications of NFPA-13 and the Thread-O-Lets are UL Listed and FM Approved.

E. Welded piping connections shall be inspected by the AHJ before installation.

F. Adapter Flanges:

1. Victaulic, Gruvlok, or equal

2. Adapter flanges (fittings) shall be cast iron/class 125 conforming to ANSI B-16.1, with a rust inhibiting coating. Flanges shall be UL Listed and FM Approved.

G. Hole Cut Outlets, New Systems: No hole cut outlets may be used on Section 21 00 00 systems.

2.02 PIPING SYSTEM ACCESSORIES

A. Piping system components shall be selected for maximum design operating pressure based on static head, shutoff pump head, and pressure relief valve setting.

B. Drain Valves (Globe & Angle Valves):

1. Grinnell, Nibco or equal

C. Pipe Supports and Hangers:

1. Grinnell, Kin-line, or equal

2. UL Listed

3. Provide hangers to support all piping: in perfect alignment without sagging or interference, to permit free expansion and contraction, and meet the requirements of NFPA-13.

4. Pipe Rings: Pipe rings to be zinc coated.

5. Hanger Rods: Hanger rods to be electro-galvanized.

6. C-Clamps: All c-clamps (beam clamps) shall be equipped with earthquake retaining straps.

7. Riser Clamps: Riser clamps shall protrude more than 2” beyond the edge of the hole.

8. At exposed to weather or outside conditions, all devices shall be stainless steel, no exceptions

9. Seismic Bracing: In accordance with NFPA-13. At exposed to weather or outside conditions, all devices shall be stainless steel, no exceptions

D. Escutcheons: Provide chrome plated steel escutcheons at piping penetrations of walls where exposed public view and required for proper appearance. Provide galvanized steel escutcheons at penetrations of masonry walls elsewhere. Escutcheons not generally required at drywall penetrations where not exposed to public view.

E. Sleeves:

1. Provide sleeves where pipes pass through floors above grade, roofs, poured-in-place masonry walls, and exterior walls.

2. Sleeves shall be standard weight steel pipe, except sleeves for concealed piping through floors not in structural members may be 25-gauge galvanized sheet metal.

3. Floor sleeves for piping shall extend from the bottom of the slab to 2-inches above the finished floor.

4. Seal between piping and sleeve with fire-rated caulk at all penetrations of fire-rated partitions and floors.

5. Make sleeves through outside walls watertight.

2.03 FIRE SPRINKLERS

A. Reliable, Viking, or equal

B. Heads shall be quick response (unless otherwise noted) type UL Listed and FM Approved

C. Where Piping is Run Concealed: Chrome plated fire sprinkler, semi-recessed with two-piece escutcheons. Color of escutcheon to match ceiling

D. Lobbies: Concealed heads with cover plates. Color of cover plate to match ceiling

E. Exterior Corridors, Underside of Exterior Balconies & below Exterior Stairs: Sidewall heads, finish of fire sprinkler head and escutcheon as directed by the Architect

F. Where Piping is Run Exposed: Pendant or upright heads. Finish of heads as directed by the Architect

G. Provide extra heads of each type for replacement, head wrench and cabinet as required by NFPA, within the floor control valve assembly enclosure

H. Provide fire sprinkler head guards for sprinkler heads subject to mechanical damage or for any sprinkler lower than 7’-0” above the floor.

I. Temperature classification of fire sprinkler heads shall be per NFPA-13 requirements.

J. Furnish (2) samples of each head with escutcheons for review by the Architect

2.04 ANCHORS, INSERTS AND FASTENERS

A. All anchors and inserts shall be installed according to the CBC standards and NFPA-13

B. Do not use powder driven and power driven (Shoot-In) fasteners, expansion nails or friction spring clips. Power driven inserts not allowed for this Project

C. All over-head concrete anchors or inserts shall be selected to comply with the NFPA-13 for the anchor or insert. Units exposed to weather or outside conditions shall be stainless steel

1. Torque testing of anchors shall be allowed to verify compliance of anchor installation. However, torque testing shall not justify usability of anchor. Only load or pull testing shall be allowed to justify usability of anchors. Failure of torque shall constitute failure of anchor.

2. Bolts and nuts:

a. Bolts and heavy hexagon nuts: ANSI B18.2.1 and ASTM A307 or A576

b. Bolts, underground: ASTM A325

c. Expansion anchors: Federal Specification A-A-1922

d. Architect to approve color of jacket

2.05 PIPE SUPPORTING DEVICES

A. All devices shall be suitable for the specific structure

B. At exposed to weather or outside conditions, all devices shall be stainless steel, no exceptions

2.06 SUPERVISORY SWITCH FOR EXISTING POST INDICATOR VALVE ASSEMBLY

A. Potter Electric Signal Co., Notifier, or equal

B. UL Listed with tamperproof cover, conduit connection and contacts as required for wiring to building fire alarm system. Units shall be State Marshal Approved and listed.

PART 3 EXECUTION

3.01 RECORD DRAWINGS

A. Keep an accurate dimensional record of installed systems and equipment. Maintain a set of record (“as-built”) drawings up-to-date as construction progresses. Drawings shall be maintained at the jobsite and available for inspection by the general contractor, other subcontractors, the Engineer, and Owner’s representatives.

3.02 PROTECTION OF WORK DURING CONSTRUCTION

A. Protect from damage, water, dust, etc., material, equipment and apparatus provided under this Division, both in storage and installed, until Notice of Completion has been filed.

B. Provide protective covers, skids, plugs or caps to protect equipment and materials from damage and deterioration during construction. Protect exposed coils with plywood or other suitable rigid covers to avoid damage to fins.

C. Cover motors and other moving machinery to protect from dirt and water during construction.

D. Material, Equipment or Apparatus:

1. Material, equipment or apparatus damaged because of improper storage or protection will be rejected.

2. Remove damaged material, equipment or apparatus from site and provide new, duplicate, material, equipment or apparatus in replacement of that rejected.

3.03 INSTALLATION AND WORKMANSHIP

A. All equipment and material shall be installed in a neat and workmanlike manner.

B. Thoroughly clean all equipment, free of dust, scale, filings, plaster, grease, oil, paint and other construction debris.

C. Repair all damaged or temporarily removed walls, equipment, etc.

D. Follow manufacturer's installation instructions and recommendations.

E. Installation of the fire sprinkler systems and all associated devices shall not be started until the shop drawings have been reviewed and approved.

3.04 PIPING

A. Install pipes and pipe fittings in accordance with recognized industry practices which will achieve permanently leak resistant piping systems, capable of performing each indicated service without piping failure. Install each run with minimum joints and couplings but with adequate and accessible unions for disassembly and maintenance/replacement of valves and equipment. Reduce sizes where indicated by use of reducing fittings. Align piping accurately at connections, within 1/16-inch misalignment tolerance.

3.05 CLEANING

A. General:

1. During construction:

a. Keep openings in piping closed to prevent entrance of foreign matter.

B. Clean all valves, water flow switches, and supervisory switches, of all dirt and debris

C. Thoroughly clean and flush interior and exterior of all piping systems of any nature of all pipe contaminates such as cuttings, fillings, grease, and welding residue.

D. Sprinkler heads shall be masked off with masking tape or plastic bag during painting. Remove all masking tape after completion of painting.

E. Thoroughly clean all equipment, etc. free of dust, scale, filings, plaster, grease, oil, paint and other construction debris.

3.06 IDENTIFICATION SIGNS

A. Floor/zone control valves, drain valves, inspector's test valves, water flow switches, and all associated equipment, shall be fitted with approved enameled signs indicating their purpose and use, and shall be securely affixed to their equipment.

3.07 LEAKAGE TESTING

A. Before conducting tests, valve-off or disconnect any equipment and apparatus which may be damaged by the test pressures higher than normal working pressures. All testing shall be witnessed by the Authority Having Jurisdiction.

B. Piping systems shall be tested and proved tight under hydrostatic pressures as required per NFPA-13 and the Authority Having Jurisdiction.

C. Systems shall be tested and inspected at both rough and final inspections as required per the AHJ.

3.08 TESTING AND ADJUSTING

A. Demonstrate correct operation of supervisory devices.

END OF SECTION

SPECIFICATION 23 05 01
MECHANICAL MATERIALS AND METHODS

PART 1 GENERAL

1.01 SUMMARY

A. Work included: Materials, equipment, fabrication, installation, starting, testing and commissioning in conformance with applicable codes and authorities having jurisdiction for Mechanical Work covered by all sections within this Division including, but not limited to

1. Heating, ventilating and air conditioning systems and equipment

B. Related Sections

1. All work in every Section must also comply with such general conditions of the specifications as are applicable, including, but not limited to

a. Instructions to Bidders

b. General Conditions

c. Special Conditions

d. Supplementary Conditions

e. Division 1 General Requirements

2. Consult all other Sections, determine the extent and character of related work and properly coordinate work specified herein with that specified elsewhere to produce a complete and operable installation. This section is provided to assist Contractor in coordination of work scope but shall not be construed to limit Contractor's scope of work encompassed by the contract documents.

3. Coordination with other Trades: The following table is intended to assist the Contractors in coordinating the scope of work between Division 23 HVAC (indicated as 23 in table), Division 25 Building Automation Systems (indicated as 25), and other Divisions as indicated. However, the General Contractor is ultimately responsible for coordination among his subcontractors regardless of what is listed in this Section.

INTERFACE/RESPONSIBILITY MATRIX					
System	Division under which the following is specified				Remarks
	Equipment	Installation	Power wiring (remark 1)	Control & interlock wiring (remark 1)	
A. FIRE SPRINKLER SYSTEM					
1. Flow switches	21	21	26	26	
2. Valve monitors	21	21	26	26	

INTERFACE/RESPONSIBILITY MATRIX					
System	Division under which the following is specified				Remarks
	Equipment	Installation	Power wiring (remark 1)	Control & interlock wiring (remark 1)	
3. Post indicating valves	21	21	26	26	
B. FIRE & LIFE SAFETY SYSTEMS					
1. Fire alarm controls	26	26	26	26	
2. Duct mounted & in-duct mounted smoke detectors	26	23	26	26	
3. Other smoke detectors	26	26	26	26	
4. Smoke control interlocks to HVAC fans	26	26	26	26	2
5. Smoke dampers with electric actuators	23	23	26	26	
6. Smoke damper end switches	23	23	26	26	
C. MECHANICAL EQUIPMENT					
1. Unitary mechanical equipment	23	23	26	25	3, 17
2. Chillers	23	23	26	25	3, 7, 17
3. Variable speed drives, field mounted	23	26	26	25	17
4. Motors, 3 phase	23	23	26	–	
5. Motor starters, 3 phase	26	26	26	25	4
6. Motors, 1 phase	23	23	26	26	5, 6
7. Other powered equipment	23	23	26	25	
8. Disconnects/circuit breakers	26	26	26	–	8
D. BUILDING AUTOMATION SYSTEM (BAS)					
1. Central control workstations & servers	25	25	26	25	
2. Control system network backbone	25	25	25	25	
3. Line voltage control devices to 120V motors	25	26	26	26	6
4. Window switches	25	25	–	25	
5. Control panels	25	25	26/25	25	9
6. Control devices	25	25	25	25	
E. ELECTRICAL SYSTEMS					
1. Lighting Control BACnet gateway	26	26	26	25	10
2. Lighting occupancy sensors	26	26	26	26/25	11
3. Daylighting sensors and controls	26	26	26	26	
4. Power monitoring sensors and gateway	26	26	26	26/25	
F. PLUMBING SYSTEMS					
1. DHW heater	23	23	26	25	
2. DHW heater venting	23	23	–	–	
3. Condensate drains including traps, primers	23	23	–	–	12
4. Condensate pumps	23	23	23/26	–	13
5. Make-up water to hot/chilled water including backflow prevention	23	23	–	–	14
6. Pipe gauges, thermometers, test plugs	23	23	–	–	
7. Sensor wells, meters and other pipe-mounted control devices	25	23	25	25	

INTERFACE/RESPONSIBILITY MATRIX					
System	Division under which the following is specified				Remarks
	Equipment	Installation	Power wiring (remark 1)	Control & interlock wiring (remark 1)	
G. HVAC HYDRONIC SYSTEMS					
1. Air to water heat pumps	23	23	26	25	17
2. Pipe gauges, thermometers, test plugs	23	23	–	–	
3. Self-powered valves, refrigerant powered head pressure control valves, pressure relief valves, liquid level controllers, etc.	23	23	–	–	
4. Relief valve vent piping, equipment drain piping, etc. from equipment to floor drains/sinks	23	23	–	–	
5. Automatic isolation and control valves	25	23	25	25	
6. Sensor wells, meters and other pipe-mounted control devices	25	23	25	25	
H. HVAC SHEET METAL					
1. Duct mounted sensors	25	23	25	25	
2. Filter gauges	25	25	–	–	
3. Control dampers	23	23	–	–	15
4. Control damper actuators	25	25	25	25	15, 16
I. HVAC TERMINAL BOXES					
1. Terminal box control transformer panel	25	25	26/25	25	9, 18
2. Terminal box with damper	23	23	–	–	
3. Digital controller and damper actuator	25	25	25	25	
4. Air-flow measurement pickup	23	23	–	–	
5. Air-flow measurement transducer and piping	25	25	25	25	
6. Wall sensor module	25	25	25	25	
7. Terminal fan	23	23	26	25	
8. HW control valve and actuator	25	23	25	25	
J. MISCELLANEOUS					
1. Demolition and salvage	2	2	–	–	19
2. Roofing, including cant strips and counterflashing at the sides of roof curbs	7	7	–	–	
3. Thermal and acoustical insulation in and on partitions and ceilings	7	7	–	–	
4. Undercutting of doors and door louvers	8	8			
5. Louvers	8	8	–	–	
6. Concrete housekeeping pads, piers, pedestals and inertia base fill etc. for equipment.	3	3	–	–	20
7. Equipment, ductwork, and piping steel supports and frames	5/23	5/23	–	–	21
8. Grates and railings protecting mechanical shaft and other floor openings	5	5	–	–	

INTERFACE/RESPONSIBILITY MATRIX					
System	Division under which the following is specified				Remarks
	Equipment	Installation	Power wiring (remark 1)	Control & interlock wiring (remark 1)	
9. Curbs at rooftop units, fans, duct/vent penetrations, and piping penetrations	23	23	–	–	22
10. Painting	9/23	9/23	–	–	23
11. Coring or cutting existing wall and floor openings for ductwork and piping	23	23	–	–	
12. Fire-stopping and acoustic around pipe and duct penetrations in floors and walls	23	23	–	–	
13. Fire rated duct wrap where shown around ducts	23	23	–	–	
14. Fire rated enclosures where shown around ducts	9	9			
15. Framing of walls and ceilings to accept air outlets, fire dampers, etc.	9	9	–	–	24
16. Ceiling and wall access doors and panels	8	8	–	–	25

NUMBERED REMARKS:

1. Wiring includes raceway, fittings, wire, boxes and related items, all voltages.
2. Wiring and controls to start and stop fans based on smoke detector status and smoke control logic specified under Division 26 Electrical.
3. Factory installed starters and variable speed drives are specified under Division 23 HVAC. Prewired control panel is specified under Division 23 HVAC; single point power connection (unless otherwise noted on drawings) specified by Division 23 HVAC.
4. Applies to motors that are not covered by note 3. Integral starter control devices such as HOA switches, 120V control transformers and time delay relays (from high to low speed) for two speed motors specified under Division 26 Electrical.
5. Single phase 120V motors with integral motor overload protection specified under Division 23 HVAC.
6. Line voltage control device such as thermostat or switch specified under Division 25 BAS; wiring and conduit between control device and motor specified under Division 26 Electrical.
7. Chilled and hydronic air to water heat pump flow switches are specified under Division 23 HVAC; wiring and conduit specified under Division 25 BAS. Bi-directional (read/write) factory installed BACnet gateway between the BAS and chiller control panel specified with chiller under Division 23 HVAC; control wiring specified under Division 25 BAS. Chiller and hydronic air to water heat pump vendors to provide all necessary technical assistance to Division 25 BAS Contractor in mapping across chiller and hydronic air to water heat pump points to the BAS.
8. Disconnects or circuit breakers are specified under Division 23 HVAC where specifically called for in equipment schedules or specifications to be factory installed with equipment. Otherwise all disconnects are specified under Division 26 Electrical.
9. 120V power to BAS control panels is specified under Division 26 for the panels shown on Drawings. Power to all other control panels that may be required is specified under Division 25 BAS, coordinated with Division 26 contractor for available circuits. Power to all other control panels that may be required is specified under Division 25 BAS, coordinated with Division 26 contractor for available circuits.
10. Lighting control vendor to provide all necessary technical assistance to Division 25 BAS Contractor in mapping across lighting control points to the BAS.
11. Occupancy sensors with auxiliary dry contacts and all lighting control wiring are specified under

INTERFACE/RESPONSIBILITY MATRIX					
System	Division under which the following is specified				Remarks
	Equipment	Installation	Power wiring (remark 1)	Control & interlock wiring (remark 1)	

Division 26. Control wiring from occupancy sensor auxiliary contact to BAS is specified under Division 25 BAS.

12. Condensate piping from condensate pans to the sewer system including trap and final connections is specified under Division 23 HVAC. Piping from auxiliary drain pans where provided at fan-coils is specified under Division 23 HVAC.
13. Condensate pumps scheduled to be an accessory to the cooling unit are powered off the cooling unit; no Division 26 work is required. Power for condensate pumps scheduled under Remarks as field installed is specified under Division 26.
14. Domestic make-up water, including shut-off valve, backflow prevention, rough-in and final connection to hot water, chilled water, condenser water and any other HVAC systems requiring make-up water is specified under Division 23 HVAC. Pressure reducing valves with bypass valve and shut-off valves at each closed-system make-up water connection are specified under Division 23 HVAC.
15. Duct access doors required for access to control devices where required specified under Division 23 HVAC.
16. Actuators for motorized dampers supplied with fans or hoods where scheduled on HVAC drawings are specified under Division 23 HVAC, mounted but not wired.
17. BACnet gateway to BAS specified in the Division 23 HVAC, factory installed, with connection of gateway to BAS specified under Division 25 BAS. AC vendor to provide all necessary technical assistance to Division 25 BAS Contractor in mapping AC control points to the BAS.
18. Control transformers for terminal boxes shall be centralized in control panels specified under Division 25 BAS.
19. Division 23 HVAC Contractor shall identify all mechanical related equipment and appurtenances to be retained, if applicable. Demolition work is specified under Division 2 Existing Conditions
20. Shop drawings showing dimensions of all curbs, bases, etc. specified under Division 23 HVAC.
21. Steel frames required to elevate HVAC equipment above the roof is specified under Division 5. All other HVAC equipment and material supports (including beams required to support cooling towers) are specified under Division 23.
22. Shims to level curb specified under Division 6. Curb insulation specified under Division 23 HVAC.
23. Painting of exposed piping, HVAC equipment, etc. per Paragraph 3.07 specified under Division 23 HVAC. All other painting specified under Division 9.
24. Additional T-bar or spline and cut ceiling tile as required to accept air outlets is specified under Division 9.
25. Dimensioning of access doors to mechanical equipment and coordination with Architect and Division 8 specified under Division 23.

1.02 REFERENCE STANDARDS

A. Reference to codes, standards, specifications and recommendations of technical societies, trade organizations and governmental agencies shall mean that latest edition of such publications adopted and published prior to submittal of the bid. Such codes or standards shall be considered a part of this Specification as though fully repeated herein.

B. Work shall be performed in accordance with all applicable requirements of the latest edition of all governing codes, rules and regulations including but not limited to the following minimum standards, whether statutory or not.

C. Requirements of Regulatory Agencies

1. In accordance with the requirement of Division 1 General Requirements

2. Nothing in contract documents shall be construed to permit work not conforming to current and applicable laws, ordinances, rules and regulations.

3. When contract documents exceed requirements of applicable laws, ordinances, rules and regulations, comply with documents establishing the more stringent requirement.

4. It is not the intent of contract documents to repeat requirements of codes except where necessary for completeness or clarity.

5. Seismic construction and restraints: In accordance with requirements of Title 17 of California Administrative Code.

6. Comply with the Safety Orders issued by California Occupational Safety and Health Act, COSHA and any other safety, health or environmental regulations of the State of California and any districts having jurisdictional authority. Where an omission or conflict appears between COSHA requirements and the Drawings and Specifications, COSHA requirements shall take precedence.

7. Applicable codes as listed below, in addition to others specified in individual sections

a. CEC – California Electrical Code

b. CBC – California Building Code

c. CMC – California Mechanical Code

d. CPC – California Plumbing Code

e. City and County Codes and Amendments

f. California Code of Regulations, including Titles 8, 17, 19, 20, 21, 22 and the California Building Standards Code Part 2, Basic Building Regulations.

D. Published specifications, standards, tests or recommended method of trade, industry or governmental organizations as listed below apply to all work in Division 23 HVAC, in addition to other standards which may be specified in individual sections.

E. All base material shall meet ASTM and ANSI standards

F. All Gas Fired Devices: Comply with standards and bear label of AGA

G. All Pressure Vessels, Relief Valves, Safety Relief Valves and Safety Valves: Comply with standards, ASME stamped

H. All Electrical Devices and Wiring

1. Conform to standards of CEC/NEC

2. All devices UL or ETL listed and identified

I. Guidelines and Standards: The latest edition of guidelines and standards published by the following groups will govern the Mechanical Systems and associated support system design. The systems shall be designed to meet or exceed these guidelines and standards.

AABC	Associated Air Balance Council
ADC	Air Diffuser Balance Council
AGA	American Gas Association
AMCA	Air Movement and Control Association, Inc.
ANSI	American National Standards Institute
AHRI	Air Conditioning, Heating, and Refrigeration Institute
ASC	Adhesive and Sealant Council
ASHRAE	American Society of Heating, Refrigeration and Air Conditioning Engineers
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
AWWA	American Water Works Association
AWS	American Welding Society
COSHA	California Occupational Safety and Health Act
ETL	Intertek Semko (Formerly Electrical Testing Laboratories)
GISO	General Industry Safety Orders
HI	Hydraulic Institute
IEEE	Institute of Electrical and Electronic Engineers
NBS	National Bureau of Standards
NEBB	National Environmental Balancing Bureau
NEMA	National Electrical Manufacturer's Association
NFPA	National Fire Protection Association
OSHPD	Office of Statewide Health Planning and Development
SFA	California State and Local Fire Marshall
SMACNA	Sheet Metal and Air Conditioning Contractors National Association, Inc.
UL	Underwriters' Laboratories, Inc.

1.03 QUALITY ASSURANCE

A. Supply all equipment and accessories in compliance with the applicable standards listed in Paragraph 1.02 and with all applicable national, state and local codes.

B. All equipment and accessories shall be new and the product of a manufacturer regularly engaged in its manufacture.

C. All items of a given type shall be the products of same manufacturer.

D. All work in Division 23 HVAC shall be commissioned. See Section 01 91 00 Commissioning and Section 23 08 00 Mechanical Commissioning.

1.04 DOCUMENT FORMAT

A. This section applies to all documents specified to be provided by Division 23 specifications except where specifically indicated otherwise.

B. Electronic copies

1. Provide in word-searchable electronic format; acceptable formats are MS Word, Adobe Acrobat (pdf) and HTML. Scanned paper documents not acceptable even if converted to text with OCR.

2. For Submittals and O&M Manuals, provide separate file for each specification section or provide one file with hyperlinked tabs to each system.

3. For Test & Balance report, provide separate files for each air handling system, hydronic system, primary equipment, etc. or provide one file with hyperlinked tabs to each system.

4. Record drawings shall be in original format per Paragraph 1.06C.3.

C. Paper copies

1. Only provide where specifically required. In general, only electronic copies are required.

2. Assemble in chronological order following alpha-numeric system used in specification, in heavy three-ring binder.

1.05 SUBMITTALS

A. No work may begin on any segment of this Project until the related submittals have been reviewed for conformity with the design intent and the Contractor has responded to all comments to the satisfaction of the Owner's Representative.

B. Submit drawings, product data, samples and certificates of compliance required as hereinafter specified.

1. See also Division 1 Shop Drawings, Product Data and Samples. Conditions in this Section take precedence over conditions in above referenced Section.

2. Provide submittals promptly in accordance with schedule and in such sequence as to cause no delay in work or in work of any other division.

3. Submittals for each specification section shall be submitted in a single package. However, it is not required (nor desired) for all products to be submitted concurrently. Rather, submittals may be staggered based on schedule and required equipment release dates.

4. Allow 15-working days for review, unless the Owner's Representative agrees to accelerated schedule.

5. For substitutions, list any features or characteristics that are not strictly in compliance with specifications. If none are listed with the submittal, Contractor is guaranteeing that substituted product is functionally equivalent to the specified product in accordance with Paragraph 1.07.

6. Submittal reviews by the Owner's Representative are intended to assist the Contractor in complying with the design intent and requirements of the drawings and specifications. Reviews do not relieve the Contractor from compliance with these requirements, and comments or lack thereof do not constitute approval of changes in these requirements.

C. Submission and Resubmission Procedure

1. Optional Pre-Submittals. At Contractor's option, electronic submittals indicated below may be submitted unofficially via email directly to the Engineer for review and comment prior to formal submission. Comments provided by the Engineer are not official and may be changed or additional comments may be provided on the formal submittal. The intent of pre-submittals is to reduce paperwork and review time.

2. Each submittal shall have a unique serial number that includes the associated specification section followed by a number for each sub-part of the submittal for that specification section, such as “SUBMITTAL 23 xx xx-01”.

3. Each resubmittal shall have the original unique serial number plus unique revision number such as “SUBMITTAL 23 xx xx-01 REVISION 1”. The cover page of resubmittals shall include a summary of prior comments and how they were resolved in the resubmittal.

4. Submit in format specified below. Submissions made in the wrong format will be returned without action.

    a. Product Submittals: One copy in word-searchable electronic format per Paragraph 1.04. Submit each specification section in a separate file named with unique name and number described above.

    b. Shop Drawings

        1) One copy in word-searchable electronic format per Paragraph 1.04.

        2) One paper copy only if requested by Owner

    c. Samples: As indicated in each specification section

5. Owner’s Representative will return a memo or mark-up of submittal with comments and corrections noted where required.

6. Make corrections

    a. Revise initial submittal to resolve review comments and corrections.

    b. Indicate any changes that have been made other than those requested.

    c. Clearly identify resubmittal by original submittal number and revision number.

7. Resubmit revised submittals until no exceptions are taken.

8. Once submittals are accepted with no exceptions taken, provide

    a. Complete submittal of all accepted products in a single electronic file for each specification section.

    b. Photocopies or electronic copies for coordination with other trades, if and as required by the General Contractor or Owner’s Representative.

D. Product Data Submittals

1. Contents

    a. Manufacturer's name and model number

    b. All information required to completely describe materials and equipment and to indicate compliance with drawings and specifications, including, but not limited to:

        1) Schedule when more than one of each item is covered by submittal

2) Physical data, as applicable

a) Dimensions

b) Weight

c) Finishes and colors

d) Dimensional shop drawings

3) Performance data, as applicable

a) Rated capacities

b) Performance curve

c) Operating temperature and pressure

d) Sound power levels

4) Flow and wiring diagrams as applicable

5) Description of system operation

c. All other pertinent information requested in individual sections

2. Format

a. See Division 1 Shop Drawings, Product Data and Samples

b. Identify clearly if submittal is substitution: Refer to Paragraph 1.07

c. Reference specification Division, Section, Title, Paragraph and Page number or drawing number as applicable

d. Use same nomenclature, legend, symbols and abbreviations on submittal material as used in contract documents

E. Layout Shop Drawings

1. Drawings shall be developed using 3D software such as CAD-Duct and CAD-Pipe that is compatible with Navisworks to minimum Level of Development 350.

2. Shop fabrication, coordination and installation drawings by the Contractor, are for the Contractor's use and shall be the Contractor's responsibility. These Drawings indicate where the Contractor intends to install the material and equipment as required by the Contract Documents. Do not submit shop fabrication documents unless requested. Use of contract documents or electronic files of contract documents for shop drawings is not sufficient.

3. Prepare and submit Shop Drawings for all Work deviating from that indicated on Contract Drawings. Clearly indicate deviations.

4. Review is not intended to verify dimensions or quantities, or to coordinate items shown on these Drawings. Review is for general conformance with design concept of the Project

and general compliance with the information given in the Contract Documents. Contractor is responsible for dimensions, which shall be confirmed and correlated at the Jobsite, for fabrication processes and techniques or construction, for coordination of Work with that of all other trades and the satisfactory performance of Work.

5. Prepare and submit layout drawings, sections and details for following areas:

    a. Roof area

    b. Penthouse – All spaces

    c. Areas at main duct shafts including all FSDs at shafts with duct takeoffs

6. Provide 3D drawings to General Contractor to ensure coordination with other trades.

7. Contractor is to assure that each trade has coordinated work with other trades, prior to submittal where submittal is required.

    a. Include stamp on each submittal indicating that layout shop drawing has been coordinated.

    b. No layout shop drawing will be reviewed without stamped and signed coordinated assurance by Contractor.

8. All changes shall be clearly marked on each submitted layout drawing. Identification of space problems without solutions is not acceptable.

9. Drawings shall show work of all trades including but not limited to:

    a. Ductwork

    b. Piping: All Trades

    c. Mechanical Equipment

    d. Electrical Equipment

    e. Main Electrical conduits and bus ducts

    f. Equipment supports and suspension devices

    g. Structural and architectural constraints

    h. Show location of

        1) Valves: manual and automatic

        2) Piping specialties

        3) Dampers: fire/smoke, automatic and manual volume, etc.

        4) Access doors

        5) Control and electrical panels

6) Others as required for clear coordination

10. Drawings shall indicate coordination with work specified in other Divisions which must be coordinated with work specified under Division 23 HVAC, including, but not limited to:

    a. Irrigation equipment and piping

    b. Elevator equipment

    c. Cable trays

    d. Computer equipment

    e. Others as required

11. Submission of drawings

    a. See Division 1 Shop Drawings, Product Data and Samples.

    b. Submit to other trades for review of space allocated to all trades.

    c. Revise drawings to compensate for requirements of existing conditions and conditions created by other trades.

    d. Ensure that each trade has coordinated work with other trades

    e. Submit with stamps of General and all other applicable Contractors, initialed and signed certifying

        1) Review of submittal

        2) Verification of products, field measurements and field construction criteria

        3) Coordination of information in submittal with requirements of work of this Division and other divisions of Contract Documents

    f. No layout shop drawing will be reviewed without stamped and signed coordination assurance by the Contractor.

F. Samples

1. Submit as required in each specification section.

1.06 COMPLETION REQUIREMENTS

A. Procedure

1. Until the documents required in this section are submitted and approved, the system will not be considered “accepted.”

2. Before requesting acceptance of work, submit one set of Completion Documents for review and approval of Owner’s Representative.

3. After review, furnish quantity of sets indicated below to Owner.

4. Format

    a. See Paragraph 1.06H for required format of Completion Documents

B. Operating and Maintenance (O&M) Manual

1. In accordance with requirements of Division 1 Operating and Maintenance and as follows

2. O&M Manual shall include but is not limited to the following

    a. Complete Product Data Submittals per Paragraph 1.05D so that the details of the device are known. This shall include only final approved submittals; rejected early submittals shall be stripped.

    b. Manufacturer's name, model number, service manual, spare-parts list and descriptive literature for all components

    c. Operating instructions

    d. Maintenance and repair requirements

    e. Wiring diagrams

    f. Requirements for special tools, test kits and calibration instructions

    g. Replacement parts list

    h. Valve tag directory

    i. Name, address and phone number of contractor’s equipment suppliers and service agencies

C. Record Drawings

1. Keep up-to-date during progress of job one set of Mechanical Drawings indicating the Record installation. In addition to changes made during course of Work, show following by dimension from readily obtained base lines

    a. Fully illustrate all revisions made by all crafts in course of work

    b. Include all field changes, adjustments, variances, substitutions and deletions, including all Change Orders

    c. Exact location, type and function of concealed valves, dampers, controllers, piping, air vents and piping drains

    d. Exact size, invert elevations and location of underground and under floor piping and ducts

2. Progress drawing set shall be available for inspection by Owner’s Representative weekly

3. Update shop drawings and record drawings to reflect revisions and additional data listed above at completion of Project

a. Original engineering design drawings will be provided to Contactor in electronic format compatible with Revit or AutoCAD version 2013 or later. Update to become record set.

b. Drawings required to be updated if revisions were made

1) Floor plans

2) Shop drawings

3) Sections

4) Riser diagrams

D. Test and Balance Reports

1. See Section 23 05 93 Testing, Adjusting and Balancing

E. Commissioning Reports

1. See Section 23 08 00 Mechanical Commissioning and 25 00 00 Building Automation Systems

F. Training Materials

1. See Section 23 08 00 Mechanical Commissioning and 25 00 00 Building Automation Systems

G. Miscellaneous Certificates

1. Pressure and Leakage Test documentation/certificates

2. Training/Instruction completion certificates

3. Fire Marshal and Fire Department approvals of system, as required

4. Final inspection certificate signed by governing authorities

5. Warranty period, including start and end period

6. Field test report, including as applicable

a. Startup documents with date and name of technician

b. Piping pressure tests

c. Flex coupled pump alignment verification

d. Drain pan drainage tests

e. Letters from manufacturers certifying their supervision of equipment installation and start-up procedures

f. Others as specified herein

H. Format of Completion Documents

1. Provide the type and quantity of media listed in table below

2. Where indicated in table, the electronic files shall be stored on the BAS systems' Operator Workstation. See Division 25 Building Automation Systems.

	Document	Paper (binder or bound)	Electronic	
			Loaded onto Flash Drive	Loaded onto Operator Workstation
1.	O&M Manuals (including submittals)	–	1	1
2.	Record Drawings	2 Full size 2 Half size	1	1
3.	Test and Balance Report	–	1	1
4.	Commissioning Reports	–	1	1
5.	Miscellaneous Certificates	–	1	1
6.	Warranty documents	–	1	1
7.	Training materials	1 per trainee	1	1

1.07 SUBSTITUTIONS AND PRODUCT OPTIONS

A. Contractor's Options

1. For products specified only by functionality and/or reference standard, select product meeting that functionality and/or standard, by any manufacturer.

2. For products specified by manufacturer and model number

a. Where "Or Equal" lists specific alternative manufacturers including specific model numbers, any of these specific products may be selected and will not be considered a substitution.

b. Where "Or Equal" lists specific alternative manufacturers but no specific model numbers

1) Functionally equivalent products by listed alternative manufacturers may be selected.

2) Functionally equivalent products by manufacturers not listed may be selected but may be rejected by Owner's Representative for any reason if there is any question with respect to functional equivalency including unfamiliarity with manufacturer and local representation.

3) Functional equivalent products to the product specified are those that

a) Are equal or better in quality, function, capacity, efficiency, serviceability, local support, etc.

b) Fully meet the product specifications unless otherwise approved by the Owner's Representative.

c) Meet site and application constraints including but not limited to size, weight, appearance, and clearance requirements.

B. Substitution Requirements

1. Where substitutions are proposed for products indicated in design documents, the Contractor shall take full responsibility for coordinating with others the requirements of the proposed substitution including but not limited to:

   a. Adequate space, including service access space

   b. Power and other electrical connections

   c. Pads or other equipment supports

   d. Control devices and interfaces

2. Include all costs for redesign and other work required by all disciplines affected by a substitution.

3. See spec 236410 for specific Air-Source Heat Pump Chiller substitution requirements

1.08 DESCRIPTION OF BID DOCUMENTS

A. Specifications

1. Specifications, in general, describe quality and character of materials and equipment

2. Specifications are of simplified form and include incomplete sentences

3. Words or phrases such as "The Contractor shall," "shall be," "furnish," "provide," "a," "an," "the," and "all" have often been omitted for brevity

B. Drawings

1. Drawings in general are diagrammatic. Intention is to show size, capacity, approximate location, direction and general relationship of one work phase to another, but not exact detail or arrangement.

2. Scaled and figured dimensions are approximate and are for estimating purposes only. Indicated dimensions are limiting dimensions where noted. Duct and piping elevations are indicated for initial coordination; final requirements shall be determined by the Contractor after final coordination with other trades.

3. Before proceeding with work check and verify all dimensions in field.

4. Assume all responsibility for fitting of materials and equipment to other parts of equipment and structure.

5. Make adjustments that may be necessary or requested in order to resolve space problems, preserve headroom and avoid architectural openings, structural members and work of other trades.

6. For exact locations of building elements, refer to dimensional Architectural and Structural drawings.

C. Do not use equipment exceeding dimensions indicated on drawings or equipment or arrangements that reduce required clearances or exceed specified maximum dimensions.

D. If any part of Specifications or Drawings appears unclear or contradictory, apply to Owner's Representative for an interpretation and decision as early as possible.

1. Do not proceed with work without the decision of the Owner's Representative.

1.09 DEFINITIONS

A. Definitions of term used in Division 23 HVAC may differ from those given in general and supplementary conditions and take precedence over them.

B. "Provide": to furnish, supply, install and connect up complete and ready safe and regular operation of particular work referred to unless specifically noted.

C. "Supply": to purchase, procure, acquire and deliver complete with related accessories.

D. "Work": labor, materials, equipment, apparatus, controls, accessories and other items required for proper and complete installation.

E. "Piping": pipe, tube, fittings, flanges, valves, controls, strainers, hangers, supports, unions, traps, drains, insulation and related items.

F. "Wiring": raceway, fittings, wire, boxes and related items.

G. "Concealed": embedded in masonry or other construction, installed in furred spaces, within double partitions, above hung ceilings, in trenches, in crawl spaces, or in enclosures.

H. "Exposed": not installed underground or "concealed" as defined above.

I. "Indicated," "shown" or "noted": as indicated, shown or noted on drawings or specifications.

J. "Reviewed," "approved," or "directed": as reviewed, approved, or directed by or to Owner's Representative.

K. "Motor Controllers": starters, variable speed drives, and other devices controlling the operation of motors.

L. "Control or Actuating Devices": automatic sensing and switching devices such as thermostats, pressure, float, electro-pneumatic switches and electrodes controlling operation of equipment.

1.10 PROJECT CONDITIONS

A. Examine site related work and surfaces before starting work of any Section

1. In case of conflict, the most stringent takes precedence.

2. For purposes of clarity and legibility, Drawings are essentially diagrammatic to extent that many offsets, bends, unions, special fittings, exact locations of items are not indicated, unless specifically dimensioned. Especially note a number of required duct and pipe offsets to coordinate with structure and not shown. Coordinate dimensioned conditions, including invert elevations, with other trades prior to installation by any trade.

3. Exact routing of piping, ductwork, etc. shall be governed by structural conditions, obstructions. Not all offsets in ductwork or piping are shown on the Mechanical Drawings. Determine which item to offset or relocate. Maintain required slope in piping. Make use of data in Contract Documents. In addition, Owner's Representative reserves right, at no additional cost to the Owner, to make any reasonable change in location of mechanical items, exposed at ceiling or on walls, to group them into orderly relationships or increase their utility. Verify Owner's Representative's requirements in this regard prior to rough-in.

4. Take dimensions, location of doors, partitions, similar physical features from Architectural Drawings. Verify at Site under this Division. Consult Architectural Drawings for exact location of outlets to center with Architectural features, panels, etc., at the approximate location shown on mechanical Drawings.

5. Mounting heights of brackets, outlets, etc., as required.

6. Report to Owner's Representative, in writing, conditions which will prevent proper provision of this work.

7. Beginning work of any Section without reporting unsuitable conditions to Owner's Representative constitutes acceptance of conditions by Contractor.

8. Perform any required removal, repair or replacement of this work caused by unsuitable conditions at no additional cost to the Owner.

B. Coordination

1. Work out all "tight" conditions involving Work specified under this Division and Work in other Divisions in advance of installation. If necessary, and before Work proceeds in these areas, prepare supplementary Drawings under this Division for review showing all Work in congested area. Provide supplementary Drawings, additional Work necessary to overcome congested conditions, at no additional cost to the Owner.

2. Conflicts: Difference or disputes concerning coordination, interference or extent of Work between sections shall be decided as follows:

    a. Install mechanical and electrical systems in the following order of preference (those trades listed below another must reroute to resolve the conflict):

        1) Drain piping required by code to be sloped

        2) Supply air and exhaust air ductwork connected to fans

        3) Electrical conduit 4 inches and larger

        4) Hydronic piping connected to pumps

        5) Domestic water piping

        6) Fire sprinkler piping

        7) Electrical conduit smaller than 4 inches

        8) Transfer ducts and other ductwork not connected to fans

        9) Control system piping and wiring

b. Continued disputes shall be decided by Contractor and Contractor's decision, if consistent with Contract Document requirements, shall be final.

3. Supervision: Personally or through an authorized and competent representative, constantly supervise the work from beginning to completion and, within reason, keep the same foreman and workmen on the Project throughout the Project duration.

4. Provide templates, information and instructions to other Divisions to properly locate holes and openings to be cut or provided.

5. The drawings govern in matters of quantity, and the specifications govern in matters of quality. In the event of conflict within the drawings involving quantities, or within the specifications involving quantities, or within the specifications involving quality, the greater quantity and higher quality shall apply. Such discrepancies shall be noted and clarified in the Bid. No additional allowances will be made because of errors, ambiguities, or omissions that reasonably should have been discovered during the preparation of the Bid.

C. Equipment Rough-In

1. Rough-in locations shown on Mechanical Drawings for equipment furnished by the Owner and for equipment furnished under other Divisions are approximate only. Obtain exact rough-in locations from following sources

a. From Shop Drawings for equipment provided under this contract

b. From Owner's Representative for Owner furnished-Contractor installed equipment

c. From existing equipment where such equipment is relocated under this Contract

2. Verify mechanical characteristics of equipment before starting rough-in. Where conflict exists between equipment and rough-in shown on Drawings obtain clarification from Owner's Representative and provide as directed by the Owner's Representative at no additional cost to the Owner.

3. Make final connections

1.11 CLEARANCE FROM ELECTRICAL EQUIPMENT

A. Piping or ductwork

1. Prohibited, except as noted, in

a. Electric rooms and closets over equipment, as restricted by CEC

b. Telephone rooms and closets

c. Elevator machine rooms

d. Electric switchboard room

2. Prohibited, except as noted, over or within 5 feet of

a. Transformers

b. Substations

c. Switchboards

d. Motor control centers

e. Standby power plant

f. Bus ducts

g. Electrical panels

B. Drip pans under piping

1. Where piping is located over any electrical equipment listed above; reroute piping if possible rather than use drip pan

2. 18 gage galvanized steel

3. 18 gage copper

4. Reinforced and supported

5. Watertight

6. With 1-1/4 inch drain outlet piped to floor drain or service sink

1.12 PRODUCT DELIVERY, HANDLING AND STORAGE

A. See Division 1 Product Requirements

B. Deliver equipment in its original package to prevent damage or entrance of foreign matter. Provide materials on factory provided shipping skids and lifting lugs if required for handling. Provide protective coverings during construction.

C. Handle and ship in accordance with manufacturer's recommendations

D. Identify materials and equipment delivered to Site to permit check against approved materials list, reviewed with no exceptions taken Shop Drawings

E. Protect from loss or damage. Replace lost or damaged materials and equipment with new at no additional cost to the Owner

F. Where necessary, ship in crated sections of size to permit passing through available space

1.13 PROJECT MANAGEMENT AND COORDINATION SERVICES

A. See Division 1 Project Coordination

B. Overview: Provide a project manager/engineer for the duration of the Project to coordinate the Division 23 HVAC work with all other trades. Coordination services, procedures and documentation responsibility shall include, but shall not be limited to the items listed in this section.

C. Review of shop drawings prepared by other subcontractors

1. Obtain copies of all shop drawings for equipment provided by others that require electrical service connections or interface with Division 23 HVAC work.

2. Perform a thorough review of the shop drawings to confirm compliance with the service requirements contained in the Division 23 HVAC contract documents. Document any discrepancy or deviation as follows:

    a. Prepare memo summarizing the discrepancy

    b. Provide a copy of the specific shop drawing, indicating via cloud, the discrepancy

3. Prepare and maintain a shop drawing review log indicating the following information

    a. Shop drawing number and brief description of the system/material

    b. Date of your review

    c. Indication if follow-up coordination is required

D. Request for information (RFI)

1. See Division 1 Request for Information

1.14 REVIEW OF CONSTRUCTION

A. Work may be reviewed at any time by the Owner's Representative

B. Advise Owner's Representative that work is ready for review at following times:

1. Prior to backfilling buried work

2. Prior to concealment of work in walls and above ceilings

3. When all requirements of Contract have been complete

C. Neither backfill nor conceal work without Owner's Representative's consent.

D. Maintain on job set of Specifications and Drawings for use by Owner's Representative's

1. Include all change orders.

E. Contractor is responsible for construction methods, sequences and safety precautions

1.15 SCHEDULE OF WORK

A. In accordance with Division 1 Contract Schedules and as follows:

1. Arrange work to conform to schedule of construction established or required to comply with Contract Documents

2. In scheduling, anticipate means of installing equipment through available openings in structure

B. Confirm in writing to Owner's Representative, within 35-days of signing of contract, anticipated number of days required to perform test, balance, acceptance testing and

commissioning of mechanical systems. Schedule test, balance and acceptance testing of mechanical systems as follows:

1. Submit for review at this time, names and qualifications of test and balancing agencies to be used

2. Test & Balance and commissioning must occur after completion of mechanical systems, including all control calibration and adjustment, and requires substantial completion of the building, including closure, ceilings, lighting, partitioning, etc.

3. Allow 21-days after test and balance for system commissioning and life safety testing (where applicable)

4. Complete and test all systems early enough to enable completion of commissioning prior to Owner move-in.

1.16 CUTTING AND PATCHING

A. See Division 1 Cutting, Patching and Patching

1.17 WARRANTY

A. In accordance with Division 1 Guarantees, Warranties, Bonds, Service & Maintenance Contracts and as follows.

B. Warranty all materials, equipment, apparatus and workmanship to be free of defective materials and faulty workmanship for period of one year from date of filing of Notice of Completion or upon beneficial use, at the direction of the Owner's Representative (see Paragraph 3.04A.1).

C. Provide new materials, equipment, apparatus and labor to replace that determined by Owner's Representative to be defective or faulty.

D. This guarantee also applies to services including instructions, adjusting, testing, noise, balancing, etc.

E. Furnish Manufacturers' standard Warranties in excess of one year.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Alternate manufacturers as identified in each section will be considered under conditions specified in Paragraph 1.07 of this section.

B. Identify materials, equipment by manufacturer's name, nameplate data. Remove unidentified materials, equipment from Site.

C. Equipment specified by manufacturer's number shall include all accessories, controls, etc., listed in catalog as standard with equipment. Furnish optional or additional accessories as specified.

D. Where no specific make of material or equipment is mentioned, any first class product of reputable manufacturer may be used, provided it conforms to requirements of system and meets with acceptance.

E. Provide an authorized representative to constantly supervise work of this Division, check all materials prior to installation for conformance with Drawings, Specifications, reviewed Submittals and reviewed Shop Drawings.

F. Conform to conditions shown and specified. Coordinate with other trades for best possible assembly of combined Work. Relocate equipment when necessitated by failures to coordinate Work or to advise Owner's Representative of conflicts in writing.

G. Material and Equipment-General Requirements

1. New

2. Approved for use by State Fire Marshal and local building inspection department when applicable

3. Testing agency labeled or with other identification wherever standards have been established

4. Owner's Representative reserves right to reject items not in accordance with Specification either before or after installation

5. Comprised to render complete and operable systems; provide additional items needed to complete installation to realized design

6. Compatible with space allocated; modifications necessary to adjust items to space limitations at Contractor's expense

7. Installed fully operating and without objectionable noise or vibration

8. Design of mechanical systems is generally based on product of the first named manufacturers cited. Where systems for product installed necessitate modification of systems shown on drawings, Contractor is responsible for installation of systems appropriate to product installed.

H. Electrical Requirements

1. Electrical Work performed under Division 23 HVAC shall conform to requirements of Division 26 Electrical

2. Provide weatherproof devices and installation for out-of-doors work

PART 3 EXECUTION

3.01 INSPECTION

A. Verify that conditions are satisfactory for the installation of materials and equipment. Notify Owner's Representative if conditions are not satisfactory and do not commence work until conditions have been corrected.

3.02 INSTALLATION

A. Install materials and equipment in compliance with governing codes.

B. Use printed descriptions, specifications and recommendations of manufacturers as a guide for installation of Work. Follow in all cases where manufacturers' of articles used furnish directions covering points not specified or shown.

C. Equipment

1. See Division 1 Supporting From Building Structure

2. Assemble equipment which is required to be field assembled under the direct supervision of the manufacturers' agent

3. Prior to the final acceptance submit letters from the manufacturers that equipment has been assembled under the direct supervision of the manufacturers' agent

4. Accurately set and level equipment with supports neatly placed and properly fastened

5. Properly fasten equipment in place with bolts to prevent movement in earthquake

6. Coordinate the installation of equipment with openings in structure

7. Coordinate and fully dimension steel supports for mechanical equipment where shown on drawings with installing contractor

8. Provide all roof curbs for roof mounted fans, flues, piping and duct penetrations, etc.

9. Concrete

a. Concrete work, include forming, steel bar reinforcing, cast-in-place concrete, finishing and grouting is specified under Division 3 Concrete

b. Coordinate and fully dimension concrete housekeeping pads and curbs with installing contractor; dimensions shall be as required for structural and seismic requirements, see Section 23 05 48 Vibration and Seismic Control

c. Coordinate inertia base fill with installing contractor

D. Electrical

1. See Division 26 Electrical

2. Install electrical devices with code required clearances and access

3. Assist the electrical contractor in the proper connecting of all electrical wiring and equipment required for mechanical equipment

E. Sleeves, Chases and Concrete Inserts

1. Provide all required sleeves, chases, concrete inserts, anchor bolts, etc.

2. Sleeves, chases are prohibited in structural members, except where shown or as directed by Owner’s Representative in writing

3. Embed no piping in concrete or masonry

F. Waterproof Construction

1. Comply with Division 7 Thermal and Moisture Protection.

2. Include membrane clamps, sheet metal flashing, counter flashing, caulking and sealant as required for waterproofing of mechanical penetrations and sealing penetrations in or through exterior walls, floors, roofs, and foundation walls.

3. All penetrations through vapor barriers at slabs on grade shall be taped and made vapor tight.

4. Provide galvanized sheet metal weather protection canopies, hoods or enclosures over all out-of-doors equipment, the operation or maintenance of which would be impaired by rain water; this requirement applies to damper operators and bearing, damper motors, controls and instruments; see other Sections in this Division for application of this requirement to motors, drive, ducts and fans.

G. Restoration of Damage

1. Repair or replace, as directed by Owner's Representative, materials and parts of premises which become damaged.

2. Remove replaced parts from premises at no additional cost to the Owner.

H. Review architectural drawings and coordinate with Architect and other contractors to be sure that all architectural shafts, plenums, rated duct enclosures etc. required for mechanical systems are properly located and dimensioned.

I. Access Panels and Doors

1. Product specified under Division 8 Openings and Division 5 Metals:

a. Coordinate size requirements and exact location with Contractor who will provide and install access doors

b. Minimum Sizes: 18 inches by 18 inches unless otherwise shown on Drawings or approved by Owner Representative

2. Provide where shown, or required by Regulatory Agencies, for access of all concealed equipment such as terminal units, valves, fire/smoke dampers, etc., for Mechanical Work:

a. Equipment shall be located wherever practical over accessible ceilings or rooms to avoid access doors

b. Access doors shall not be used solely for access to balancing dampers; use instead remote control devices specified under Section 233300 Duct Accessories

J. Openings

1. Coordinate and fully dimension all openings in walls, floors, roofs and structural elements required for mechanical work.

2. Provide all required fire-stopping around pipe, duct and other penetrations required for mechanical work in rated partitions where required by code.

3. Fire damper openings: Contractor shall provide damper UL installation requirements to contractor installing partitions to ensure construction complies with listing.

4. Air outlet openings

   a. Contractor shall coordinate exact locations of air outlets in floors, walls and ceilings with contractor installing partition.

   b. Contractor shall coordinate additional T-bar or spline required to accept air outlets with contractor providing and installing ceiling and associated materials.

3.03 PROTECTION OF MATERIALS

A. See Division 1 Product Requirements.

B. Completely cover motors and other moving machinery to protect from dirt and water during construction.

C. During transport to and storage on the construction site, and during rough-in until final connections are made, all ductwork and other related air distribution component openings shall be covered with plastic to prevent contamination from dust, water, and debris.

D. Cap all openings in pipe and ductwork daily to protect against entry by foreign matter.

E. Material, equipment or apparatus damaged because of improper storage or protection will be rejected

1. Remove from site and provide new, duplicate, material, equipment or apparatus in replacement of that rejected.

2. Any porous materials, such as duct liner or flexible ductwork that becomes wet; for example, due to rain shall be replaced; drying is not sufficient (due to possible microbial contamination).

F. Perform Work in manner precluding unnecessary fire hazard.

3.04 ADJUSTMENT

A. Preliminary Operation

1. Operate any portion of installation for Owner's convenience if so requested by Owner’s Representative. Such operation does not constitute acceptance of Work as complete but does constitute beneficial use, see Paragraph 1.17B. Cost of utilities, such as gas and electrical power, will be borne by the Owner if operation is requested by Owner’s Representative.

B. Startup Service

1. Prior to startup, ensure that systems are ready, including checking the following: Proper equipment rotation, proper wiring, auxiliary connections, lubrications, venting fan balance, controls and installed and properly set relief and safety valves. See pre-function tests in Division 23 HVAC.

2. Start and operate all systems.

3. Provide services of factory trained technicians for startup of major equipment and systems including boilers, cooling equipment, etc.

4. Adjusting: See Section 23 05 93 Testing, Adjusting and Balancing.

5. Functional Testing: See Division 25 Building Automation Systems.

6. Life Safety Testing

    a. Assist Division 26 Electrical contractor in testing fire alarm controls, including control of smoke dampers and shut-off of fan systems.

    b. Correct any problems related to equipment supplied under Division 23 HVAC.

    c. Provide all tests, air balance and start-up personnel required to start and commissioning the system and for assisting the design/construct team in demonstrating system compliance with the local fire district and building department

C. Noise

1. Cooperate in reducing any objectionable noise or vibration caused by mechanical systems to the extent of adjustments to specified and installed equipment and appurtenances.

2. Completely correct noise problems caused by failure to make installation in accordance with Contract Documents, including labor and materials required as a result of such failure, at no additional cost to the Owner.

3.05 SPECIAL TOOLS

A. Furnish to Owner at completion of work one set of any special tools required to operate, adjust, dismantle or repair equipment furnished under any section of this Division.

3.06 CLEANING

A. See Division 1 Closeout Procedures, Final Cleaning and Extra Material

B. Thoroughly clean equipment, fans, pumps, motors, piping and other materials under this. Division free from all rust, scale and all other dirt before any covering or painting is done, or the systems put in operation; leave in condition satisfactory to Owner's Representative.

C. At all times keep the premises free from accumulation of waste material and debris caused by his employees. At the completion of the Project, and at other times as Owner's Representative may direct, remove refuse from within and around the building. All tools, scaffolding and surplus materials shall also be removed, leaving the Site of his Work clean.

D. Completely cover all motors and other moving machinery to prevent entry of dirt and water during construction.

E. Effectively cap all openings into ducts and pipes to keep moisture and foreign matter out during construction

3.07 PAINTING

A. Painting

1. Piping exposed to outdoors
    a. One coat primer
    b. Two coat alkyd oil paint, UV resistant for PVC piping, color as indicated
    c. Not required for copper, galvanized steel, or insulated piping
2. Steel hangers and supports exposed to outdoors
    a. One coat primer
    b. Not required for galvanized steel
3. Interior of ductwork and duct accessories, including insulation stick pins, at air outlets as far back as visible from occupied spaces
    a. Flat black
4. Marred surfaces of factory painted equipment
    a. Spot coat to match adjacent coat
5. Insulation exposed to sunlight: See Section 23 07 00 Mechanical Insulation

B. Execution

1. Protect flooring and equipment with drip cloths.
2. Paint and materials stored in location where directed.
3. Oily rags and waste removed from building every night.
4. Wire brush and clean off all oil, dirt and grease areas to be painted before paint if applied.
5. Workmanship
    a. No painting or finishing shall be done with
        1) Dust laden air
        2) Unsuitable weather conditions
        3) Space temperature below 60 degrees Fahrenheit
    b. Pipes painted containing no heat and remain cold until paint is dried.
    c. Paint spread with uniform and proper film thickness showing no runs, sags, crawls or other defects.
    d. Finished surfaces shall be uniform in sheen, color and texture.
    e. All coats thoroughly dry before succeeding coats are applied, minimum 24 hours between coats.

f. Primer undercoat of slightly different color for inspection purposes

6. Piping continuously painted in all exposed areas

C. Paint

1. High gloss medium or long alkyd paint

2. Best grade for its purpose

3. Deliver in original sealed containers.

4. Apply in accordance with manufacturer's instructions.

D. Colors

1. Colors as directed by Owner's Representative unless specified herein.

2. Condenser water piping: pale green

3. Interior of ductwork as far back as visible from outside: flat black

4. Uncoated hangers, supports, rods and insets: dip in zinc chromate primer

E. Factory finish

1. Ceiling and wall mounted air outlets in acoustical tile ceilings: Baked white enamel

2. Aluminum air outlets that are not to be painted: anodized

F. Marred surfaces of prime coated equipment and piping: spot prime coat to match adjacent coat

G. Properly prepare Work under this Division to be finish painted under Division 9 Painting

H. Provide moisture resistant paint for exterior painting and heat resisting paint for hot piping, equipment and materials

I. Factory Finishes

1. Exposed fan coil units: baked enamel

2. Unit ventilators and unit heaters: baked enamel

3. Fans, pumps, compressors, tanks and like items

4. Air handlers, pumps, water heaters and like items where exposed

J. For the following, provide factory prime coat. Also, provide factory finish painting on each if not specified in Painting Division

1. Other air outlets

K. Paint all equipment out-of-doors and equipment supports with two coats of weather resistant enamel

L. Protect all finished surfaces of fixtures with heavy paper pasted thereon, or by other means, throughout the period of construction

M. Refinish Work supplied with final finish under this Division if damaged under this Division to satisfaction of Owner's Representative

3.08 FIELD QUALITY CONTROL

A. See Division 1 Quality Control

B. Tests

1. Perform as specified in individual sections and as required by authorities having jurisdiction

2. Perform commissioning work

a. Perform pre-function tests as specified in Division 23 HVAC

b. Perform functional and post-occupancy tests. See Division 25 Building Automation Systems

3. Duration as noted

C. Provide required labor, material, equipment and connections

D. Furnish written report and certification that tests have been satisfactorily completed

E. Repair or replace defective work, as directed by Owner's Representative in writing, at no additional cost to the Owner

F. Restore or replace damaged work due to tests as directed by Owner's Representative in writing, at no additional cost to the Owner

G. Restore or replace damaged work of others, due to tests, as directed by Owner's Representative in writing, at no additional cost to the Owner

H. Remedial work shall be performed to the satisfaction of the Owner's Representative, at no additional cost to the Owner, including

1. Work related to all Division 23 HVAC pre-functional tests

2. Division 23 HVAC work related to Section 01 91 00 Commissioning

3. Division 23 HVAC work related to Section 23 05 93 Testing, Adjusting and Balancing

4. Division 23 HVAC work related to Section 23 08 00 Mechanical Commissioning

I. Remedial work shall include performing any commissioning or other tests related to remedial work an additional time at no additional cost to the Owner

END OF SECTION

SPECIFICATION 23 05 05
MECHANICAL DEMOLITION

PART 1 GENERAL

1.01 SUMMARY

A. Work included: Selective mechanical systems demolition

1.02 SYSTEMS DESCRIPTION

A. Remove existing HVAC systems

1. Areas indicated by hatching on “M-1” series demolition drawings show where mechanical items described below are to be removed. Equipment to be saved for new tenant shall be moved to second floor holding area, as designated by general contractor. Equipment to be saved is described in detail below.

B. Fire sprinkler systems shall remain in their entirety.

C. Disconnect and remove the following existing mechanical equipment. Note some equipment will be retained under the tenant improvement contract, as described. Demo other equipment on floors if not described specifically and found in areas hatched on “MD” series plans.

1. Hot water air handling units

PART 2 PRODUCTS

2.01 MATERIALS AND EQUIPMENT

A. Materials and equipment necessary for mechanical and plumbing equipment removal

PART 3 EXECUTION

3.01 EXAMINATION

A. Contractor shall thoroughly review conditions in the area of demolition prior to submission of price proposal and commencing work to insure complete understanding of existing installation in relationship to demolition work.

3.02 GENERAL REQUIREMENTS

A. Remove equipment indicated to be removed.

B. Existing devices and equipment that are shown are indicated only for informational purposes. Contractor shall visit the site and shall verify conditions as they exist and shall remove, relocate and/or rework any mechanical, plumbing and fire sprinkler systems equipment (whether indicated or not) due to removal of existing walls, ceilings, etc. Coordinate all work with that of other trades.

3.03 RETAINED SYSTEMS

A. Retain the existing systems as indicated.

B. Disable a system only to make repairs to damaged equipment. Obtain permission from Owner's designated representative at least 24 hours before disabling the system. For the fire sprinkler system, notify Owner, Fire Department and the Fire Supervisory Service.

END OF SECTION

SPECIFICATION 23 05 13
MOTORS AND CONTROLLERS

PART 1 GENERAL

1.01 SUMMARY

A. Work included in this section: materials, equipment, fabrication, installation and tests in conformity with applicable codes and authorities having jurisdiction for the following:

1. Motors
2. Variable speed drives
3. Motor controllers where not provided as part of mechanical equipment

1.02 REFERENCE STANDARDS

A. ABMA 9 Load Ratings and Fatigue Life for Ball Bearings

B. ABMA 11 Load Ratings and Fatigue Life for Roller Bearings

C. ANSI/IEEE 112 Test Procedure for Polyphase Induction Motors and Generators

D. ANSI/NEMA MG 1 Motors and Generators

E. ANSI/NFPA 70 National Electrical Code

F. IEEE Standard 519-1992, IEEE Guide for Harmonic Content and Control

G. NEC 430.120, Adjustable-Speed Drive Systems.

H. NEMA ICS 7.0, AC Adjustable Speed Drives

I. Underwriters Laboratories UL 508 Standard for Industrial Control Equipment

J. Underwriters Laboratories UL 508A Standard for Industrial Control Panels

K. Underwriters Laboratories UL 508C Standard for Power Conversion Equipment

1.03 DEFINITIONS

A. VSD: Variable speed drive

B. ECM: Electrically Commutated Motor

1.04 SUBMITTALS

A. See Section 23 05 01 Basic Mechanical Materials and Methods.

B. Submit product data, O&M data, and samples and show item on shop drawings (where shop drawings are required) according to the following table.

1. "R" means required.

2. "R2" means required only for products and equipment differing for the specified manufacturer and model and for "or equals" where specified.

Item	Product Data	O&M Manual	Samples	Shop Drawing
Motors	R	R		R
Belts and Drives		R		
Variable Speed Drives	R	R		R

C. Submittals shall include certification from the motor manufacturer certifying compliance with NEMA MG-1, part 31 for motors that are driven by variable speed drives.

1.05 WARRANTY

A. Special Warranty: VSD warranty shall be 24 months from date of start-up certification including all parts, labor, travel time, and expenses.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Motors

1. US Motors

2. General Electric

3. Gould Inc.

4. Baldor

5. Ebm-papst

6. Or equal

B. Variable speed drives

1. ABB

2. Danfoss

3. Yaskawa

4. Or equal

2.02 MOTORS

A. General

1. In accordance with NEMA, IEEE, and ANSI C50 standards

2. Capacity

a. Minimum horsepower indicated

b. To operate driven devices under all conditions without overload

3. Squirrel-cage induction type, NEMA Type "B: insulation class, continuous duty

4. Speed

a. 1750 RPM, unless otherwise indicated

b. See schedules on drawings for other speeds

5. Minimum NEMA KVA/HP Locked Rotor Code:

HP Range	Code Letter
≤2	M
3	K
5	J
7.5-10	H
>10	G

6. Service factor: 1.15

7. Type unless otherwise scheduled on Drawings

a. Voltage: As scheduled on Drawings

b. 1/2 horsepower and smaller

1) Single-phase, 60 hertz

2) With built-in auto-reset thermal overload protection

c. 3/4 horsepower and larger

1) Three-phase, 60 hertz

2) 50 horsepower and over: Reduced voltage start, suitable for star-delta starting

d. Electrically Commutated Motor (ECM)

1) Where scheduled on Drawings or equipment Specifications

8. Bearings

a. Ball type, unless otherwise indicated

b. Sealed, permanently lubricated, unless otherwise noted or not available in motor size

1) One bearing size on both ends of the motor

2) Minimum bearing life of

a) 50,000 hours for belt-drive

b) 130,000 hours for direct-drive

B. Enclosure

1. Open drip-proof (ODP)

a. Provide ODP motors unless otherwise indicated

2. Totally enclosed (TEFC)

a. Motors outside the building or otherwise exposed to the weather

b. Non-ventilated: under 1/2 horsepower

c. Fan-cooled: 1/2 horsepower and larger

3. See schedules on drawings for other enclosures

C. Belt-connected motors

1. Foundation slide base

2. Shaft as required for aligning pulleys

D. Motors 1 horsepower and larger shall be NEMA Premium™ labeled and have guaranteed efficiencies equal to or exceeding NEMA Table 12-6D.

E. Motors driven by variable speed drives

1. Shall be “inverter ready” motors that meet the requirements of NEMA MG-1 part 31

2. Where used for pumps or fans (variable torque), shall have minimum 10:1 turndown and be capable of operating at 10 percent speed indefinitely

3. Shall incorporate a design to prevent arcing through the motor bearings, such as: insulated bearings, ceramic bearings, grounded motor shafts such as those manufactured by AEGIS Ground Shafting Systems, or approved equal, for the following applications:

a. Motors are larger than 75 HP

b. The VSD runs near constant speed such as data center air handlers and VSDs used only to adjust for filter loading such as clean room air handlers

c. Where indicated on Drawings

F. Electrically Commutated Motors (ECMs) ≤1 HP

1. Brushless DC type with electronic commutation from 115 volt, 277 volt, or 480 volt single phase power to a DC signal

2. Speed controllable from a minimum of 15% or less to 100% of full speed

3. Minimum 80% efficiency at all speeds

4. Include time delay relays or other electrical devices as necessary to limit motor in-rush current to 10 times the maximum motor running current.

5. Provide one of the following as indicated on Drawings or Specifications

   a. Constant speed applications

      1) Potentiometer dial mounted on the exterior of the motor housing

      2) Programmed with fan-curve for “constant airflow”

   b. Variable speed applications

      1) 0-10 volt DC control signal input

      2) Signal configured to be proportional to fan speed, or to torque if speed not available.

      3) Where specified in other Sections: Motor shall shut off when speed signal is below 2 Vdc minimum.

      4) Where specified in other Sections, include 0-10 volt DC speed feedback output.

6. The motor in-rush current, including transient in-rush currents of less than one 60 Hz cycle (0.016 seconds), shall not exceed 10 times the motor RLA. The manufacture shall include transient in-rush suppression circuit as required to achieve these values. The transient in-rush suppression circuit shall be ETL or UL listed by the manufacturer and shall be designed to be fail safe. The manufacturer shall submit actual factory recorded in-rush values recorded with a meter for the first 10 seconds of the motor starting for the complete assembly, including the current waveform of the initial transient current.

7. Equal to Regal Beloit ECM

2.03 VARIABLE SPEED DRIVES

A. General

1. All variable speed drives other than those that are factory packaged with equipment shall be supplied by one manufacturer.

2. VSDs shall be completely assembled and tested by the manufacturer in an ISO 9001 & 14001 facility.

3. All circuit boards shall be coated to protect against corrosion. Control boards shall be conformal coated to at least IEC 60721-3c2.

4. Include factory installed door interlocked pad-lockable disconnect switch that will disconnect all input power from the drive and all internally mounted options and comply with Lock Out/Tag Out (LOTO) requirements of CEC 430.

B. Performance

1. The VSD shall provide full rated output from a line of ±10% of nominal voltage. The VSD shall continue to operate without faulting from a line of +30% to -35% of nominal voltage.

2. Overload rating of VSD shall be 110% of normal duty current rating for 1 minute every 10 minutes, 130% overload for 2 seconds every minute.

3. VSDs shall be capable of continuous full load operation in the following environmental conditions:

    a. Ambient temperature: 5°F to 104°F. Operation to 122°F shall be possible with a 10% reduction from VSD full load current

    b. Altitude: 0 to 3300 feet above sea level. Operation to 6600 feet shall be possible with a 10% reduction from VSD full load current

    c. Relative humidity: 0 to 95%, non-condensing

4. Efficiency shall be not less than 97 percent at rated voltage, current, and frequency and fundamental power factor shall not be less than 98 percent at all speeds and loads.

C. Electrical Characteristics

1. Provide 3-5% impedance AC line reactors or internal dual 5% DC chokes to reduce harmonics to the power line and as protection from AC line transients. VSDs with only one DC choke shall include AC line reactors.

2. VSD shall automatically mitigate harmonics throughout the effective load range using Swinging chokes or other devices designed to lower harmonics when VSD is at partial loads.

3. Include Ferrite Core EMI/RFI/Common mode filters. The onboard filters shall allow the VSD assembly to be CE Marked and the VSD shall meet product standard EN 61800-3 for the First Environment restricted level (Category C2).

D. Equipment Protection and Safeties

1. VSD shall:

    a. Be UL 508 listed for a minimum of 100 kA short circuit current rating (SCCR) without the need for external input fuses or external series rated combination circuit breakers.

    b. Include built in coordinated AC transient surge protection system consisting of 4 MOVs (phase to phase & phase to ground), capacitor clamp, 1600 PIV Diode Bridge and internal chokes.

    c. Automatically mitigate harmonics throughout the effective load range using Swinging chokes or other devices designed to lower harmonics when VSD is at partial loads.

    d. Protect itself against all normal transients and surges in incoming power line, any grounding or disconnecting of its output power, and any interruption or run away of incoming speed signal without time delay considerations. Protection is defined as normal shutdown with no component damage.

    e. Be capable of sensing a loss of load (broken belt / broken coupling) and signal the loss of load condition. The VSD shall be programmable to signal this condition via a keypad warning, relay output and/or over the serial communications bus. Relay output shall include programmable time delays that will allow for drive acceleration from zero speed without signaling a false under-load condition.

f. Protect itself against all phase-to-phase or phase-to-ground faults.

g. Be able to have a distance from the VFD to the motor of at least 250' at the maximum carrier frequency or provide a DV/DT filter in addition to each VFD as needed to protect the motors.

h. Be able to start into a rotating load (flying start) at all speeds (forward or reverse) without trip.

i. Ride through an input power dip of 3 cycles without trip.

j. Operate properly at a -35% +30% voltage fluctuation from rated voltage.

k. Operate properly at a 10 percent frequency variation from rated frequency.

l. Employ three current limit circuits to provide trip-free operation: slow current regulation, rapid current regulation, and current limit switch-off limit. VSD shall be designed so that overcurrent trip shall be at least 315 percent of the drive's current rating.

m. Withstand unlimited switching of the output under full load, without damage to the VSD. Operation of a disconnect switch between the motor and VSD shall not have an adverse effect on the VSD, whether the motor is operating or not. Controls conductors between the disconnect and the VSD shall not be required for the safe and reliable operation of the VSD.

n. Withstand switching of the input line power up to 20 times per hour without damage to the VSD.

o. Anti-regeneration circuit shall match the deceleration rate of the drive to that of the motor to prevent high bus voltage shutdown common to high inertia loads, such as fans.

E. Human-Machine Interface

1. Keypad with backlit LCD

2. Removable, capable of remote mounting and allow for uploading and downloading of parameter settings as an aid for start-up of multiple VSDs.

3. Password protection against parameter changes

4. Hand-Off-Auto selections and manual speed control with "bumpless transfer" of speed reference when switching between "Hand" and "Auto" modes

5. "Help" button with built-in assistance for programming and troubleshooting

6. Complete English words for programming and fault diagnostics; alphanumeric codes only are not acceptable

7. Time stamped fault history with details (amps, volts, type of fault etc.) of drive conditions of at least the last 3 faults with a timestamp and total history of at least 7 of the last faults

8. Displays and meters for the following: Output voltage, output frequency, motor rpm, motor current, motor watts, speed signal input, last three faults

F. Software Features

1. Adjustable PWM switching carrier frequencies from 1 to 8 kHz.

   a. Include a PWM switching carrier frequency control circuit that reduces the carrier frequency based on actual VSD temperature that allows the highest PWM switching carrier frequency without derating the VSD or operating at high PWM switching carrier frequency only at low speeds.

2. Ability to automatically restart after an over-current, over-voltage, under-voltage, or loss of input signal or protective trip. The number of restart attempts, trial time, and time between attempts shall be programmable for each fault type.

3. Ability to set a maximum current available to the motor with automatic speed reduction to prevent high current trip.

4. Motor flux optimization that automatically reduces applied motor voltage to the motor to optimize energy consumption and reduce audible motor noise.

5. Noise smoothing feature that randomly varies switching frequency to distributes acoustic motor noise over a range of frequencies instead of a single tonal frequency resulting in lower noise intensity.

6. Three programmable critical frequency lockout ranges to prevent the VSD from operating the load continuously at an unstable speed. Each lockout range must be fully adjustable from 0 to full speed.

7. Adjustable acceleration and deceleration ramps, 1 – 1800 seconds adjustable.

8. If input speed reference is lost, VFD shall be programmable to (1) stop and display the fault, (2) run at a programmable preset speed, (3) hold the VFD speed based on last known reference received, or (4) go to a backup control signal wired to the VFD. VFD must also be capable of issuing an alarm locally at the HMI and via the BAS on loss of speed reference.

G. Input/Outputs

1. Minimum Inputs

   a. Two programmable analog inputs, 0/4-20ma or 0/2-10 Vdc signals, any of which shall be capable of being programmed to the following:

      1) Control point feedback signal for internal PID loop

      2) Control point setpoint for internal PID loop

   b. Six programmable digital inputs, 24Vdc, any of which shall be capable of being programmed to the following:

      1) Start/stop

      2) Run permissive safety interlock

      3) Programmable preset speed

4) Forward/reverse direction

2. Minimum Outputs

a. Two programmable analog outputs, 0/4-20ma or 0/2-10 Vdc signals, any of which shall be capable of being programmed output proportional to the following:

1) Motor Speed

2) Motor Power (kW)

3) Active PID Reference

4) Active PID Feedback

b. Three programmable, digital Form-C relay outputs, ≥8 amps at 24 VDC, any of which shall be capable of being programmed to the following:

1) Open damper or VAV boxes with programmable time delay start

2) Fan status, based on field adjustable motor current that can indicate broken belt or coupling

3) Any fault/alarm

4) Loss of input power to VSD

H. Controls

1. Self-contained controls

a. Built-in PID control loop, allowing connection of a pressure or flow signal to a VSD analog input for closed loop control.

b. A second PID loop that can utilize the second analog input and modulate one of the analog outputs to maintain the set point of an independent process.

c. PID sleep feature to shut off VSD when speed drops below an adjustable value for an adjustable period of time.

d. PID set points adjustable from the VSD keypad, analog inputs, or over the communications bus.

e. Built-in time clock with a battery backup with 10 years minimum life span. The clock shall be used to date and time stamp faults and record operating parameters at the time of fault. VSD programming shall be held in non-volatile memory and is not dependent on battery power

2. Serial Communications

a. Built in EIA-485 port with standard protocols

1) BACnet-MS/TP

a) Certified BTL listing as B-ASC

b) Adjustable to 9.6, 19.2, 38.4, or 76.8 Kbps

b. At a minimum, the following points shall be provided:

1) Read only: Speed feedback, output speed, current, % torque, kW power, kilowatt hours (resettable), operating hours (resettable), drive temperature, digital input status, analog input values, all diagnostic warning and fault information, keypad "Hand" or "Auto" selected, bypass selected, deceleration rate, and acceleration rate

2) Read/write: On/off, output speed, digital output status, analog output values, remote fault reset, PID setpoint and gains, maximum speed, and minimum speed

I. Bypass. Not required:

J. Enclosure

1. Enclosure requirements apply to VSD and all specified options and accessories.

2. VSD Enclosures shall be UL rated. Self-certified enclosures or enclosures with only NEMA ratings are not acceptable.

3. Provide enclosure scheduled on Drawings

a. NEMA 1/UL Type 1 enclosure for indoor installation

b. NEMA 3R/ UL Type 3R enclosure for outdoor installation

c. NEMA 12/UL Type 12 for wet or dirty mechanical rooms

d. NEMA 4X for outdoor installation in extreme climates

4. VSDs shall be UL listed as plenum rated where located in supply, return, or outdoor air stream.

5. NEMA 4X panel shall be stainless steel cabinet with temperature controlled mechanically cooled air isolated from outside air in the VSD cabinet.

6. Thermostatically controlled cooling fans shall be provided where required to meet ambient operating conditions. Fans shall be designed for replacement without requiring removal of the VSD from wall mount or removal of circuit boards. Fan sound power shall be no greater than local noise sources where VSD is installed. Fans shall operate only when required, based on the temperature and run command to the drive.

2.04 MOTOR CONTROLLERS

A. See Division 26 Electrical.

B. Refer to individual equipment sections for factory-provided controllers

1. Installed on equipment by manufacturer

2. Supplied with equipment by manufacturer for field installation

PART 3 EXECUTION

3.01 INSTALLATION

A. See Section 230548 Vibration and Seismic Control.

B. Coordinate with work of other trades.

C. Install in accordance with manufacturer's written installation instructions.

D. See 25 00 00 Building Automation Systems for control wiring, including network interface wiring.

E. Drives for packaged equipment shall be mounted and wired by equipment manufacturer.

F. Mounting and power wiring of field mounted variable speed drives and other motor controllers is specified under Division 26 Electrical.

1. Where wall space is not available for mounting VSDs or other motor controllers, provide mounting struts securely mounted to the floor, roof, or adjacent structure

2. Strictly follow VSD manufacturer's recommendations, in particular with respect to grounding.

G. Set overload devices to suit motors provided in accordance with NEC.

3.02 INSPECTION

A. Verify that adequate clearance between motor, controllers and adjacent walls or equipment is available to permit maintenance and repairs.

B. Check that motor and controller are properly supported and allows for proper alignment and tension adjustments as necessary for application.

3.03 PRE-OPERATING CHECKS

A. Before operating motors and controllers

1. See Section 23 08 00 Mechanical Commissioning.

2. Complete the Pre-Functional Test Data Sheet for each motor and controller.

3. Check for proper and sufficient lubrication.

4. Check for correct rotation.

5. Confirm alignment and re-align if required.

6. Check for proper adjustment of vibration isolation.

3.04 STARTUP, TESTING, AND ADJUSTING

A. Start and test motors and controllers in accordance with manufacturers written installation instructions.

B. After starting motors

1. Check for high bearing temperatures.

2. Check for motor overload by taking ampere reading at maximum operating conditions, with all valves open and individual motor running.

3. Check for objectionable noise or vibration; correct as needed at no additional cost to the Owner.

C. Variable speed drives

1. Certified factory start-up shall be provided. A certified start-up form shall be filled out for each VSD with a copy to the Owner's Representative and a copy kept on file by the manufacturer. Start-up technician shall configure the VSD as follows:

a. Set variable speed ramp-up rates on variable air volume systems slow enough to prevent high pressure trips and/or damage to duct systems. Coordinate with Division 25 Building Automation Systems contractor.

b. Set minimum speed for all applications in accordance with procedure indicated in Division 25 Building Automation Systems.

c. Enable current limit control and set maximum current limit setpoint to the motor to the motor's full load amps.

d. Enable flying start feature.

e. Set voltage to speed ratio (V/f) to "squared"

f. Enable Flux Optimization capability.

g. Set switching frequency:

1) Set to 4 kHz then check for motor noise in nearby occupiable spaces.

2) If motor noise is audible in occupied space, enable noise smoothing feature.

3) If noise is still a problem, raise switching frequency to 8 kHz. Do not raise switching frequency above 8 kHz.

h. Configure status point to only indicate status when the drive detects a current above that which occurs when a belt is broken (fan), the rotor is locked, or a discharge damper or valve is fully closed.

i. Set VSD to automatically restart with shortest time period allowed by VSD

1) After power is restored after a power interruption

2) After alarms are cleared

j. For fans such as relief fans and cooling tower fans: Run fan through entire speed range and program out speeds that cause fan vibration.

k. For VSDs powered by emergency generators, disable Under-volt Control (to cause the Pre-Charge Contactor to open as quickly as possible and prior to transfer of power, avoiding current surge and possible VFD damage).

l. For supply air fans for which supply air FSDs are interlocked to shut when the fan is off:

1) Configure one DO contact to close when the VFD has been commanded to start. (This is used to convey to the fire alarm system that the FSDs must be opened. All wiring by Division 26.)

2) Configure the VFD so the drive does not actually start until 15 seconds after the above DO contact has been closed. (This provides sufficient time for the fire alarm system to open the FSDs to avoid a nuisance trip.)

2. After VSD is fully configured and programmed, all settings shall be documented and included with commissioning documentation in electronic format per Section 230501 Basic Mechanical Materials and Methods. The intent is to allow replacement drive electronics to be readily configured.

3. See Section 25 00 00 Building Automation Systems for points to be mapped from the drive controller to the BAS; coordinate information addresses and other information required with the Division 25 Building Automation Systems contractor.

D. See Section 23 05 93 Testing, Adjusting and Balancing.

E. See Section 23 08 00 Mechanical Commissioning.

3.05 TRAINING

A. See Section 23 08 00 Mechanical Commissioning.

B. VSD manufacturer to provide one of the following:

1. 4-hours of customer training

2. Interactive Computer based training on VSD installation, start-up, programming, and trouble shooting

END OF SECTION

SPECIFICATION 23 05 23
VALVES

PART 1 GENERAL

1.01 SUMMARY

A. Work Included in This Section: Materials, equipment, fabrication, installation and tests in conformity with applicable codes and authorities having jurisdiction for the following:

1. Service valves in hydronic systems
2. Manual and automatic balancing valves
3. Check valves
4. Pressure reducing valves
5. Safety and relief valves
6. Refrigeration valves
7. Manual and automatic air vents
8. Miscellaneous valves

1.02 QUALITY ASSURANCE

A. Provide valves with manufacturer's name and pressure rating clearly marked on outside of body.

1.03 SUBMITTALS

A. See Section 23 05 01 Basic Mechanical Materials and Methods.

B. Submit product data, O&M data, and samples and show item on shop drawings (where shop drawings are required) according to the following table.

1. "R" means required.
2. "R2" means required only for products and equipment differing for the specified manufacturer and model and for "or equals" where specified.

Item	Product Data	O&M Manual	Samples	Shop Drawing
Valves, all types	R	R		R
Manual and automatic air vents	R2	R		

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Named manufacturer model numbers used as example of item and establish minimum level of quality and minimum standard options. Equivalent models of listed manufacturers are acceptable.

B. Ball, butterfly, and check valves

1. Nibco Inc.
2. Crane Company
3. De Zurik Corporation
4. Victaulic
5. Or equal

C. Balancing valves

1. ITT Bell and Gossett
2. Tour & Anderson
3. Taco, Inc.
4. Or equal

D. Combination check and shut-off valves and Triple duty valves: Not allowed

E. Pressure reducing and relief valves

1. ITT Bell and Gossett
2. Watts
3. Consolidated
4. Tour & Anderson
5. Or equal

F. Vent and cocks

1. Weiss
2. Weksler
3. Crane Company
4. Lunkenheimer
5. Or equal

G. Automatic air vents

1. Amtrol Inc.

2. Bell and Gossett ITT

3. Hoffman

4. Or equal

2.02 GENERAL

A. Where possible, provide valves of same manufacturer for all Mechanical Sections per products in this Section.

B. For copper tubing provide solder-joint valves, flare fittings, or IPS-to-copper adaptor, sized for use with tubing and respective valve.

C. For flanged valves, provide streamline companion flanges, ANSI B16.5, 1988 150 class pounds per square inch

1. 255 pounds per square inch at 150 degree Fahrenheit

2. 225 pounds per square inch at 250 degree Fahrenheit unless indicated otherwise

D. Provide valves rated not less than 125 pounds per square inch steam working pressure, unless indicated otherwise.

E. Provide valve materials suitable for service and temperature of respective systems, especially with respect to discs, plugs, balls, linings, gaskets, and lubricants of plug cocks, ball valves, etc.

F. Provide chain-operated hand wheels, rustproof chain and chain guide for following valves

1. Valves 8 feet or more above operating floor or platform

2. As noted

G. Valves in Insulated Piping: With 2 inch stem extensions and the following features:

1. Ball Valves: With extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation and memory stops that are fully adjustable after insulation is applied. Nibco Nib-seal handle extension or equal by Conbraco Industries, Inc. or Apollo Div.

2. Butterfly Valves: With extended neck.

2.03 BUTTERFLY VALVES

A. Flange Type

1. Cast Iron body

2. 316 or 416 stainless steel stem, continuous with pinned disc

3. Disk shall be either

a. 304 or 316 stainless steel

b. Aluminum bronze

c. Nickel encapsulated ductile iron

d. EPDM encapsulated ductile iron

e. Nylon encapsulated ductile iron

4. EPDM seat and seal

5. Factory tested bubble-tight at 150 pounds per square inch

B. Type

1. Lug Type

a. Equal to Nibco Series LD-2000

b. Lugs drilled and tapped to match ANSI 150 flanges

c. Recommended by manufacturer or dead-end service at full pressure without the need for downstream flanges

d. Use cap screws both sides

2. Wafer Type

a. Equal to Nibco Series WD-2000

3. Grooved-end type

a. Equal to Victaulic 300 MasterSeal

b. Recommended by manufacturer or dead-end service at full pressure without the need for downstream flanges

C. Operator

1. Throttling handle with memory stops: smaller than 8 inches

2. Gear operators: 8 inches and larger

2.04 BALL VALVES

A. Materials

1. Two piece body, bronze ASTM B584 C84400

2. 316 stainless steel stem and ball

3. PTFE Seat

4. Full Port 1/2 to 1 inch; Standard Port 1-1/4 and larger

5. 600 pounds per square inch at 100 degree F, 125 pounds per square inch saturated steam

6. Infinite throttling handle with memory stop

7. Equal to Nibco 580-70-66

B. Lock guard/shield

1. Where called for on drawings

2. Equal to Brady Ball Valve Lockout (padlock by Owner)

2.05 MANUAL BALANCING VALVES

A. Calibrated Balancing Valves

1. Combination balancing and shut-off valves

2. Calibrated name plate and adjustable memory stop handle

3. Capped read-out valves

4. Pre-formed insulation for chilled water valves

5. Provide one differential pressure read-out meter for all valves in system

6. 3 inches and smaller

a. Brass body

b. 304 stainless steel ball

c. Soldered or threaded ends

d. Teflon or TFE seats

e. 250 pounds per square inch at 250 degrees Fahrenheit

7. 4 inches and larger

a. Ductile or cast iron body

b. Flanged or Grooved-end

c. 175 pounds per square inch at 250 degrees Fahrenheit

8. Devices using venturi type flow meter not acceptable (due to propensity for clogging and ease of putting valve with limited flow range in wrong location)

9. Devices using Pitot tube or Annubar type flow meter not acceptable (due to propensity for clogging)

10. Devices using other than ball or butterfly valves shall not be used for coil isolation – a separate ball valve or butterfly valve shall be added for isolation (to ensure positive shut-off and to allow 90° open-close with memory stop) whether shown on schematics or not.

11. Bell & Gossett Circuit-Setter Plus, Nexus UltraMB, or equal (no other known equals).

B. Combination shut-off, balancing, and check valve: Not allowed

2.06 PRESSURE REDUCING VALVES

A. Brass or bronze body, threaded

B. Removable strainer

C. 125 psig working pressure rating

D. Adjustable range; see drawings for setpoint

2.07 SAFETY AND RELIEF VALVES

A. General

1. Constructed, rated and stamped in accordance with Section IV of the ASME Boiler and Pressure Vessel

2. Direct spring-loaded type

3. Adjustable discharge pressure setting

4. Brass or bronze body and all wetted parts shall be non-ferrous

5. Suitable and rated for system pressure and temperature

B. Set pressures

1. Set pressure as indicated on Drawings; not to exceed pressure rating of protected equipment

2. Valves to open, under test, at set pressure with following tolerance

a. Set pressure up to 70 pounds per square inch gage: plus or minus 2 pounds per square inch

b. Set pressure, above 70 pounds per square inch gage: plus or minus 3 percent

C. Capacities

1. Valves shall have capacity to relieve maximum possible generated energy while maintaining pressure in protected equipment at no more than 10 percent above vessel working pressure.

2. For boiler relief valves, the valve shall have a BTU/h rating in excess of the BTU/h rating of the boiler's heating output

3. Provide multiple valves if required for capacity even though only one valve may be shown on Drawings

D. Maintain pressure in protected equipment at not more than following

1. Low pressure Boilers: 5 pounds per square inch above boiler working pressure

2. High pressure Boilers: 6 percent above boiler working pressure

3. Unfired Pressure Vessels: 10 percent above vessel working pressure

2.08 VENT & GAUGE COCKS

A. Bronze body, 1/4 inch size

B. Lever handle

C. 125 pounds per square inch steam working pressure

D. Equal to Weiss LC-14

2.09 AIR VENTS

A. Manual Air Vents

1. Vertical

2. Provide 1/4 inch brass needle or ball valve at top of chamber

3. To 3 inch pipe: Line size air chamber, 12 inch long

4. 4 inch to 8 inch: Line size air chamber, 6 inch long

5. 10 inch and larger: Line size pipe cap

B. Automatic Air Vents

1. Float type

a. With isolating valve

b. Brass or cast iron body

c. Copper or stainless steel float

d. Stainless steel valve and valve seat

e. Suitable for system operating temperature and pressure

f. Non-opening on negative pressure

g. Equal to Amtrol No. 747

2. Threaded vent connection for piping vent to drain

3. Upstream valve cock for isolation

PART 3 EXECUTION

3.01 INSTALLATION

A. Coordinate with work of other trades.

B. Install valves in accordance with manufacturer’s written installation instructions.

C. Provide valves as shown on drawings, and provide shutoff valves around all equipment whether shown with valves on drawings or not.

   1. Ball and butterfly valves are considered interchangeable; where one type is shown on drawings, the other type may be used at contractor's option.

D. Provide all valves (except control valves), strainers, and check valves of same size as the pipes in which they are installed unless otherwise indicated.

E. Pressure rating of valves same as piping in which installed.

F. Install valves with stems upright or horizontal, not inverted.

G. Install valves with cast directional arrows in direction of flow.

H. Support line valves at the valve in addition to regularly spaced pipe supports shown and specified.

I. Butterfly valves

   1. Lug or Grooved-end type at equipment isolation valves and for capped dead head shut off only. Piping adjacent to lug type shall be flange removable while valve is in use.

   2. Lug, wafer or Grooved-end type at all other locations

J. Control valves

   1. See Section 25 00 00 Building Automation System for valve specifications.

   2. Install so that actuators, wiring, and tubing connections are accessible for maintenance. Where the actuator top and position indicator are below 5 feet above the floor, install with valve stem axis vertical with actuator side up. Otherwise, valves shall be installed with stem horizontal so that the position indicator is visible from the floor. Do not install valves with stem below horizontal or down.

K. Provide blow-down ball valves and hose adaptors at strainers, air separators, tanks, pipe traps, equipment drains, etc. of same size as strainer blow-off connection.

L. Provide drain valves at main shut-off valves, low points of piping and apparatus.

M. Locate wheel handles to clear obstructions with hand.

N. Install valves only in accessible locations.

O. Wherever possible, install valves accessible from floor level. Provide guided chain operators on valves over 8 feet above floor in equipment areas. Extend chains to within 6 feet 6 inches of floor.

P. Locate equipment shut-off valves to be accessible without climbing over equipment.

Q. Provide operating handles for all valves and cocks without integral operators, unless otherwise noted. Provide adequate clearance for easy operation.

R. Provide discharge pipe to atmosphere from all relief and safety valves, sized with area equal to sum of outlet areas of all valves connected thereto, unless indicated larger. Extend to over code compliant drain receptacle with air gap.

S. Provide open-ended line valves with plugs or blind flanges.

3.02 AIR VENTS

A. Manual air vents

1. Locate

a. As shown on drawings

b. At all high points in closed piping systems

c. At equipment with vents, such as coils

2. 1/4 inch copper tube discharged into nearest drain or with 180 degree bend to discharge into portable container

3. Extend tubing or piping as required to make valve accessible

B. Automatic air vents

1. Locate as shown on drawings and at all air separators.

2. Provide manual cock at inlet to automatic air vents. Except for vent on air separators, shut valve after system is free of air (to prevent leaks from failed floats).

3. 1/4 inch copper tube discharged into nearest drain

3.03 FIELD QUALITY CONTROL

A. Test operate valves from closed-to-open-to-closed position while valve is under test pressure.

B. Test automatic valves including solenoid valves, expansion valves, water regulating valves, pressure reducing valves, pressure relief valves, safety valves and temperature and pressure relief valves for proper operation at settings indicated.

C. Insure that valves are field checked for packing and lubricant and that disc is for service intended. Replace leaking packing at no additional cost to the Owner. Service valves which do not operate smoothly and properly with suitable lubricant before placing in operation at no additional cost to the Owner.

3.04 INSPECTION & COMPLETION

A. Verify that adequate clearance between valves and adjacent walls or equipment is available to permit maintenance and repairs.

B. Verify valve set for normal operation.

C. Valves tags: See Section 23 05 53 Mechanical Identification.

D. See Section 23 08 00 Mechanical Commissioning.

E. See Section 23 05 93 Testing, Adjusting and Balancing.

END OF SECTION

SPECIFICATION 23 05 29
HANGERS AND SUPPORTS

PART 1 GENERAL

1.01 SUMMARY

A. Work included in this section: materials, equipment, fabrication, installation and tests in conformity with applicable codes and authorities having jurisdiction for the following:

1. Pipe and duct hangers, supports and associated anchors

2. Thermal hanger shields for insulated piping

1.02 REFERENCE STANDARDS

A. American Society of Mechanical Engineers: ASME Section VIII – Boiler and Pressure Vessel Code – Pressure Vessels

B. Pipe Supports: ANSI B31.9, Facility Services Piping

C. Duct Hangers: SMACNA Duct Manuals

1.03 SUBMITTALS

A. See Section 23 05 01 Basic Mechanical Materials and Methods.

B. Submit product data, O&M data, and samples and show item on shop drawings (where shop drawings are required) according to the following table.

1. “R” means required.

2. “R2” means required only for products and equipment differing for the specified manufacturer and model and for “or equals” where specified.

Item	Product Data	O&M Manual	Samples	Shop Drawing
Pipe hangers and supports	R2			R
Structural attachments	R2			R
Pipe protection and thermal hanger shields	R2			
Expansion shields	R2			

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Named manufacturer model numbers used as example of item and establish minimum level of quality and minimum standard options. Equivalent models of listed manufacturers are acceptable.

B. Hangers, Inserts and Supports

1. Midland-Ross Corp.: Superstrut

2. Elcen Metal Products Company
3. Fee and Mason
4. ITT Grinnell Corporation
5. Kin-Line, Inc.
6. Unistrut
7. Superstrut
8. B-Line
9. Tolco
10. Mason Industries
11. Or equal

C. Pipe Protection and Thermal Hanger Shields

1. Pipe Shields, Inc.
2. Elcen Metal Products Company
3. Midland-Ross Corp.: Superstrut
4. Uni-Grip
5. Kin Line
6. Or equal

D. Expansion Shields

1. ITT Phillips Drill Co.: Red Head
2. Hilti Fastening Systems
3. Omark Industries, Inc.
4. Ramset Fastening Systems
5. Or equal

2.02 PIPE HANGERS AND SUPPORTS

A. Model numbers are Superstrut, unless otherwise indicated. Equal products from all other manufacturers are acceptable.

B. Provide electro-chromate, galvanized or factory painted finish; no plain "black" hangers allowed

C. Dielectric Isolators: All uninsulated copper tubing systems; Superstrut isolators or equal, Cush-A-Strip or Cush-A-Clamp on all pipe clamps; for individual hangers, use felt lined hangers

D. Individual Pipe Hangers

1. Cold pipe all sizes: Clevis hanger, No. C710

2. Hot pipe sizes up to 4 in: Clevis hanger, No. C710

3. Hot pipe sizes above 6 in: Adjustable steel yoke and cast iron roll No. C729

E. Multiple or Trapeze Hangers

1. Factory channel

a. 12 gauge thick steel

b. Single or double section

c. Electro-chromate finish

d. Strutnuts: Series A-100 or CM-100

e. Straps: Series 702

f. Other accessories

g. No. A-1200 or A-1202

2. Hot pipe sizes 6 in and larger: cast iron roll and stand; C728 or CR728

F. Wall Supports

1. Pipe sizes up to 3 in: Steel bracket No. C738

2. Pipe sizes 4 in and larger: Welded steel bracket C-735

3. Hot pipe sizes 6 inches and larger

a. Welded steel bracket No. C739

b. Adjustable steel yoke and cast iron roller No. C729

G. Vertical Support

1. General: Riser clamp Series C-720

2. Chilled water: Either of the following:

a. Hydra-Zorb (copper) or Pipe Shield (steel)

b. Series C-720 wrapped with insulating tape.

H. Floor Support

1. Hot pipe sizes up to 4 in; cold pipe, all sizes
    a. Adjustable cast iron saddle No. R786
    b. Locknut nipple
    c. Floor flange
2. Hot pipe sizes 6 in and larger: Adjustable cast iron roll and stand No. R-730-C

I. Thermal Hanger Shields

1. High Density Insert
    a. See Section 230700 Mechanical Insulation
    b. Same thickness as adjoining pipe insulation
2. Galvanized Sheet Metal Shield
    a. Shield length and gauges

Pipe Size	Shield Length	Minimum Gauge
1/2-1 1/2	4	26
2 - 6	6	20
8 - 10	9	16

3. Insert to extend one inch beyond metal shield ends on chilled water piping
4. Use double layer shield on bearing surface for
    a. Roller hangers
    b. Support spacing exceeding 10 feet
5. Pipe Shields Incorporated or equal

J. Pipe Isolators

1. Hanger with minimum ¼ inch felt padding
2. Tolco Fig. 3F felt lined hangers or equal

K. Insulated Pipe Supports

1. Pipe supported on rod hangers - use Models A1000, A2000, A3000, 4000 and A9000
2. Pipe supported on flat surfaces - use Models A1000, A2000, A5000, A6000, A7000, A7200 and A7400 Series
3. Pipe supported on pipe rolls - use Models A3000, A4000, A5000, A6000, A8000, A8200 and A8400 Series
4. Model designations are Pipe Shields, Inc. or equal; use only models designed for service for which supports are to be used

L. Anchors and Guides: Provide anchors and guides where indicated on the Drawings and as required. Structural inserts shall be high density calcium silicate compressive strength 600 pounds per square inch. Guide slide pads shall be Teflon. Ensure that slide accommodates pipe movement over full range of service and out-of-service temperatures. Guides shall be Pipe Shields, Inc. Model #B3000 or equal. Anchors shall be Pipe Shields, Inc. Model #C4000 or equal. See Section 230700 Mechanical Insulation.

M. Insulated Pipe Strap

1. 1/2 in to 1 in plumbing piping in wood frame construction

2. Felt insulated

3. Nailable pipe straps; In lieu of other hangers and dielectric isolators

4. Kopty or equal

N. Escutcheons: See Section 232114 Piping Specialties

O. Flashing and Sleeves

1. Flashings

a. See Division 7 Thermal and Moisture Protection

b. Flash and counter flash watertight all pipe and duct penetrations of roofs and exterior walls

c. Flash pipes through roofs with ITWBuildex Dektite

d. Flash vents through roofs with

1) Minimum 24 gage soldered roof jack for flat surface roofs

2) Minimum 4 pound lead soldered roof jack for roofs other than flat surface roofs

3) Vandal caps

4) Provide counter-flashing sleeves and storm collars

5) Caulk counter-flashing and storm collar weather tight

6) Other flashings shall be minimum 24-gage galvanized sheet metal

2. Sleeves

a. Through exterior concrete walls below grade, floor slabs on grade, and through concrete tank walls

1) Schedule 40, galvanized steel pipe sleeves

2) Seal annular space between pipe and sleeve water tight with one of the following

a) Thunderline Link-Seals

b) Calpico Pipe Linx

c) Or equal

b. Other concrete walls, floors and roofs

1) Adjustable telescopic metal sleeves

2) Tightly pack annular space between pipe and sleeve with fiberglass. Seal both sides with mastic

c. For insulated piping, sleeve diameter shall not be less than diameter of insulation.

d. Terminate sleeves flush with walls, and ceiling.

e. For flood prevention on vertical pipe, extend sleeves 1 inch above finished floor or use W-rated waterproof fire barrier packing.

f. Firestopping at penetrations of fire rated floors and partitions. See Section 232113 HVAC Piping.

3. Separate piping through walls, other than concrete walls, from contact with wall construction materials; use non-hardening caulking.

4. Install insulation on piping in walls which require insulation at time of installation.

2.03 DUCT HANGERS AND SUPPORTS

A. See Section 23 31 00 Ducts

2.04 STRUCTURAL ATTACHMENTS

A. Model Numbers are Superstrut, unless otherwise indicated

B. Anchor Bolts: Size as specified for hanger rods

C. Concrete Inserts

1. Malleable iron

2. Place reinforcing steel through insert as recommended by manufacturer for recommended loads

3. No. 452 or equal

D. Beam Clamps

1. All with U-568 safety strap

2. All with locknuts on

a. Set Screw

b. Hanger rod

3. Bottom flange attachment

a. Loading 150 pound and less: U-563

b. Loading 150 pound to 300 pound: U-562

c. Loading more than 300 pound: U-560

4. Top flange attachment

a. Permitted only when bottom flange attachment cannot be used

b. Loading 400 pound and less: M-777

c. Loading more than 400 pound: M-778

E. Welded Beam Attachments

1. No. C-780 or equal

F. Side Beam Brackets

1. No. 542 or equal

G. Hanger Rods

1. ASTM A575 Hot rolled steel

2. ANSI B1.1 Unified Inch Screw Treads

3. Threaded both ends, threaded one end, or continuous threaded

H. Hanger Rod Fixtures

1. Turnbuckles: No. F-112 or equal

2. Linked Eye Rod

a. Rod swivel

b. No. E-131 or equal

3. Clevis: No. F-111 or equal

I. Powder or Gas Actuated Anchors

1. Hardened steel stud with threaded shank; size of shank to match hanger rod size

2. Use only with non-shock loads

3. Maximum load safety factors:

a. Maximum anchor load: 100 pounds

b. Static loads - 5

c. Vibratory loads - 8-10

4. For concrete and steel; not to be used for light weight concrete, brick or concrete block

5. 10% testing rate required, testing by contractor
6. Omark Drivit or equal

J. Expansion Shields

1. Carbon-steel anchors, zinc coated
2. Stainless steel for corrosive atmospheres
3. For normal concrete use
   a. Self-drilling anchor
   b. Sleeve anchor
   c. Stud anchor
4. For thin concrete use: wedge anchor
5. For brick or concrete block use: sleeve anchor
6. Maximum load safety factors
   a. Static loads - 4
   b. Vibratory loads - 8 - 10
   c. Shock loads - 8 - 10
7. Size to suit hanger rods
8. ITT Phillips Red Head or equal

K. Steel Deck Inserts

1. Factory stud with
   a. Clip
   b. Spring
   c. Coupling
2. ITT Phillips Red-Head or equal

L. Rooftop Supports

1. UV resistant and suitable for installation on any type of roofing material or other flat surfaces
2. DURA-BLOK DB-Series channel support or equal

M. Miscellaneous Metal

1. Steel plate, shapes and bars: ASTM A36

2. Steel pipe columns: ASTM A53, Schedule 40, black

3. Bolts and nuts: regular hexagon-head type, ASTM A307, Grade A

4. Lag bolts: square head type, Fed. Spec. FF-B-561

5. Plain washers: round, carbon steel, Fed. Spec. FF-W.92

PART 3 EXECUTION

3.01 PIPE HANGERS, SUPPORTS AND GUIDES

A. General

1. Assure adequate support for pipe and contents

2. Provide adjustable hangers for all pipes complete with inserts, adjusters, bolts, nuts, swivels, all-thread rods, etc., except where specified otherwise

3. Arrange for grouping of parallel runs of horizontal piping to be supported together on trapeze type hangers where possible. Where piping of various sizes is to be supported together by trapeze hangers, space hangers for smallest pipe size or install intermediate supports for smaller diameter pipe. Do not use wire or perforated metal to support piping and do not support piping from other piping.

4. Except as otherwise indicated for exposed continuous pipe runs, install hangers and supports of same type and style as installed for adjacent similar piping

5. Install all cast iron piping in accordance with Cast Iron Soil Pipe Industry (CISPI) Standards

6. Support all piping within 2 feet of each change of direction on both sides of fitting

7. Thermal hanger shields shall be provided at hangers and supports where piping is insulated

8. Prevent vibration or swaying

9. Provide for expansion and contraction

10. Supports of wire, rope, wood, chain, strap perforated bar or any other makeshift device not permitted

11. Comply with applicable requirements at ANSI B31.1 and B31.2 for piping

12. Support piping independently so that equipment is not stressed by piping weight of expansion

13. See Section 23 05 48 Vibration and Seismic Control for mechanical sound, vibration, and seismic control

14. See Section 23 05 48 Vibration and Seismic Control for hangers, guides, anchors and supports requiring vibration isolation units

15. Hangers and supports shall have minimum safety factor of five (5), based on ultimate tensile or compressive strength, as applicable, of material used; base calculations on equipment's heaviest operating weight and pipes full of water

16. Install additional supports or braces if, during normal operation, piping should sway, crawl or vibrate. Piping shall be immobile

17. Install thrust blocks as required to prevent sway

B. Horizontal piping, except as noted

1. Adjustable clevis type and rod; all services at or below 250 degrees F

2. Rollers or slide bases: not required

3. Trapeze hangers; guide individual pipes on trapezes with 1/4 inch U-bolt or Superstrut 702 pipe clamp

a. Install thermal hanger shield at each support point

4. Galvanized sheet metal shields between hangers and PVC piping

5. Threaded steel rods

a. 2 in vertical adjustment with 2 nuts each end for positioning and locking

b. Size to 8 in inside pipe size (IPS)

Pipe, IPS	Rod
to 2 inch	3/8 inch
2-1/2 inch and 3 inch	1/2 inch
4 inch	5/8 inch
6 inch and 8 inch	3/4 inch

c. For double rod hangers: 1 size smaller than above

C. Vertical piping

1. Base support

a. Base elbow or welded equivalent

b. Bearing plate on structural support

2. Guides

a. At every third floor but not to exceed

1) 25 feet for piping to 2 inch

2) 36 feet for piping 2-1/2 inch to 12 inch

3) 50 feet for piping 14 inch and larger

b. Or as otherwise designed by the Vibration Isolation vendor; coordinate with Section 23 05 48 Vibration and Seismic Control

3. Top support

a. Special hanger or saddle in horizontal connection

b. Provisions for expansion

4. Intermediate supports: steel pipe clamp at floor

a. Bolted and welded to pipe

b. Extension ends bearing on structural steel or bearing plates

5. For multiple pipes: coordinate guides, bearing plates and accessory steel

D. Horizontal insulated piping

1. Install saddles for rollers or slide bases

2. Install thermal hanger shields for all other types of supports

3. See Section 23 07 00 Mechanical Insulation for insulation connection to shields

E. Vertical insulated piping

1. Install thermal hanger shields at guides

2. Use insulated riser clamps at rigid connections.

3. See Section 23 07 00 Mechanical Insulation for insulation connection to shields

F. Install Pipe Isolators between hangers and piping for all uninsulated copper tubing.

G. Spring Supports for Piping

1. See Section 23 05 48 Vibration and Seismic Control

H. Miscellaneous Steel

1. Provide miscellaneous steel members, beams, brackets, etc., for support of work in this division unless specifically included in other divisions

I. Fire-stopping

1. At pipe penetrations through rated assemblies

2. Commercial pipe sleeve assemblies that are UL listed and that have been approved by the fire marshal for this purpose.

3.02 PIPE SUPPORT SPACING

A. Maximum spacing for horizontal piping

Type of Pipe	Size	Maximum Spacing
Steel	1-1/2 inch and smaller	7 feet
	2 inch and larger	10 feet
Copper	3/4 inch and smaller	5 feet
	1- 1-1/2 inch	6 feet
	2 - 3 inch	8 feet
	4 inch and larger	10 feet
Plastic	3/4 inch and smaller	3 feet

B. Spacing Notes: Additional supports at

1. Changes in direction
2. Branch piping and runouts over 5 feet
3. Concentrated loads due to valves, strainers and other similar items
4. At valves 4 inch and larger in horizontal piping, support piping on each side of valve

C. Parallel piping on trapezes

1. Maximum spacing to be that of pipe requiring closest spacing

3.03 ATTACHMENT TO STRUCTURE

A. Concrete

1. Use inserts for suspending hangers from reinforced concrete slabs, walls and sides of reinforced concrete beams wherever practicable
2. Set inserts in position in advance of concrete work
3. Provide reinforcement rod in concrete for inserts carrying
    a. Pipe over 4 inch
    b. Ducts over 60 inches wide
4. Where concrete slabs form finished ceiling, finish inserts flush with slab surface
5. Where inserts are omitted, install hangers with expansion shields
6. Through-deck support
    a. Drill through concrete slab from below
    b. Provide rod with recessed square steel plate and nut above slab
7. Powder actuated anchors or expansion shields may be used in lieu of inserts
    a. In bottom of thick slabs
    b. In thin slab construction, only in sides of beams
8. Pre-Cast Concrete

a. Use pre-set inserts

b. Where inserts are not available, field drill through beam or joists at locations as directed by Owner's Representative

c. Through bolt side beam bracket to beam or joist

9. Poured-In-Place Concrete

a. With metal form or underdeck

b. Before concrete is poured

1) Field drill hole through metal deck

2) Provide bearing plate, nut and locknut on rod; or install factory-made steel deck inserts specified hereinbefore

c. After concrete is poured

1) Install hangers with expansion shields

B. Steel Beam Anchors

1. Beam or channel clamps

2. Do not cut or weld to structural steel without permission of structural engineer

C. Steel Deck Anchors

1. Concrete filled: as specified above

2. Decking without concrete

a. Through rod Support

1) Weld to square plate, 1/4 in thick

2) Plate to distribute load over minimum of two full cells

3) Coordinate with floor layouts to clear cells with wiring

D. Side Wall Supports

1. Concrete walls

a. As specified for hangers

2. Stud Walls

a. Toggle bolts

b. Studs welded to structural studs

E. Support Spreaders

1. Install spreaders spanning between structural members when hangers fall between them, and hanger load is too great for slab or deck attachment

2. Spreaders may be one of methods listed below, or combination of both as required

    a. Fabricated from structural channel

        1) End fittings bolted or welded

        2) Secure to structural members

            a) As required by construction

            b) As reviewed by Structural Engineer

    b. Formed channels with fittings, Superstrut or equal

        1) Submit manufacturer's calculations for installation

3.04 DUCT HANGERS AND SUPPORTS

A. See Section 23 31 00 Ducts

END OF SECTION

SPECIFICATION 23 05 48
VIBRATION AND SEISMIC CONTROL

PART 1 GENERAL

1.01 SUMMARY

A. Work Included in This Section: Materials, equipment, fabrication, installation and tests in conformity with applicable codes and authorities having jurisdiction for the following:

1. Vibration isolators for equipment
2. Vibration isolators for piping systems
3. Equipment bases
4. Inertia bases
5. Seismic control for equipment on isolators
6. Seismic bracing and restraints for piping and ductwork
7. Seismic bracing and restraints for rigidly mounted equipment

1.02 REFERENCE STANDARDS

A. ASHRAE – American Society of Heating, Refrigerating and Air Conditioning Engineers

B. NEMA – National Electrical Manufacturer's Association

C. Underwriters' Laboratories, Inc.: UL 778 – Motor Operated Water Pumps

D. American Society of Mechanical Engineers: ASME Section VIII – Boiler and Pressure Vessel Code – Pressure Vessels

E. Published specifications standards, tests or recommended methods of trade, industry or governmental organizations apply to work in this section where cited below

1. Mason Industries “Seismic Restraint Guidelines for Suspended Piping, Ductwork, and Electrical Systems”
2. SMACNA and PPIC “Guidelines for Seismic Restraints of Mechanical Systems and Plumbing Piping Systems”.

F. Publication references below are basic industry standards; however, regulatory requirements may reference, modify or supersede:

1. American Institute of Steel Construction (AISC) publications
    a. Specification for the Design, Fabrication and Erection of Structural Steel Buildings (Eighth Edition)

2. American National Standards Institute (ANSI) Standard

    a. B027.2-965 – Plain Washers

3. American Society for Testing and Materials (ASTM) Specifications

    a. A 6 – General Requirements for Delivery and Rolled Steel Plates, Shapes, Sheet Piling, and Bars for Structural Use

    b. A 36 – Structural Steel

    c. A 53 – Welded and Seamless Steel Pipe

    d. B633 – Electrodeposited Coatings of Zinc on Steel

    e. A 307 – Carbon Steel Externally and Internally Threaded Standard Fasteners

    f. A 500 – Cold-Formed Welded and Seamless Carbon Steel Structural Tubing

    g. A1011 – Hot Rolled Carbon Steel Sheet and Strip

4. American Welding Society (AWS) Publication

    a. D 1.1 – Structural Welding Code

1.03 QUALITY ASSURANCE

A. Qualifications

1. Manufacturer

    a. All equipment and accessories to be the product of a manufacturer regularly engaged in its manufacture for not less than five years

B. Manufacturer or manufacturer's representative of vibration isolation equipment shall have the following responsibilities

1. Determine vibration isolator sizes and locations

2. Provide piping and equipment isolation systems as scheduled or specified

3. Guarantee specified isolation system static deflection under installed actual load.

4. Provide installation instructions, drawings and field supervision to assure proper installation, adjustment and performance

C. The installation of all vibration isolation units and associated hangers and bases shall be as directed by the vibration isolation manufacturer's representative.

D. It is the objective of this Specification to provide the necessary design for the control of excessive noise and vibration in the building due to the operation of machinery or equipment, and due to interconnected piping, ductwork or conduit

1. All vibration isolators shall have either known undeflected heights or calibration markings so that, after adjustment, when carrying their load, the deflection under load can be

verified, thus determining that the load is within the proper range of the device and that the correct degree of vibration isolation is being provided according to the design.

2. All isolators shall operate in the linear portion of their load versus deflection curve. Load versus deflection curves shall be furnished by the manufacturer and must be linear over a deflection range of not less than 50 percent greater than the design deflection.

3. The theoretical vertical natural frequency for each support point, based upon load per isolator and isolator stiffness, shall not differ from the design objectives for the equipment as a whole by more than ±10 percent.

4. All neoprene mountings shall have a Shore hardness of 30 to 50 ±5, after minimum aging of 20 days or corresponding oven-aging.

E. Acoustical Testing

1. The contractor shall cooperate with regard to sound tests (ARI 575, ANSI S1.13) which may be conducted by the Owner's Representative to verify that noise criteria are met.

2. The contractor shall notify the Owner's Representative of any changes which will affect the acoustical performance.

F. Seismic load calculations for piping, ductwork and equipment

1. Fp, the total design lateral seismic force, shall be calculated by a licensed structural engineer, unless it is explicitly stated in the plans or specifications. This engineer shall be hired by the contractor responsible for this Section of work.

2. Shall meet California Building Code requirements

3. Calculations required for supports and bracing for situations not covered by referenced Guidelines.

a. Hired by contractor under this Section or work

b. Cost of calculations borne by contractor under this Section

4. Calculations made and signed by registered civil or structural engineer knowledgeable in seismic design

5. Include horizontal and vertical reaction loads at connections to building structures for all seismic restraints, including those covered by referenced Standards

a. Coordinate reaction loads and attachment details with structural engineer for building

1.04 SUBMITTALS

A. See Section 23 05 01 Basic Mechanical Materials and Methods.

B. Submit product data, O&M data, and samples and show item on shop drawings (where shop drawings are required) according to the following table.

1. "R" means required.

2. "R2" means required only for products and equipment differing for the specified manufacturer and model and for "or equals" where specified.

Item	Product Data	O&M Manual	Samples	Shop Drawing
Vibration isolation devices: catalog cuts, static deflections, quantity, load per isolator, mounting details, seismic restraints, mounting details, etc.	R	R		
Concrete and steel details for equipment pads.				R
Welds or anchor bolt locations.				R
Reinforcing and template steel locations and details				R
Seismic calculations for each seismic restraint sized and signed by registered structural or civil engineer.	R	R		
Inertia and equipment bases	R	R		R
Anchors, inserts and fasteners and fastening details	R2	R2		R
Seismic restraints	R2	R2		R
Seismic bracing and restraint mounting details	R	R		
Flexible pipe connectors	R	R		R
Flexible duct connectors	R2	R2		R

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Named manufacturer model numbers used as example of item and establish minimum level of quality and minimum standard options. Equivalent models of listed manufacturers are acceptable.

B. Vibration Isolation

1. Mason Industries, Inc.

2. Kinetics Noise Control, Inc.

3. M.L. Saussé & Co. (Vibrex)

4. Amber-Booth

5. Or equal.

C. Flexible Duct Connections

1. Ventfabrics

2. Duro Dyne

3. Or equal

D. Seismic Restraints

1. Hangers and snubbers: Any manufacturer who can verify compliance with SMACNA standards and the California Building Code

2. Strut - Channel Framing: Any manufacturer who can verify compliance with SMACNA standards and the California Building Code

3. Anchors - Drill in, wedge type: Any manufacturer who can verify compliance with the California Building Code

4. Snubbers: Any manufacturer who can verify compliance with the California Building Code

2.02 VIBRATION ISOLATOR TYPES

A. Spring type

1. Spring isolators shall incorporate following

a. All springs to be single coil steel with minimum spring coil outer diameter 0.8 of loaded operating height

b. Horizontal spring stiffness within 0.8 to 1.25 times rated vertical spring stiffness

c. Corrosion resistance

1) Where exposed to corrosive environment including but not limited to:

a) Outdoors

b) Exposed to outdoor air within 5 feet of outdoor air intake

2) Springs neoprene coated

3) Hardware cadmium plated

d. Reserve deflection (from loaded to solid height) of 50 percent of rated deflection

e. Designed and installed so that ends of springs remain parallel; neoprene cups not acceptable

f. Noise pads of ½ inch or 1 inch thickness below the spring base or within the frame to reduce the chance that the springs shall be resonant with equipment forcing frequencies or support structure natural frequencies. For seismic isolators, the pad shall be within the frame. See Table in Paragraph 3.04A.8 for applicability and thickness.

g. Leveling device

h. Where operating weight differs from installed weight provide built-in adjustable limit stops to prevent equipment rising when weight is removed. Stops shall not be in contact during normal operation.

2. Type "A": Similar to Mason Type SLF

3. Type "B": same as Type "A" except

a. Provide built-in resilient vertical limit stops

b. Tapped holes in top plate for bolting to equipment

c. Capable of supporting equipment at fixed elevation during equipment erection

d. Mason Type SLRSO or equal for 1 inch and 2 inch deflection, Type SLR Series 100 for 3 inch to 5 inch deflection

4. Type "C": spring hanger rod isolators shall incorporate the following

a. Spring element seated on steel washer within neoprene cup

b. Steel retainer box encasing spring and neoprene cup

c. Minimum 1/2 inch clearance between retainer box and spring hanger rod

d. Minimum 15 degrees angular clearance between rod and retainer box

e. Double deflection LDS element

f. Mason RW30N or equal

B. Elastomer mounting types

1. Type "D": Double deflecting type incorporating following

a. Bolt holes for bolting to equipment base

b. Bottom steel plates for bolting to sub-base as required

c. Unit type design molded in black oil-resistant neoprene

d. Neoprene compounded to meet following:

1) Not greater than 50 durometer

2) Minimum tensile strength 2000 pounds per square inch

3) Minimum elongation 300 percent

4) Maximum compression set of 25 percent of the original deflection

e. Mason Type ND or equal (where seismic restraint not required by CBC)

f. Mason Type BR or equal (where seismic restraint required by CBC)

2. Type "E": Elastomer hanger rod isolators shall incorporate following

a. Molded unit type neoprene element

b. Compounding described in Type "D" above

c. Steel retainer box encasing neoprene mounting.

d. Minimum 1/2 inch box

e. Mason Type HD or equal

3. Type "F": Pad type elastomer mountings to incorporate following

a. 5/16 to 3/8 inch minimum thickness per layer

b. 50 psi maximum loading

c. Ribbed or waffled design

d. 1/16 inch galvanized steel plate between multiple layers of pad thickness

e. 1/16 inch deflection per pad thickness

f. Suitable bearing plate to distribute load

g. Bolts through equipment and pad shall be oversized and provided with resilient washers, bushings and lock nuts

h. Mason Type Super W Series or equal

4. Type "G": Pad type elastomer mountings to incorporate following

a. High quality bridge bearing neoprene

b. Maximum loading 800 psi

c. Suitable bearing plate to distribute load

d. Minimum thickness 2 inch

e. Mason Type BBP or equal

5. Type "H": Combination spring/elastomer hanger rod isolators to incorporate following

a. Spring and neoprene isolator elements in steel box retainer

b. Characteristics of spring and neoprene as described in Type "C" and Type "E" hanger isolators

c. Factory preloading to 75 percent of rated load

d. Mason PC30N or equal

C. Seismic Snubbers

1. Type SS: All-directional seismic snubber

2. Neoprene bushing to be bridge bearing quality

3. Male portion to be smooth round bar; threaded bolts not acceptable

4. Mason Z-1225 or equal

2.03 EQUIPMENT BASES

A. Integral structural steel bases, Type "B-1"

1. Reinforced as required to prevent base flexure at start-up and misalignment of drive and driven units

2. Fan bases complete with motor slide rails

3. Drilled for drive and driven unit mounting template

4. Mason Type WFSL/WFND or equal

B. Concrete inertia base, Type "B-2"

1. Formed in structural steel frame

2. Structural base reinforced as required to prevent flexure, misalignment of drive and driven unit or stress transferal into equipment

3. Minimum thickness of the inertia base shall be 6 inches or greater if required to meet weight ratio specified below

4. Fan bases complete with motor slide rails

5. Pump bases shall be large enough to support suction and discharge elbows and suction diffusers

6. Bases complete with

a. Height saving brackets

b. Reinforcing

c. Equipment bolting provisions

d. Isolators provided by vibration control supplier, type as scheduled

7. Base ready for concrete pour

8. Inertia Base Weights

a. Centrifugal Fans, except as noted: Minimum 1.0 times weight of fan, motor and drive

b. Air handling Units, except as noted: Minimum 1.0 times weight of fan and coil cabinet, coils, fan, motor and drive

c. Pumps: Minimum 1.5 times weight of pump, motor and base

1) Base to be sized to support suction diffuser when used

9. Mason Type KSL/BMK or equal

C. Seismic restraint, Type I

1. All directional type

2. Steel and elastomeric

3. Mason Type Z-1225 or equal

D. Seismic restraint, Type II

1. Criteria

a. Designed for seismic force criteria specified in Part 3

b. Submit application details for approval

2.04 ANCHORS, INSERTS AND FASTENERS

A. All anchors and inserts shall be installed according to the California Building Code.

B. Do not use any anchor or insert in concrete which does not have a signed structurally engineered design value based on its installed application and one of the following

1. California Building Code evaluation report

2. Lab test report verifying compliance

C. Do not use powder driven and power driven (Shoot-In) fasteners, expansion nails or friction spring clips.

D. All over-head concrete anchors or inserts shall be selected to comply with the California Building Code table for the anchor or insert.

E. Torque testing of anchors shall be allowed to verify compliance of anchor installation. However, torque testing shall not justify usability of anchor. Only load or pull testing shall be allowed to justify usability of anchors. Failure of torque shall constitute failure of anchor.

F. Bolts and nuts

1. Bolts and heavy hexagon nuts: ANSI B18.2.1 and ASTM A307 or A576

2. Bolts, underground: ASTM A325

3. Expansion anchors: Federal Specification A-A-1922

2.05 SEISMIC RESTRAINTS

A. General

1. Capable of safely accepting indicated external forces without failure

2. Maintain equipment, piping and ducts in a captive position

B. Criteria: Design for seismic forces specified herein

C. Bracing system: Provide one of the following methods as most applicable for each brace

1. Material used, except for pipes, shall be structural steel with ASTM A36. Steel pipes shall conform to ASTM A501

2. Complete system of factory fabricated components

3. Complete system of job fabricated components

4. Miscellaneous metal structural shapes

2.06 FLEXIBLE PIPE CONNECTORS

A. Flexible Piping Couplings for Vibration Isolation

1. Flexible mechanical joints

2. Victaulic Style 077/177 or equal

B. Twin Sphere Connections for Vibration Isolation

1. Molded twin-sphere type connectors made of peroxide cured EPDM and Kevlar tire cord reinforcement and reinforcing ring

2. Connectors up to 2 inch diameter may have threaded ends

3. Connectors 2-1/2 inch diameter and larger to have floating steel flanges recessed to lock the connector's neoprene flanges

4. Connectors rated a minimum of 150 pounds per square inch at 220 degrees Fahrenheit without control rods or cables; connectors that require control rods are not acceptable.

5. Mason SAFEFLEX Type SFDEJ (no equal)

C. Hose Connections for Vibration Isolation

1. Stainless steel braid over an EPDM liner

2. Rated for -40 to 230°F and a minimum working pressure of 300 psig

3. Minimum length required to provide one ninety degree turn

4. 304 stainless steel hose and braid

5. 125 psi rated

6. Connectors up to 2 inch diameter may have threaded ends

7. Connectors 2 inch and larger shall have free floating flange or grooved connection

8. Mason SS 60º Vee

2.07 FLEXIBLE DUCT CONNECTORS

A. General

1. Conform to NFPA 701 and NFPA 90A

2. Flame spread rating: 25

3. Smoke development rating: 50

4. Airtight and waterproof to plus or minus 10 inches

B. Construction

1. Metal collar at each end

a. Galvanized steel G60

b. Minimum thickness: No. 24 USSG

c. Minimum length: 3”

d. Double lock joint

2. Length of fabric

a. Minimum: 4 inch

b. Maximum: 10 inch

3. Materials

a. Coated glass fabric

b. Sewed and cemented seams

c. Indoors

1) Neoprene or woven nylon/polyester blend with vinyl coating

2) 22 oz. per square yard minimum

3) Ventfabrics, Inc. Ventglas or equal

d. Outdoors

1) Woven fiberglass with Hypalon coating

2) Weather-resistant

3) UV, sunlight, and ozone resistant

4) 26 oz. per square yard minimum

5) Ventfabrics, Inc. Ventlon or equal

PART 3 EXECUTION

3.01 INSTALLATION

A. Install isolators and seismic restraints in accordance with manufacturer's written instructions

B. Vibration isolators must not cause any change of position of equipment or piping resulting in piping stresses or misalignment

C. Make no rigid connections between equipment and building structure that degrade noise and vibration isolation system herein specified

1. Electrical conduit connections to isolated equipment shall be flexible liquid tight conduit of sufficient length to incorporate a right angle bend, an offset of not less than 8 inches or a loop to allow free motion of isolated equipment

2. The HVAC Sub-contractor shall not install any equipment, piping or conduit which makes rigid contact with the building unless permitted in this Specification; building includes, but is not limited to, slabs, beams, columns, studs and walls

3. Coordinate work with other trades to avoid rigid contact with the building. Inform other trades following work, such as plastering or electrical, to avoid any contact which would reduce the vibration isolation

D. Do not use isolator leveling bolts as jacking screws

E. Verify that all installed isolators and mounting systems permit equipment motion in all directions

3.02 SEISMIC CONTROL

A. General

1. Install seismic restraints for pipes, ducts and equipment per applicable code

2. Design and provide restraints to prevent permanent displacement in any direction caused by lateral motion, overturning or uplift

a. Prepare designs and include on shop drawings, including arrangements, sizes and model numbers indicated or referenced in applicable standards. Each shop drawing shall bear a Structural or Civil Engineer's stamp and signature registered in the State of California.

b. Where designs, etc., are neither indicated nor referenced, contractor shall submit such designs, together with supporting calculations prepared by Structural or Civil Engineer registered in State of California. Calculations shall substantiate seismic restraint capability to safely accept external forces without failure and maintain equipment in position.

c. Capable of safely accepting external forces per CBC without failure.

3. Provide resilient restraining devices as required to prevent equipment motion in excess of 1/4 inch

4. Coordinate seismic bracing requirements with other sections to result in

a. Vertical pipe and duct restraints to coincide with and take place of required hangers

b. Longitudinal pipe bracing to coincide with required pipe anchors

5. Shall not short circuit vibration isolation systems or transmit objectionable vibration or noise

B. Attachments to Structure: See Section 230529 Hangers and Supports

3.03 FLOOR MOUNTED EQUIPMENT

A. Concrete housekeeping pads

1. Isolation and seismic restraint supplier to determine dimensions and thickness required

a. Minimum thickness: 5.5 inches

2. Support all vibration isolation devices and bases

3. Key with stirrups as required, integral with structural slab

4. Incorporate seismic restraint anchor plates flush with top of housekeeping pad

3.04 EQUIPMENT ISOLATION

A. General

1. Provide 1 inch operating clearance between equipment or structural bases and housekeeping pad

   a. 2 inch minimum clearance for inertia bases over 96 inches in any dimension

2. Position equipment, structural base and concrete bases on blocks or wedges at proper operating height

3. Provide operating load conditions prior to transferring base isolator loads to springs and removing wedges

4. Adjust or provide additional resilient restraints to flexibly limit start-up equipment lateral motion to 1/4 inch

5. Prior to start-up, clean out all foreign matter between bases and equipment

6. Verify that there are no isolation short circuits in the base, isolators or seismic restraints or conduit, pipe and duct connections

7. Position all corner or side seismic restraints with equipment in operation for proper operating clearance. Weld or bolt seismic restraints to seismic anchor plates in housekeeping pad

8. Locate spring hanger boxes directly adjacent to the structural support element above, as opposed to down at the location of the supported equipment.

9. Where isolator base pad is called for in Vibration Isolator Schedule, install pad between the isolator base and structure.

10. For isolator pads penetrated by anchors to the structure, to prevent short-circuiting, provide neoprene grommet between the anchor and isolator. Hand-tighten nut to so that grommet is not compressed then secure with lock nut.

B. Vibration Isolator Schedule

Equipment	**Base Type**	**Isolator Type**	**Isolator Static Deflection**	**Acoustical Base Pad Thickness**
Air to Water Heat Pumps	None	B	2 inch	1/2 inch
Floor-mounted pump	B-2	A	1.5 inch	1/2 inch

3.05 PIPING ISOLATION

A. See Section 23 21 13 HVAC Piping

B. See Section 23 05 29 Hangers and Supports for general support of piping including felt lined hangers for uninsulated piping.

C. Piping other than as shown on the Drawings at the secondary hot water pump, HWP-1

1. No vibration isolation required except at equipment, as noted

D. Equipment

1. Provide twin-sphere flexible couplings at pump. Install per manufacturer's instructions.

2. For air to water heat pumps provide minimum three flexible style mechanical couplings between the vibrating equipment and the first rigid support to the structure. This can be couplings that are part of elbows and other normally required fittings; it is not necessary to include couplings dedicated to this purpose.

a. Not required at:

1) Coils

2) VAV boxes including fan-powered VAV boxes

3.06 DUCTWORK ISOLATION

A. See Section 23 31 00 Ducts.

B. Ductwork

1. No vibration isolation required other than flexible connections at fans

C. Flexible Connections

1. Install at all connections to fans and air handling units and as indicated on Drawings

a. Not required at suspended direct drive fans <1/3 HP

b. Not required at fan-powered VAV boxes

c. Not required at internally isolated air handling units unless shown on drawings

2. 2 inch slack in fabric; install to allow minimum movement of 1 inch in both tension and compression

3. Outdoor Installations

a. Protect from direct solar and rain exposure with sheet metal shroud

b. Install shroud on top and both sides; not required on bottom

c. Shroud shall be fastened to fan and cantilevered over and extending a minimum of 2 inches beyond the flexible connection

3.07 WALL AND FLOOR PENETRATIONS

A. All piping and ductwork to be vibration isolated, and all piping and ductwork passing through acoustically rated partitions, shall freely pass through walls and floors without rigid contacts or connections. Penetration points shall be sleeved or otherwise formed to allow passage of piping or ductwork, and maintain 0.75 inches to 1.25 inches clearance around the pipe or duct outside surfaces. For installations through air plenum partitions and through acoustically

rated partitions, clearance space shall be tightly packed with fiberglass, and caulked airtight after installation of piping or ductwork. Caulk shall be Hilti CP 506 or equal.

B. For installation in rated walls, see Section 23 21 13 HVAC Piping and Section 23 31 00 Ducts

C. Provide sleeves and escutcheons as specified in Section 23 21 13 HVAC Piping and Section 23 31 00 Ducts.

3.08 SEISMIC BRACING INSTALLATION

A. Piping and Ductwork

1. Bracing system shall meet the seismic load requirements (See Section 1.03F)

2. Install all bracing and restraints per referenced Guidelines in Paragraph 1.02, where applicable

3. Where the referenced Guidelines in Paragraph 1.02 are not applicable then submit details of a proposed bracing system. The proposed system shall be stamped by a licensed civil or structural engineer and shall be submitted for approval prior to construction.

4. Coordinate seismic bracing and restraints so that required expansion provisions will not be restricted

5. Provide floor support and bracing of pipe connection risers to equipment

6. Where seismic bracing and restraints are not required refer to Section 23 05 29 Hangers and Supports

B. Flexibly Supported Piping and Ducts

1. Provide and locate restraints to allow normal operation of systems without transmitting vibrations to building structure

2. Location of Restraints: Per referenced Guidelines in Paragraph 1.02

3. Construction of Restraints: Steel cables, installed slack

C. Rigidly Mounted Equipment

1. Secure to floor as required to prevent horizontal motion and overturning

2. Secure to walls or other equipment to prevent overturning

a. Attach to elements capable of taking calculated loads

b. Provide steel backing in walls as required to brace equipment and piping from wall

3.09 FIELD QUALITY CONTROL

A. Inspection by manufacturer's representative of all vibration isolating devices

1. After installation of all devices

2. Provide written report by manufacturer regarding

a. Installation errors

b. Improper selection of devices

c. Other fault that could affect performance of system

B. Submit written report to Owner's Representative

1. Include manufacturer's report indicating required corrections

2. Include report on steps to properly complete isolation work

C. See Section 23 08 00 Mechanical Commissioning

END OF SECTION

SECTION 23 05 53
HVAC SYSTEM IDENTIFICATION

PART 1 GENERAL

1.01 SUMMARY

A. Identify piping and equipment components of the mechanical systems to indicate their function and system served

1.02 REFERENCE STANDARDS

A. Pipe marker shall comply with ANSI/ASME A13.1

1.03 SUBMITTALS

A. See Section 23 05 01 Basic Mechanical Materials and Methods.

B. Submit product data, O&M data, and samples and show item on shop drawings (where shop drawings are required) according to the following table.

1. "R" means required.

2. "R2" means required only for products and equipment differing for the specified manufacturer and model and for "or equals" where specified.

Item	Product Data	O&M Manual	Samples	Shop Drawing
Pipe markers	R2			
Equipment tags	R2			
Concealed equipment markers	R			

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Named manufacturer model numbers used as example of item and establish minimum level of quality and minimum standard options. Equivalent models of listed manufacturers are acceptable.

B. W.H. Brady

C. Seton

D. Marking Services, Inc. (MSI)

E. Or equal

2.02 DUCTWORK IDENTIFICATION

A. Not required

1. be in pressurized spray-can form.

2.03 PIPING IDENTIFICATION

A. Colors

Pipe Service	Background	Lettering
Chilled water supply	Blue	White
Chilled water return	Blue	White
Heating water supply	Yellow	Black
Heating water return	Yellow	Black

B. Label Content

1. Pipe service

2. Arrow indicating flow direction

C. Labels

1. Vinyl duct markers, self-adhesive

2. Able to withstand temperatures up to 160°F

3. Minimum letter size: per ANSI/ASME A13.1

4. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

D. Provide custom marker labels for all piping for which no standard manufactured marker is available. Submit sample for approval

E. Specialty Gases piping shall be identified with Brady B-60 fiber tags, or equal, with chemical symbol on tag

2.04 VALVE IDENTIFICATION

A. Valve Tags: Not required

2.05 EQUIPMENT IDENTIFICATION

A. Nameplates

1. Tag all scheduled and uniquely tagged mechanical equipment with engraved nameplates. Nameplates shall be 1/16-inch thick, 3 x 5 or 2 x 6 laminated 2-ply plastic, center ply white, outer ply black. Form letters by exposing center ply.

2. Identify unit with building number (if applicable), unit mark as shown on equipment schedules on Drawings, and service. For example: VAV-1-3 PRIVATE OFFICE 115.

2.06 TERMINAL UNITS

A. Same as Paragraph 2.05

1. Hand-written or stenciled tag on terminal casing in indelible ink also acceptable

PART 3 EXECUTION

3.01 MANUFACTURER'S IDENTIFICATION

A. Equipment manufacturer's nameplate, name or trademark shall be permanently affixed to all equipment and material furnished under this specification. The nameplates of subcontractor or distributor are not acceptable.

B. Identify model number, size, capacity, electrical characteristics, serial number, etc.

C. Leave nameplates clean, legible and with unobstructed view

3.02 PIPING IDENTIFICATION

A. All piping concealed or exposed shall have identification markers.

B. Unless the current version of the recommendations of ANSI A13.1, 1981 are more stringent, apply labels or letters after completion of pipe cleaning, insulation, painting, or other similar work, as follows:

1. Every 20 feet along continuous exposed lines

2. Every 10 feet along continuous concealed lines

3. Adjacent to each valve and stubout for future

4. Where pipe passes through a wall, into and out of concealed spaces

5. On each riser

6. On each leg of a “T”

7. Locate where conspicuously visible

C. Further, apply labels or letters to lower quarters of the pipe on horizontal runs where view is not obstructed or on the upper quarters when pipe is normally viewed from above. Apply arrow labels indicating direction of flow; arrows to be the same color and sizes as identification labels.

D. Spray a protective coating of clear epoxy over markers and arrows in corrosive atmosphere areas.

3.03 EQUIPMENT IDENTIFICATION

A. All equipment and apparatus shall have identification nameplates. Cardholders in any form not acceptable.

1. Provide identification nameplate for variable speed drives and starters provided under this Division indicating the equipment that the VFD powers.

B. Locate where conspicuously visible

C. Attach either with sheet metal screws, brass chain, or contact cement as applicable

D. Identify equipment out of view behind access doors, in unfinished rooms on the face of the access door

E. Place warning signs on machines driven by electric motors which are controlled by fully automatic starters, in accordance with Article 3281, General Industry Safety Orders

F. Nameplate Directory: Post final copy in Operation and Maintenance Manual

3.04 TERMINAL UNITS

A. Same as Paragraph 3.03

B. Identify room sensor/thermostat relating to terminal unit with indelible marker on sensor hidden by cover.

3.05 CONCEALED EQUIPMENT IDENTIFICATION

A. Where fire/smoke dampers, terminal units, and other equipment requiring routine maintenance are located above accessible ceilings, color-coded markers shall be provided as specified below to make it easier for equipment to be located by maintenance personnel.

1. Marker

a. DONN Fineline, narrow tee-bar (tees with flat surface less than 1/2 inch wide), or concealed spine ceilings: 1/8 inch round-head map tack

b. Standard tee-bar ceilings: 3/8 inch round sticker made of vinyl, polyester, or PVC (paper not acceptable), equal to EMS Tough-Spots

2. Locate marker on the ceiling tile (tack) or tee (sticker) closest to side of the equipment requiring maintenance (such as damper motor, controls, and valves).

3. Unless otherwise directed, color codes shall be:

a. Fire/smoke and smoke dampers: red

b. HVAC equipment, such as terminal units, VAV boxes, and heat pumps: blue

c. Valves such as at riser taps and riser or branch isolation valves: yellow

B. Label duct access door to fire and smoke dampers in letters not less than 1/2 inch height reading FIRE DAMPER, or FIRE/SMOKE DAMPER. Indelible ink is acceptable.

END OF SECTION

SECTION 23 05 93
TESTING, ADJUSTING AND BALANCING

PART 1 GENERAL

1.01 SUMMARY

A. Work included in this section: materials, equipment, fabrication, installation and tests in conformity with applicable codes and authorities having jurisdiction for the following:

1. Operational testing and adjusting of air handling equipment

2. Balancing of air distribution systems

3. Testing and adjustment of air terminal devices

4. Flow testing, adjusting and balancing of hydronic systems.

1.02 REFERENCE STANDARDS

A. National Environmental Balancing Bureau Procedural Standards

B. Associated Air Balance Council National Standards

C. Testing, Adjusting and Balancing Bureau Standards

D. ASHRAE Standard 111 Practices for Measurement, Testing, Adjusting, and Balancing of Building Heating, Ventilating, and Air-Conditioning Systems

1.03 QUALITY ASSURANCE

A. Contractor shall be member of Associated Air Balance Council (AABC), National Environmental Balancing Bureau (NEBB), or Testing, Adjusting and Balancing Bureau (TABB)

B. Contractor shall have satisfactorily balanced at least three systems of comparable type and size

C. Prior to start of testing, adjusting and balancing, verify that required Project conditions are met

1. Systems installation is complete and in full operation

2. All pre-functional tests have been performed

3. Equipment has been started and tested in accordance with manufacturers' installation instructions

4. Doors and windows are in place and closed or under normal traffic conditions

1.04 SUBMITTALS

A. All submittals shall follow Submission and Resubmission Procedures outlined in 23 05 01 Basic Mechanical Materials and Methods.

B. Submit documentation that demonstrates

1. Contractor is a member of AABC, NEBB, or TABB

2. Contractor has satisfactorily balanced at least three systems of comparable type and size

C. Pre-Test Submittal

1. At least 30 days prior to starting field work, submit the following:

a. Set of final report forms

1) Complete with design conditions of all equipment and design flow rates for all equipment and devices to be tested.

2) Forms shall include blank entry space for all data requested in this Section. Carefully review requested data; standard balancing forms may not be acceptable.

3) Forms shall be in acceptable word-searchable electronic format per Section 23 05 01 Basic Mechanical Materials and Methods.

b. Complete list of instruments proposed to be used

1) Organize in appropriate categories

2) Include data sheets for each

3) Show

a) Manufacturer and model number

b) Description and use when needed to further identify instrument

c) Size or capacity range

d) Latest calibration date

c. Provide certification that

1) All instruments have been calibrated prior to tests

2) Instruments comply with requirements of AABC, NEBB, or TABB for tests required

3) Contractor is currently certified by AABC, NEBB, or TABB

2. Do not proceed with field work until the above submittal has been approved by Owner's Representative.

D. Final Test & Balance Report

1. At least 15 days prior to Contractor's request for final inspection, submit electronic copy of final reports on approved reporting forms for review and approval by Owner's Representative. Once approved, provide required quantity of paper and electronic copies per 23 05 01 Basic Mechanical Materials and Methods.

2. Form of Final Reports

    a. Completed forms shall be typed (not hand written) and be in acceptable word-searchable electronic format per Section 23 05 01 Basic Mechanical Materials and Methods.

    b. Fully completed report forms for all systems specified to be tested and balanced including at a minimum all data specified herein to be recorded

    c. Each individual final reporting form must bear

        1) Signature of person who recorded data

        2) Signature of air balance supervisor of reporting organization

    d. When more than one certified organization performs total air balance services, firm having managerial responsibility shall make submittals.

    e. Identify instruments of all types that were used and last date of calibration of each.

1.05 PROJECT REVIEW

A. Pre-Construction Review

1. Review following documents

    a. Contract documents

        1) Drawings

        2) Specifications

        3) Addenda

        4) Change orders

    b. Submittal data

    c. Shop drawings

    d. Building Automation System drawings

    e. Pre-functional test reports

2. Identify potential problems from standpoint of total system balance.

3. Review design and shop drawings and specifications for

    a. Potential problems for total system balance

        1) Location of balancing devices

        2) Lack of balancing devices

        3) General System layout

4) Architectural features

5) Accessibility

b. Most effective system balance procedures

c. Scheduling and coordination requirements

4. Review submittal data for

a. Completeness of data

b. Conformity with contract documents

c. Special instructions for use of balancing devices

d. Factors for flow meters

e. Limitations affecting accuracy of measurements

f. Balancing forms shall show design data and submittal data where different

g. Equipment performance data and curves

5. Review BAS drawings and specifications for:

a. Calibration and setpoint adjustment requirements by this Section

b. Determining most effective total system balance procedure for minimum control manipulation

c. Coordinate required control manipulation with BAS installer

6. Submit report recommending addition and/or relocation of balancing devices, including, but not limited to

a. Volume dampers

b. Balancing valves (including ball and butterfly valves with memory-stops, which are used in the design for balancing)

c. Pressure and temperature measuring points

B. Construction Review

1. Make on-site visits during progress of construction: Number of visits to be as required to perform the functions specified below.

2. Purpose of review

a. Identify potential problem for performing total system balance

b. Identify modifications that will affect air total system balance

c. Schedule and coordinate total system balance with other work

d. Identify conditions that could create hazardous environment for building occupants

3. Typical activities

a. Check that necessary balancing and measuring hardware is

1) In place

2) Located properly and accessibly

3) Installed correctly

b. Identify and evaluate variations from system design

c. Record data from equipment nameplates

d. Identify and report possible restrictions in systems; such as

1) Poorly designed duct fittings

2) Questionable piping connections

3) Others as may arise or based on contractor's experience

e. Verify that construction progress will not delay total system balance

f. Identify best location for duct traverses

g. Identify scaffolding needs

PART 2 PRODUCTS

2.01 TEST EQUIPMENT

A. All testing equipment shall be of sufficient quality and accuracy to test and/or measure system performance with the tolerances specified herein. If not otherwise noted, the following minimum requirements apply

1. Volt-meter: plus or minus 1 percent scale

2. Ammeter: plus or minus 1 percent scale

3. Ohmmeter: plus or minus 0.1 percent scale for calibrating plus or minus 0.4 degrees Fahrenheit resistance temperature sensors, plus or minus 0.25 percent scale for calibrating plus or minus 1 degrees Fahrenheit temperature sensors, plus or minus 1 percent scale for measuring motor current

4. Ultrasonic time-of-travel strap-on flow sensor: plus or minus 5 percent of reading

5. Other flow sensors: plus or minus 2 percent of reading

6. Water pressure gauge: plus or minus ½ percent scale, ASME Grade 2A

7. Watt meter, plus or minus ½ percent scale: 3 phase split core current transducers

8. Temperature: plus or minus 0.4 degrees Fahrenheit

B. All equipment shall be calibrated within 6 months of use, or according to the manufacturer's recommended interval, whichever is shorter, and when dropped or damaged. Calibration tags shall be affixed or certificates readily available and proof of calibration shall be included reports.

PART 3 EXECUTION

3.01 GENERAL

A. Coordinate with work of other trades.

B. Coordinate all work with Commissioning Coordinator

1. See Section 01 91 00 Commissioning

2. See Section 23 08 00 Mechanical Commissioning

C. Report to Owner's Representative any discrepancies or items not installed in accordance with the Contract Drawings pertaining to proper balance and operation of air and water distribution systems.

D. Perform testing, adjusting and balancing in accordance with AABC, NEBB, or TABB standards.

E. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary to allow adequate performance of procedures. After testing and balancing, close probe holes and patch insulation with new materials identical to those removed. Restore vapor barrier and finish according to Section 23 07 00 Mechanical Insulation.

F. Mark equipment settings with paint or other suitable, permanent identification material, including damper control positions, valve indicators, and similar controls and devices, to show final settings.

G. Assist in performance testing where specified in Section 23 08 00 Mechanical System Commissioning.

3.02 CONTROL SYSTEM COORDINATION

A. See Division 25 Building Automation Systems

B. System balance techniques in this Section rely on the operation of the BAS. Test and balance contractor shall coordinate schedule of work with BAS installer to ensure test and balance work can be executed and completed in a timely manner.

C. Cooperate with BAS installer in determining operating conditions and setpoints, as indicated in this Section.

D. Cooperate with BAS installer in calibrating all airflow measuring devices.

E. Obtain and receive training for required software from BAS installer for setting calibration constants in terminal devices.

3.03 WATER SYSTEMS BALANCING

A. Prepare water systems for balancing in following manner

1. Verify the following conditions

a. Piping systems have been flushed and treated in accordance with Section 23 21 13 HVAC Piping

b. Strainers have been cleaned

c. Piping systems are completely full of water, all air properly vented

d. All coil and heat exchanger shut-off, balance, and control valves are fully open

2. Check pump

a. Rotation

b. Pump factory impeller trimming by comparing shut-off heads with pump curves from approved submittals

1) Note that impellers on variable speed pumps should not be trimmed to design flow and head conditions. See Section 23 21 23 Pumps.

2) Report discrepancy in shut-off head to Owner's Representative and if impeller does not appear to be properly trimmed. Wait for direction before proceeding with pump test and balance.

3. BAS and Air to Water Heat Pump Operability

a. Do not proceed with any of the following balancing procedures until the BAS is capable of operating equipment such as fans, pumps, VAV boxes, control valves, etc. in manual and automatic modes and capable of reading sensors such as differential pressure, flow rates, temperatures, etc. of air and hydronic systems to be tested and adjusted.

b. Do not proceed with air handler testing until chilled and hot water at design temperatures are available from the air to water heat pumps.

B. Pumps

1. Test and report for each pump at test conditions indicated in Paragraphs below.

a. Tag

b. Manufacturer and model of pump and motor

c. Motor horsepower, volts, phase, full load amps

d. Pump shut-off head from curves, measured shut-off head, and resulting impeller diameter from pump curve

e. At test condition specified

1) Volts and amps

2) Calculated brake horsepower

3) Entering and leaving gage pressure and difference in feet

4) Flow rate deduced from pump curve

5) For pump with variable speed drive

a) Speed (Hz)

b) Kilowatts

2. Include pump curve from approved submittals in final report.

C. Chilled Water and Hot Water Distribution System

1. Coil Test & Balance

a. Systems with two-way modulating valves: System is self-balancing. Two-way control valves at coils prevent each coil from being over-supplied with water, other than minor excursions during transients such as cool-down or warm-up. Conventional balancing (throttling of balancing valves) will increase pump energy use by not allowing aggressive differential pressure setpoint reset. Hence, do not adjust any valves on any coil or pump, except temporary adjustments where noted. Calibrated balancing valves may be provided for flow measurement and diagnostics but they shall not be modulated for flow balancing. Pressure independent valves shall be set to maximum flow rate of the valve, not the design flow rate. All manual valves at coils and pumps shall be wide open when test and balance work is complete.

b. Report with all control valves open to coil and all pumps (except standby pumps, where applicable) operating at full speed

1) See Air Balance below for coil temperature data where required

2) See Pump test data above for pump data

3) Coils with modulating two-way or three-way control valves

a) Terminal tag

b) Control valve model number and serial number

c) Pressure drop across coil

d) Flow as measured by calibrated balancing valve (where applicable). Where a calibrated balancing valve is not provided, determine flow by either of the following:

1. Use test plugs to measure pressure drop across the coil and estimate flow using coil manufacturer's submittal data of flow vs. pressure drop. This option shall only be used when design coil pressure exceeds 5 feet.

2. Use test plugs to measure pressure drop across the control valve and calculate flow using valve manufacturer's submitted Cv.

c. Report at condition described above

1) Tag of coils downstream of differential pressure sensor, along with the following for each

a) Design flow rate and pressure drop

b) Tested flow rate and pressure drop with differential pressure at setpoint determined above

2) Water flow rate through flow meter, through BAS

3) See Pump test data above for pump data

2. Control Valve Shut-off Test

a. Close all control valves in the system through the BAS. Run all pumps (except stand-by pump, if any) at full speed.

1) Verify that all control valves remain shut with no measurable flow, as indicated by pump differential pressure and any temperature rise across coils.

2) Do not run pumps deadheaded for more than 5-minutes at any one time.

b. Report at condition described above

1) Tag of coils where flow is detected: Initials of BAS installer to indicate that this information was transmitted to them.

2) Measured pump inlet and outlet pressures, and difference converted to feet

3) Differential pressure reading at all differential pressure sensors, through BAS

D. Air to Water Heat Pumps

1. Air to Water Heat Pump Balancing

a. Place all air to water heat pumps in cooling mode

1) Run all primary pumps.

2) Report at condition described above

a) Design and final flow rate at each air to water heat pump

b) Design and final inlet and outlet pressure at each air to water heat pump

b. Place AWHP-1 in cooling mode, shut of AWHR-2

1) Run AWHP-1 primary pump.

2) Report at condition described above

a) Design and final flow rate at each air to water heat pump

b) Design and final inlet and outlet pressure at each air to water heat pump

c. Place AWHR-2 in cooling mode, shut of AWHP-1

1) Run AWHR-2 primary CHW pump.

2) Report at condition described above

a) Design and final flow rate at each air to water heat pump

b) Design and final inlet and outlet pressure at each air to water heat pump

d. Place AWHR-2 in heating mode, shut of AWHP-1

1) Run AWHR-2 primary HW pump.

2) Report at condition described above

a) Design and final flow rate at each air to water heat pump

b) Design and final inlet and outlet pressure at each air to water heat pump

e. Place AWHP-1 in heating mode, shut of AWHR-2

1) Run AWHP-1 primary pump.

2) Report at condition described above

a) Design and final flow rate at each air to water heat pump

b) Design and final inlet and outlet pressure at each air to water heat pump

f. Place all air to water heat pumps in heating mode

1) Run all primary pumps.

2) Report at condition described above

a) Design and final flow rate at each air to water heat pump

b) Design and final inlet and outlet pressure at each air to water heat pump

2. Hot Water Secondary Loop Balance

a. Start with all control valves at VAV reheat coils wide open.

b. Run all primary air to water heat pumps.

c. Report

1) See Pump test data above for pump data

2) Design flow rate and pressure drop at each reheat coil.

3) Measured secondary pump inlet and outlet pressure and pressure drop and flow rate deduced from pressure drop from manufacturer's data.

4) Report flow from flow meter on BAS.

3.04 AIR SYSTEM BALANCING

A. General

1. Do not operate fan systems for test or balance until spaces served have been cleaned of dust and debris, to avoid contamination of supply air or return air paths and equipment.

2. Filters

a. Check that filters of the type specified are installed, oriented in the proper airflow direction, free of bypass, and clean.

b. Simulate design air filter resistance at time of tests, such as by installing temporary blank-offs across a portion of filter bank. Pressure drop across filter banks shall midway between drop for clean and dirty filters at design airflow.

3. In cooperation with BAS installer, set adjustments of automatically operated dampers and valves to operate as indicated.

4. Balance hydronic systems prior to air balance and have operational during air balance for air temperature measurements where specified.

B. Air Outlets

1. Adjust diffusers' throw pattern prior to balance as indicated below unless otherwise indicated on Drawings. Review manufacturer's instructions for proper diffuser blade or weir gate positions to provide this throw pattern as it is not always intuitive. It is TAB contractor's responsibility to adjust throw patterns for all adjustable throw diffusers. If diffuser has a fixed throw pattern and is incorrectly installed, HVAC contractor shall correct pattern prior to balance.

a. Ceiling diffusers: As indicated on the Drawings.

1) Star pattern diffuser deflectors shall be adjusted for corner blow pattern unless otherwise indicated on Drawings.

b. Slot diffusers supplying cooling-only, or heating and cooling with ceilings 15 feet and lower: Adjust to throw away from adjacent walls along the ceiling toward the center of the room served.

c. Slot diffusers supplying heating-only, or heating and cooling with ceiling above 15 feet: Adjust to throw downward and slightly toward adjacent wall.

d. Double-deflection grilles: Adjust rear blades horizontal 22 degree upward and splay front blades in 45 degree pattern at each end gradually rotating to be almost straight at blades in center of grille.

2. Test and adjust each diffuser, grille and register to within plus or minus 10 percent of design requirements

a. Start with all dampers wide open.

b. Adjust dampers, starting with nearest to terminal unit or fan. Make adjustments using duct mounted volume dampers rather than dampers at diffuser face (if any) unless absolutely required.

c. At least one damper shall remain wide open at end of balance.

3. Plenum return air grilles or slots in lights: No balance required

4. Report

a. Tag each grille, diffuser and register and mark tag on copy of floor plan.

b. For each grille, diffuser and register, indicate tag, size, type, and effective area (where applicable).

c. Required velocity/cubic feet per minute

d. Initially tested velocity/cubic feet per minute

e. Finally tested cubic feet per minute after adjustments

C. Terminal Boxes

1. Balancing contractor shall provide laptop computer or other device for communicating with BAS system, using software provided by BAS installer. Cooperate with BAS installer to learn how to use software to calibrate BAS zone controller.

2. Terminal box calibration procedure listed below may be modified based on specific features or limitations of digital controller and recommendations of the controller manufacturer. Submit revised procedure for approval by Owner's Representative along with pre-test submittal per Paragraph 1.04C.

3. Use BAS terminal "commissioning" software where available and record all calibration and test data through the BAS.

4. Zero transmitter prior to each test.

5. Adjust BAS calibration constants so that the VAV box controller and measured air flow rate at air outlets matches BAS reading within range listed at all of the following conditions at a minimum:

a. Maximum airflow setpoint, ±5%

b. Controllable minimum airflow setpoint, ±10%. The controllable minimum value shall be that determined by the BAS contractor per Section 25 00 00.

c. Zero flow

1) If BAS can only calibrate to one point, adjust VAV box controller minimum volume setpoint so that measured air flow rate at air outlets equals desired minimum, even though this will cause BAS to read improperly.

6. Terminal fans (fan-powered boxes)

a. Adjust speed to achieve cooling design cfm within 10 percent

b. For series-flow boxes, adjust BAS setpoint to allow VAV damper to operate at maximum airflow rate: Increase fan speed until there is no backflow through plenum opening.

c. For ECMs with speed controlled by BAS, set maximum speed via BAS interface and note speed setpoint in air balance report.

7. Report

a. Tag, manufacturer, and model

b. VAV maximum cooling flow rate, design and measured

c. VAV minimum flow rate, design and measured

d. BAS calibration coefficients at all calibration points

e. Fan-powered boxes

1) Fan flow rate, design and measured

2) Final speed setpoint

3) Fan volts, phase, FLA, measured current

4) Entering and leaving fan static pressure with fan-powered box fan on and

a) VAV airflow at minimum

b) VAV airflow at cooling maximum

f. Terminals with reheat coils, with HW valve wide open

1) Entering air drybulb temperature to reheat coil

2) Leaving air drybulb temperature from reheat coil

3) Entering HW temperature to reheat coil

4) Leaving HW temperature from reheat coil

D. BAS airflow measuring station (AFMS)

1. For outdoor air AFMS associated with a VAV box system

a. Test Conditions

1) Command all VAV boxes to full open.

2) Override the economizer to 100% outdoor air, i.e. configure the outdoor air damper to be 100% open and the return air damper to be 0% open.

3) Start supply fan and run it slowly from 10% speed up to 100% speed, in 10% increments with a pause at each step to allow time for the VAV boxes to communicate. At each 10% increment, measure and report:

a) Sum of VAV box airflows (should be displayed on BAS AHU graphic)

b) Airflow measurement station airflow reading

c) Traverse across supply air duct, filter bank, or other location where the most accurate airflow reading is possible

b. Plot the speed vs. all three measured airflows. They should be linear and the three readings should be within 10% of each other.

2. For factory calibrated AFMS: If measured airflow and BAS readings differ by more than 10%, consult with Owner's Representative for recalibration instructions. Do not change factory calibration without written direction.

3. For field calibrated AFMS: Coordinate with BAS installer to adjust calibration coefficients. Report coefficients in air balance report.

E. Air Handling Unit Readings

1. Total supply air quantities shall be determined at all of the following where applicable

a. Pitot traverse in the supply duct downstream, positive pressure side of the fan

b. Pitot traverse at coil or filter bank

c. Totaling the readings of individual air outlets

d. Totaling the readings of individual terminals as read through the BAS

e. Supply fan airflow sensor reading as read through the BAS

2. Total return air quantities shall be determined at all of the following where applicable

a. Pitot traverse in the return air duct or damper entering air handler

b. Totaling the readings of individual air outlets, if ducted return system

c. Totaling reading of each return air shaft inlet, if multi-story plenum return system

d. Return fan airflow sensor reading as read through the BAS

3. Outside air quantities shall be determined by all of the following where applicable

a. Subtracting pitot traverses of supply and return ducts

b. Pitot traverse of outdoor air intake duct

c. Outdoor airflow sensor reading as read through the BAS

d. Note: Balance by measurement of return air, outside air, and mixed air temperatures shall not be used due to inherent inaccuracy.

F. Variable Air Volume Air Handlers

1. Adjust fan speed using manual adjustment of variable speed drive for testing only. Do not change or adjust sheaves.

2. Supply fan DP Setpoint.

a. Establish maximum static pressure setpoint (DPmax) in conjunction with the BAS installer as follows. All adjustments made via the BAS, not field measurements except as noted.

b. Test Conditions

1) Set all boxes to operate at maximum airflow setpoints; allow controls to stabilize.

2) For cooling systems only to account for diversity: Shut off boxes, starting with boxes whose dampers are the most closed, as indicated by the BAS, and upstream of the DP sensor, until the airflow equals scheduled design airflow rate.

c. Procedure

1) Manually lower fan speed slowly while observing VAV box airflow rates downstream of the static pressure sensor. Stop lowering speed when one or more VAV box airflow rates drops 10 percent below maximum airflow rate setpoint.

2) Once flow condition in previous step is achieved, note the BAS system static pressure reading at the duct static pressure sensor.

a) This reading becomes the maximum static pressure setpoint.

b) Using pressure taps at differential pressure sensor and handheld digital pressure sensor, verify accuracy of BAS reading.

d. If there are multiple static pressure sensors, repeat steps above for each sensor. Each sensor will have its own setpoint.

e. Convey to the BAS installer

1) Static pressure setpoints

2) Any discrepancy between BAS differential pressure reading and handheld measurement

f. Report

1) Static pressure setpoint and concurrent reading of handheld measurement: Initials of BAS installer to indicate that the information was transmitted to them.

2) Tag of VAV boxes that dropped below design maximum airflow rate in tests above. These are the critical boxes, those requiring the largest static pressure.

3) Concurrent fan data

a) Volts and amps

b) Amps and kilowatts from variable speed drive

c) Variable speed drive speed in hertz

d) Entering and leaving fan static pressure

e) Flow rate, summed from BAS terminals

f) Fan airflow sensor reading from BAS, where applicable

3. Minimum outside air flow

   a. Supply air fan and return air fan (if any) shall first be operating at design airflow. For VAV systems with diversity, close enough boxes close to fan to reduce supply airflow to scheduled design condition.

   b. For systems with economizers and differential pressure sensor

      a) Open return air damper fully.

      b) Adjust the outdoor air damper signal through the BAS until the minimum outdoor airflow rate is achieved.

      c) Convey this minimum outdoor air damper signal to BAS installer and note on air balance report.

      2) Note differential pressure as measured by the BAS. This value becomes the minimum outdoor air differential pressure setpoint in the BAS. Convey this setpoint to BAS installer and note on air balance report.

      3) For systems with CO_2 demand-controlled ventilation

         a) With the system at the minimum outdoor air condition, reduce supply air fan speed until the outdoor air rate is equal to the absolute minimum outdoor air rate on AHU schedule.

         b) Note differential pressure across the outdoor air damper. This value becomes the absolute minimum outdoor air differential pressure setpoint in the BAS. Convey this setpoint to BAS installer and note on air balance report.

   c. For systems with outdoor airflow measuring stations, see Paragraph 3.04D.

   d. For systems with both a design minimum outdoor air rate and an “absolute” minimum outdoor air rate, repeat the tests above for the lower rate achieved by slowing down the supply air fan.

4. Test with system operating at design fan and minimum outside air flow conditions described above and report the following on a schematic of the system:

   a. Tags of all equipment

   b. Manufacturer and model of all fans and motors

   c. Motor horsepower, rpm, volts, phase, full load amps

   d. Sheave data at motor and fan; belt data

   e. Fan airflow rate at all locations measured, as listed above

   f. Final measured fan speed and amps

   g. Amps and kilowatts from variable speed drives

h. Variable speed drive speed in hertz

i. Static pressures measured at

1) Return air plenum

2) Mixed air plenum

3) Downstream of relief fan

4) Downstream of filter

5) Downstream of coil

6) Discharge of supply fans

7) At static pressure sensor

j. Concurrent airflow rate readings from BAS airflow sensors, including sum of VAV box airflow rates

k. Minimum BAS outdoor air control setpoints and signals as applicable

l. Cooling Coil Performance

1) Test with both air to water heat pumps in cooling mode

a) Associated pumps running in automatic

b) Controls adjusted to provide lowest coil design water temperature entering coil

c) Fan is running at design airflow

2) Measure and report on a schematic of the system

a) Entering water temperature

b) Leaving water temperature

c) Each coil differential pressure drop

d) Each coil flow rate, from calibrated balance valve or deduced from manufacturer's coil flow vs. pressure drop data, see submittals

e) Coil entering drybulb and wetbulb

f) Leaving supply air drybulb and wetbulb

5. Relief Fan

a. Test Conditions

1) Economizer in 100% outdoor air position

2) Supply fan at design supply air rate

3) All doors and windows closed in area served by air handler

4) All exhaust fans on in area served by air handler

b. Procedure

1) Measure building pressure using BAS sensor.

2) Manually adjust fan speed at variable speed drive to achieve than 0.05" building pressure.

a) Fan speed may exceed 60 Hz if necessary. Do not change or adjust sheaves.

b) If required fan speed exceeds 60 Hz, convey maximum speed to BAS contractor.

3) At the above design conditions, measure fan inlet and outlet pressures and measure total relief air quantities with pitot tube traverse of main ducts near the fan inlet or outlet where possible.

c. Report

1) Amps and kilowatts from variable speed drive

2) Variable speed drive required speed in hertz

3) Inlet and outlet static pressure

4) Building static pressure

G. Drain Pan Testing

1. This test shall be performed for the drain pan

2. Procedure

a. Pan Slope Test

1) Turn AHU off.

2) Plug the drain at the discharge air gap.

3) Fill the drain pan with water until standing water covers all of the pan.

4) Remove the test plug and verify all of the water drains, leaving puddles no larger than 2" in diameter and 1/8" deep anywhere in the pan.

b. Trap Sizing Test – Draw-Through Fans

1) Plug the drain at the discharge air gap.

2) Open the air handler/fan-coil coil access panel and fill the drain pan until all areas of the pan are covered with at least ½" of water. Close the access panel.

3) Configure and operate the air handler/fan-coil at design operating conditions as defined above herein. The intent is that the coil section will be at the lowest expected operating pressure.

4) Remove drain and observe condensate flow at drain pipe discharge air gap. Within a few minutes, there should be little to no flow.

5) Use theatrical smoke or other flow indicator near the drain vent/cleanout and verify that air is not being drawn into the trap. If airflow is detected, the trap is dry and the trap depth, as measured from the centerline of the drain connection to the centerline of the bottom of the trap, is too shallow.

6) Place a bucket or other receptacle at the drain discharge to capture condensate runoff.

7) Turn off air handler/fan-coil fan. Additional runoff will occur from the P-trap, and possibly from the AHU if the drain pan is still partially full. The vertical distance from the centerline of the unit connection to the drain connection is “A”. If the amount of water in the receptacle after runoff stops exceeds the condensate pipe volume determined based on the nominal pipe diameter and “A”, then moisture was still standing in the pan at the end of the test, indicating future water retention problems are likely. If so, the distance “A” needs to be extended. Otherwise, the pan was dry, and the install is acceptable.

H. Constant Volume & Variable Volume Exhaust Fans and Recirculating Fan

1. See Paragraph 3.04B for air outlet balancing

2. Total air quantities for fan shall be determined by both

   a. Pitot tube traverse of main ducts near the fan inlet, and

   b. Totaling the readings of individual air outlets

3. Total air quantities shall be obtained within 10 percent of design by adjustment of fan speed

   a. Constant speed fans

      1) Adjust sheaves on fans with adjustable sheaves.

      2) Change sheaves on fans with fixed sheaves.

      3) Adjust speed potentiometer for ECMs.

4. Report

   a. Tag

   b. Manufacturer and model of fan and motor

   c. Sheave data at motor and fan; belt data

   d. Motor horsepower, rpm, volts, phase, full load amps

   e. Fan airflow rate at all locations measured, as listed above

f. Final measured amps

g. ECM potentiometer setting

h. Inlet and outlet static pressure

3.05 ADDITIONAL COSTS

A. Fans: If drives are not capable of being adjusted to meet required performance, inform Owner's Representative and indicate added price to supply and install required sheaves. Do not include sheave changes in initial bid.

B. Pumps: If impeller must be trimmed, inform Owner's Representative and indicate added price to trim impeller and replace. Do not include impeller trim in initial bid.

C. Do not proceed until work is approved by Owner's Representative.

3.06 SPOT CHECKING

A. Spot checks shall take place after test and balance work is complete and reports have been prepared and approved.

B. Spot checks shall be witnessed by an Owner's Representative. Schedule spot checks with Owner's Representative at least 1 week prior to proposed test date.

C. Owner's Representative shall select subsets of any tested and balanced air or hydronic system to be spot-checked on the day of tests without prior notice to the Contractor.

1. Spot-checking will not require more than one working day.

2. If additional spot checks are requested by the Owner's Representative causing the time limit above to be exceeded, inform Owner's Representative and indicate added price to perform the additional tests. Do not include additional tests in initial bid.

D. Discrepancies

1. If any of the spot-check measurements differ more than 15 percent from those documented in test and balance reports, the Contractor shall completely rebalance the associated system. For balance discrepancies at or downstream of a VAV box, rebalance only is required at or downstream of that box.

2. If discrepancies as described above are found on more than 25 percent of the spot-checks for air systems, all air systems shall be rebalanced.

3. If discrepancies as described above are found on more than 25 percent of the spot-checks for hydronic systems, all hydronic systems shall be rebalanced.

4. Rebalance work shall be witnessed by an Owner's Representative at the option of the Owner's Representative.

5. All rebalance work shall be documented and documentation shall be resubmitted as specified above.

6. All rebalance work shall be provided at no additional cost to the Owner.

3.07 TRAINING OWNER PERSONNEL

A. See Section 23 08 00 Mechanical Commissioning.

B. Go over the final Testing, Adjusting and Balancing Report, explaining the layout and the meanings of each data type.

C. Discuss any outstanding deficient items in control, ducting, piping or design that may affect the delivery of air or water.

D. Identify and discuss any systems or system components that are not meeting their design capacities.

E. Discuss any temporary settings and steps to finalize them for any areas that are not finished or fully occupied.

F. Any other appropriate points that may be helpful for facilities operations, relative to testing, adjusting and balancing or the mechanical systems.

END OF SECTION

SPECIFICATION 23 07 00
HVAC INSULATION

PART 1 GENERAL

1.01 SUMMARY

A. Work Included in This Section: Materials, equipment, fabrication, installation and tests in conformity with applicable codes and authorities having jurisdiction for the following:

1. Piping insulation
2. Pipe insulation jacket
3. Equipment insulation
4. Ducts and plenums, thermal insulation
5. Duct and plenums, acoustic insulation

1.02 REFERENCE STANDARDS

A. ASTM B209 – Aluminum and Aluminum-Alloy Sheet and Plate

B. ASTM C177 – Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus

C. ASTM C335 – Steady-State Heat Transfer Properties of Horizontal Pipe Insulation

D. ASTM C585 – Inner and Outer Diameters of Rigid Thermal Insulation for Nominal Sizes of Pipe

E. ASTM C921 – Properties of Jacketing Materials for Thermal Insulation

F. ASTM E84 – Surface Burning Characteristics of Building Materials

G. ASTM E96 – Water Vapor Transmission of Materials

H. ASTM E1222 − Standard Test Method for Laboratory Measurement of the Insertion Loss of Pipe Lagging Systems

I. ASTM D 5590 - Standard Test Method for Determining the Resistance of Coatings to Fungal Defacement

J. ASTM F 1249 -- Standard Test Method for Water Vapor Transmission Rate Through Plastic Film Using a Modulated Infrared Sensor

K. NFPA 255 – Surface Burning Characteristics of Building Materials

L. SMACNA – HVAC Duct Construction Standards - Metal and Flexible

M. UL 723 – Surface Burning Characteristics of Building Materials

1.03 DEFINITIONSDuct Dimensions

1. Where acoustical liner is indicated on the Drawings the duct sizes indicated shall be clear inside dimensions unless duct size is specifically indicated as outside dimensions (OD).

1.04 QUALITY ASSURANCE

A. Source Quality Control

1. Service: Use insulation specifically manufactured for service specified

2. Labeling: Insulation labeled or stamped with brand name and number

B. Applicator: Company specializing in performing the work of this section with minimum three years' experience

1.05 SUBMITTALS

A. See Section 23 05 01 Basic Mechanical Materials and Methods.

B. Submit product data, O&M data, and samples and show item on shop drawings (where shop drawings are required) according to the following table.

1. "R" means required.

2. "R2" means required only for products and equipment differing for the specified manufacturer and model and for "or equals" where specified.

Item	Product Data	O&M Manual	Samples	Shop Drawing
Equipment insulation	R			
Piping insulation	R			
Jackets	R			
Duct insulation, wrap and liner	R			
Adhesives and coatings	R2			
Mechanical fasteners	R2			

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Named manufacturer model numbers used as example of item and establish minimum level of quality and minimum standard options. Equivalent models of listed manufacturers are acceptable.

B. Insulation: Fiberglass

1. Owens-Corning Fiberglass Corporation

2. Manville

3. Certainteed Corporation

4. Knauf

5. Or equal

C. Insulation: Elastomeric Closed Cell

1. Armacell, Inc.
2. Rubatex Corporation
3. Or equal

D. Weatherproof Aluminum Jacket

1. Childers Products Company
2. Insul-Coustic/Birma Corporation
3. Or equal

E. Pre-molded pipe fitting covers and Jacketing

1. Manville: Zeston
2. Childers Products Company
3. Proto Corporation
4. Insul-Coustic/Birma Corporation
5. Or equal

F. Adhesives, Coatings, and Sealants

1. Foster
2. Childers
3. Epolux Mfg. Corporation
4. Insul-Coustic/Birma Corporation
5. Armacell
6. Or equal

G. Mechanical Fasteners

1. AGM Industries, Inc.
2. Miracle Adhesives Corporation
3. Grip-Nail
4. Or equal

2.02 GENERAL

A. Energy Codes: The current versions of California Title 24 and California Building Code shall govern where requirements for thickness exceeds thickness specified

B. All insulation materials, including jackets, facings, adhesives, coatings, and accessories are to be fire hazard rated and listed by Underwriters' Laboratories, Inc., using Standard UL 723 (ASTM E-84), (NFPA-255), (ASA A2.5-1963)

1. Flamespread: maximum 25

2. Fuel contributed and smoke developed: maximum 50

3. Flameproofing treatments subject to deterioration from moisture or humidity are not acceptable

C. Insulation and accessories shall not provide any nutritional or bodily use to fungi, bacteria, insects, rats, mice, or other vermin, shall not react corrosively with equipment, piping or ductwork, and shall be asbestos free: Duct lining shall meet ASTM C1136 and ASTM C665 for biological growth in insulation

D. Products shall not contain or be coated with any PBDEs.

2.03 INSULATION MATERIALS

A. Pipe Insulation

1. Fiberglass

a. Molded: one piece, maximum 0.26 K factor at 75 degrees Fahrenheit mean temperature: Owens-Corning ASJ/SSL-II Pipe Insulation or equal

b. Blanket: minimum 1 lb. density, maximum 0.28 K factor at 75 degrees Fahrenheit mean temperature: Owens-Corning Faced Duct Wrap or equal

c. Board: Density as noted, maximum 0.26 K factor at 75 degrees Fahrenheit mean temperature: Owens-Corning 700 Series with face or equal

2. Flexible, closed cell elastomeric thermal insulation

a. Insulation ASTM C534

b. Service rating of 220 degrees Fahrenheit

c. Density 3 to 6 pounds per cubic foot

d. Closed cell foam: Vapor permeability ASTM E96 0.2 perm

e. Max moisture absorption: 1.0 percent by volume, 10 percent by weight

f. Molded pipe insulation

1) Maximum 0.27 K factor at 75 degrees Fahrenheit mean temperature

2) Maximum water vapor transmission rating of 0.17 perm-inches

g. Sheet insulation

1) Maximum 0.28 K factor at 75 degrees Fahrenheit mean temperature

2) Maximum water vapor transmission rating of 0.17 perm-inches

h. Seal with Rubatex adhesive or equal

i. Armacell Armaflex or equal

3. Calcium Silicate

a. Insulation ASTM C 533, Type I

1) ESLIN Industrial Insulation also acceptable

b. Sectional with 14 pounds per cubic foot nominal density

c. 0.45 maximum K-factor at 300 degrees Fahrenheit mean temperature and 1200 degrees Fahrenheit maximum service rating

d. Waterproofed

e. Flexural Strength 100 pounds per square inch

f. JM Thermo-12 Gold or equal

B. Jackets

1. Factory Applied Vapor Barrier All Service Jacket (ASJ)

a. ASTM C921, White kraft paper bonded to aluminum foil

b. Moisture Vapor Transmission: ASTM E96; 0.02 perm inches

c. Secure with self sealing longitudinal laps and butt strips.

d. Seal all seams with vapor barrier coating.

e. Coat all insulated fittings, elbows, and valves with vapor barrier coating and reinforcing mesh.

f. Tie Wire: See Paragraph 2.03E.1, with twisted ends on maximum 12 inch centers

g. Vapor Barrier Lap Adhesive: Compatible with insulation

2. Aluminum Jacket: ASTM B209

a. Use for weatherproof jacket

b. Thickness: 0.016 inch sheet

c. Finish: Embossed

d. Joining: Longitudinal slip joints and 2 inch laps

e. Fittings: 0.016 inch thick die shaped fitting covers with factory attached protective liner

f. Metal Jacket Bands: 3/8 inch wide; 0.015 inch thick aluminum or 0.010 inch thick stainless steel

3. Preformed PVC

    a. Polyvinylchloride covers similar to Manville Zeston.

    b. Color: white

4. Equipment insulation facings: Foil-scrim-kraft laminate of aluminum foil facing, glass scrim reinforcing, kraft paper backing

C. Preformed Pipe Fitting Covers

1. Aluminum

    a. Factory fabricated formed covers

    b. General Aluminum Supply Corporation GASCO or equal

2. PVC

    a. Factory fabricated formed covers

    b. Manville Zeston or equal

    c. Grooved end piping: Proto Corporation Losmoke or equal

D. Adhesives and coatings

1. Foster and Childers product names and figure numbers or approved equal

    a. Lagging adhesive: Foster 30-36; Childers CP-50AMV1

    b. Vapor barrier coating

        1) Foster Vapor Safe 30-80

        2) UP Label, comply with MIL-C-19565C, Type II; fire and water resistant

        3) Permeance no greater than 0.08 perms at 37 mil dry film thickness as test by ASTM F 1249

    c. Vapor-seal adhesive (lap adhesive): Foster 85-60

    d. Fiberglass adhesive (duct liner and duct wrap adhesive): Meets ASTM C916 Type II. Foster 85-60; Childers CP-127

    e. Cellular glass bedding and sealing compound adhesive: Foster Foamseal 30-45; Childers CP-70

    f. Outdoor vapor barrier coating: Foster 30-90. Permeance no greater than 0.08 perms at 37 mil dry film thickness as test by ASTM F 1249.

    g. Elastomeric insulation: 520 contact adhesive

E. Wire, banding and fastening devices

1. Wire: minimum 16 gauge copper clad annealed steel wire

2. Bands: 3/4 inches nominal width with wing seals, of minimum thickness as follows:

    a. Aluminum: 0.007 inches. Except where exposed to weather, 0.020 inches

    b. Galvanized steel: 0.005 inches

    c. Stainless steel: 0.010 inches

3. Staples: outward clinching type of corrosion resistant steel

F. Mechanical Fasteners

1. Mild steel, copper plated

2. AGM Industries Power Base insulation pins or equal

3. Insulation washers

    a. Galvanized steel

    b. 1- 1/2 inch diameter

    c. AGM Industries SLW-1 or equal

G. Provide a continuous vapor seal for any service piping or equipment that carries liquid below 60 degrees Fahrenheit. Coat all ASJ vapor retarder seams with vapor barrier coating to prevent moisture ingress. Coat all ASJ seams with vapor barrier coating.

H. Pre-insulated pipe support and shields

1. Provide insulated pipe supports for all insulated pipe and tubing.

2. Hangers and supports shall fit outside of all pipe insulation and insulation inserts. See Section 230529 Hangers and Supports

3. Insulated pipe supports

    a. Pipe Shields, Inc. or equal

    b. Waterproof calcium silicate or polyurethane insulation insert

    c. Galvanized steel or aluminum shield

    d. Minimum temperature rating equal to maximum design fluid temperature plus 25ºF

    e. Load rated, based upon testing and analysis in conformance with the latest edition of the following codes: ASME B31.9, MSS SP-58, MSS SP-69 and MSS SP-89

4. Pipe supports for use on flat surfaces shall have integral load distribution plates coated with zinc primer minimum 3 mils thick.

5. Install pre-insulated pipe supports per manufacturer's installation instructions. Shield lengths and gauges shall also be per manufacturer's recommendations.

6. Tape all butt joints where pipe insulation butts up against hanger shield

a. On hot pipe, apply three inch wide vapor barrier tape or band over the butt joint

b. On cold pipe, apply a wet coat vapor barrier lap cement on all butt joints and seal the joints with a minimum of three inch wide vapor tape or band and vapor barrier coating.

I. Fire-stopping

1. At pipe penetrations through rated assemblies

2. Commercial pipe sleeve assemblies that are UL listed and that have been approved by the fire marshal for this purpose

3. Insulation shall be continuous through penetration.

J. Accessories

1. Insulation Protection Saddles: 12-inch long, 16 gauge steel

2. Paint: Ultraviolet resistant latex paint with special adherence capabilities to the fitting covers, elastomeric, aluminum facing, Kraft paper, tapes and adhesives

K. Equipment Insulation

1. Glass fiber, semi-rigid

a. Insulation: ASTM C612; rigid, noncombustible

1) 'K' ('ksi') value: ASTM C335, 0.24 at 75 degrees Fahrenheit

2) Maximum service temperature: 450 degrees Fahrenheit

3) Maximum moisture absorption: 0.1 percent by volume

4) Density: 3.0 pounds per cubic foot density

b. Vapor Barrier Jacket

1) Kraft paper bonded to aluminized film

2) Moisture vapor transmission: ASTM E96; 0.04 perm

3) Secure with self sealing longitudinal laps and butt strips. Minimum lap 2 inches

4) Secure with bands, adhesive or ties

c. Facing: 1 inch galvanized or stainless steel hexagonal wire mesh stitched on one face of insulation

d. Vapor Barrier Lap Adhesive: Compatible with insulation

e. Insulating Cement/Mastic: ASTM C195; hydraulic setting on mineral wool

2. Jackets

a. Aluminum

b. Use for weatherproof jacket

c. Thickness: 0.016 inch sheet

d. Finish: Embossed

e. Joining: Longitudinal slip joints and 2 inch laps

f. Fittings: 0.016 inch thick die shaped fitting covers with factory attached protective liner

g. Metal Jacket Bands: 3/8 inch wide; 0.015 inch thick aluminum or 0.010 inch thick stainless steel

3. Equipment insulation facings: Foil-scrim-kraft laminate of aluminum foil facing, glass scrim reinforcing, kraft paper backing

4. Wires, bands and fastening devices

a. Wires: Minimum 16 gage galvanized steel wire

b. Bands: 3/4 inch nominal width wing seals, of minimum thickness as follows

1) Aluminum: 0.007 inches indoors. Where exposed to weather 0.020 inches

2) Stainless Steel: 0.010 inches

L. Duct Insulation

1. Duct Wrap with Vapor Barrier; Type DW-V

a. Insulation

1) ASTM C553

2) Flexible, noncombustible blanket

3) K-value: ASTM C518, 0.3 at 75 degrees Fahrenheit

4) Maximum service temperature: 250 degrees Fahrenheit

5) Maximum moisture absorption: 0.20 percent by volume

6) Minimum density: 0.75 pounds per cubic foot

b. Vapor Barrier Jacket

1) Factory installed Foil Scrim Kraft (FSK)

2) Kraft paper reinforced bonded to aluminized film

3) Moisture vapor transmission: ASTM E96 Procedure E; 0.02 perm

c. Vapor Barrier Tape: Kraft paper reinforced bonded to aluminized film, with pressure sensitive rubber based adhesive

d. Owens-Corning All Service Faced Duct-Wrap or equal

2. Duct Board without Vapor Barrier; Type DB

a. Insulation

1) ASTM C612

2) Rigid, noncombustible blanket

3) K-value: ASTM C518, 0.25 at 75 degrees Fahrenheit

4) Maximum service temperature: 250 degrees Fahrenheit

5) Maximum moisture absorption: 0.20 percent by volume

b. Owens-Corning Type 703 or equal

3. Duct Board with Vapor Barrier; Type DB-V

a. Insulation

1) ASTM C612

2) Rigid, noncombustible blanket

3) K-value: ASTM C518, 0.25 at 75 degrees Fahrenheit

4) Maximum service temperature: 250 degrees Fahrenheit

5) Maximum moisture absorption: 0.20 percent by volume

b. Vapor Barrier Jacket

1) Factory installed Foil Scrim Kraft (FSK)

2) Moisture vapor transmission: ASTM E96 Procedure E; 0.02 perm

c. Vapor Barrier Tape: Kraft paper reinforced bonded to aluminized film, with pressure sensitive rubber based adhesive

4. Tie Wire: Annealed steel, 16 gage

M. Duct and Plenum Lining

1. Rectangular Duct Lining; Type AL

a. Material

1) Insulation: ASTM C423

2) K-value: ASTM C518, 0.23 at 75 degrees Fahrenheit

3) Maximum service temperature: 250 degrees Fahrenheit

4) Maximum moisture absorption: 0.20 percent by volume

5) 1-1/2 pounds per cubic foot unless shown otherwise to be 3 pounds per cubic foot

6) Minimum noise reduction coefficient (NRC) rating of 0.7 at 1 inch, 0.9 at 2 inch

b. Interior air-side surface

1) Smooth black neoprene or matte facing overlay on air side. Coating shall conform to NFPA 90A, ASTM C665, ASTM G21

2) Suitable for velocity up to 4000 feet per minute

3) Meet erosion test method described in UL publication No. 181

4) Durable and mechanically cleanable

5) EPA registered anti-microbial agent

6) Certainteed Toughgard R Duct Liner or equal

7) Adhesives

a) Duct Insulation, Internal: Foster 85-60 or equal

b) Weld Pins: Duro-Dyne CP or equal

2. Round Duct Lining; Type RAL

a. Material same as Paragraph 2.03M.1.a

b. Interior air-side surfaces same as Paragraph 2.03M.1.b

c. Self-supporting, slide-in installation

d. JM Permacote Spiracoustic or equal

e. Small diameter ducts which cannot be insulated internally using duct lining materials shall be pre-fabricated. Insulation material shall be fixed between outer duct metal and a perforated metal liner. United McGill k27 series or equal. Fittings shall be insulated to same standard and shall be by same manufacturer.

3. Plenum Lining; Type PL

a. Material same as Paragraph 2.03M.1.a

b. Interior air-side surfaces same as Paragraph 2.03M.1.b

PART 3 EXECUTION

3.01 PIPE & EQUIPMENT INSULATION SCHEDULE

A. Insulation Application Types

1. Type P-1

a. Molded fiberglass

b. All-service jacket

c. Vapor-sealed

2. Type P-1A

a. Molded fiberglass

b. Aluminum preformed jacket or PVC jacket

c. Vapor-sealed

3. Type P-2

a. Molded fiberglass

b. All-service jacket

4. Type P-2A

a. Molded fiberglass

b. Aluminum preformed jacket or PVC jacket

5. Type P-3: Flexible elastomeric insulation

6. Type P-4

a. Calcium silicate insulation

b. Aluminum preformed jacket

7. Type E-1

a. Fiberglass board

b. Minimum 3 pounds per cubic foot density

c. Foil-scrim-kraft facing

d. Vapor-sealed

8. Type E-2

a. Fiberglass board

b. Minimum 3 pounds per cubic foot density

c. Segmented or scored for curved surfaces

9. Type E-3: Flexible cellular foam insulation

B. Application Schedule

Service	Location	Type	Pipe Size	Thickness
Hot and chilled water piping	General	P-1	All	Per Title 24, 1.5 inch minimum
Hot water and new domestic piping	General	P-2	All	Per Title 24, 1.5 inches minimum
Hot water pump, HWP-1	General	E-2 or E-3		Per Title 24, 2 inches minimum
Hot and chilled water buffer tanks	General	E-2 or E-3		Per Title 24, 2 inches minimum
Hot water reheat coil frame and tube bends	Ceiling return air plenum, and unconditioned spaces	E-2 or E-3 or DW-V duct wrap		1/2 inch E-2/3 1.5 inch DW-V

C. Non-insulated piping and equipment

1. Cooling coil condensate drains except concealed horizontal portions

2. Expansion tanks and piping to them other than the first 2 feet from the point of connection at piping mains

3. Pot feeders and piping to them other than the first 2 feet from the point of connection at piping mains

4. Vent, overflow, drain and relief, except as noted otherwise

3.02 PIPING INSULATION INSTALLATION

A. Install materials in accordance with manufacturer's instructions

B. Coordinate with work of other trades

C. Deliver material to job site in original non-broken factory packaging, labeled with manufacturer's density and thickness

D. Install insulation where it cannot become wet. If insulation becomes wet, remove and dispose of properly and replace with new, dry insulation. Wetted insulation is not acceptable. Ensure insulation is dry before and during installation.

E. Insulate all piping, valves, fittings, flanges and accessories

F. On piping exposed to public view, locate insulation and cover seams in least visible locations

G. Insulate fittings, joints and valves with insulation of same material and thickness as adjoining pipe. Use pre-molded fiberglass fitting covers or radial mitered segments of pipe insulation. For strainers, expansion joints, fittings and accessories requiring servicing or inspection insulation shall be removable and replaceable without damage.

H. Insulate flanges with insulation sleeve of same material as pipe insulation to cover flange and overlap insulation on adjacent piping

I. Continue insulation through walls, sleeves, pipe hangers and other pipe penetrations

J. Finish insulation at supports, protrusions and interruptions. No hangers or supports shall be embedded in insulation. Do not insulate expansion bellows.

K. Fiberglass insulation

1. Provide insulation with factory applied vapor barrier jackets
2. Butt edges neatly. ASJ with 3 inch minimum butt strips
3. Longitudinal overlaps: Minimum 2 inch self sealing, double adhesive
4. Apply additional jacket as specified
5. For piping conveying fluids below ambient temperature finish with vapor barrier adhesive

L. Calcium Silicate Insulation

1. Provide insulation without vapor barrier
2. Secure insulation sections with min. 16 gage wire
3. Build up coating of insulating and finishing cement
4. Provide calcium silicate rings between flange sleeve and pipe insulation
5. For piping conveying fluids below ambient temperature finish with vapor barrier adhesive
6. Apply additional jacket as specified. If no additional jacket specified apply skim coat of finishing cement to smooth out surface of fitting insulation

M. Elastomeric Tubing

1. Provide insulation
2. Butt edges neatly. Seal longitudinal and transverse joints with adhesive to maintain minimum vapor permeance. Adhesive shall be selected and applied in accordance with insulation manufacturer's recommendations.
3. Apply additional jacket as specified

N. For all pipe systems exposed in the mechanical penthouse spaces, finish with an all service jacket

O. For insulation exposed to weather

1. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe, and finish with glass mesh reinforced vapor barrier cement.
2. Cover with weatherproof aluminum jacket with seams located on bottom side of horizontal piping. For mechanical joints (such as Victaulic) only, 30 mil UV-resistant PVC fitting covers are acceptable in lieu of aluminum.

P. Perform work at ambient and equipment temperatures as recommended by adhesive manufacture

Q. Protection: Protect against dirt, water, chemical, or mechanical damage before, during, and after installation. Repair or replace damaged insulation at no additional cost

R. All vapor barriers shall be continuous. Tears, holes, staples, etc. shall be coated with vapor barrier mastic and patch with facing or tape.

S. Joints between insulation and access shall be sealed with vapor barrier mastic

3.03 PIPE INSULATION APPLICATION

A. General

1. Before applying insulation

a. Test piping for tightness and obtain approval

b. Clean surfaces to be insulated of dust, grease and foreign matter

2. Butt edges neatly

3. Fill voids with insulating cement

4. Longitudinal overlaps

a. 2 inches minimum

b. For exposed work: toward ceiling or wall

c. For weatherproof aluminum jackets: on side to shed water

5. Circumferential overlaps on weatherproof aluminum jackets: 2 inches minimum

6. Continuous insulation passing through sleeves or other openings

7. Oversize insulation to accommodate heat tracing on piping

B. Valves, fittings, flanges and accessory insulation

1. Unless otherwise noted, insulate

a. Valves including bonnets

b. Flanges

c. Fittings

d. Strainers

e. Expansion joints

f. Specialties

2. Insulation for strainers, expansion joints, fittings and accessories requiring servicing or inspection

a. Insulation removable and replaceable without damage

b. Enclosed within two piece, No. 18 gauge aluminum covers fastened with cadmium plated bolts and nuts

3. Insulation of same thickness as adjacent piping insulation

4. For piping systems insulated with fiberglass

    a. Wire on pre-molded fiberglass fitting covers or mitered segments of pipe insulation

    b. For pipe sizes under 3 inches, hydraulic setting insulating cement may be used

    c. Vapor barrier for vapor-sealed insulation only

        1) Apply uniform layer of vapor barrier coating to cover entire surface of fitting insulation

        2) Embed layer of fiberglass tape into wet coating, extending 2 inches over adjoining pipe covering

        3) Apply finish layer of vapor barrier coating over entire surface

    d. Finish for exposed locations only

        1) Apply skim coat of insulating cement to smooth out surface of fitting insulation

        2) Embed layer of fiberglass tape into uniform coat of wet mastic, extending 2 inches over adjoining pipe covering

        3) Apply finish coat of same mastic over entire surface of fitting insulation

5. For piping systems insulated with calcium silicate

    a. Wire on pre-molded sections of calcium silicate fitting covers or mitered segments of pipe insulation

    b. Under 3 inches pipe size, built up coating of insulating and finishing cement to match thickness of adjoining pipe insulation, may be used

    c. For exposed locations only, apply skim coat of finishing cement to smooth out surface of fitting insulation

6. Flanges

    a. Insulation sleeve of same material as pipe insulation, to cover flange and overlap insulation on adjacent piping

    b. For calcium silicate insulation provide calcium silicate rings between sleeve and pipe insulation

C. At pipe hangers

1. Insulation protection shields specified in Section 230529 Hangers and Supports

2. Butt insulation to shields

3. Cold piping: Wet coat of vapor barrier lap cement on all butt joints

D. Jackets and facings

1. Vapor-sealed types: continuous; staples not permitted

2. Adhere longitudinal laps: Adhere 3 inches wide joint strip, of same material as facing, at center of each butt joint

3. Adhesives

   a. Vapor-sealed insulation: vapor-seal adhesive

   b. Heating service insulation: vapor-seal adhesive

   c. Weatherproof aluminum jacket: sealing compound

   d. Underground asphalt felt jacket: asphalt mastic

E. Wiring, banding and fastening devices: Secure insulation to piping and equipment in accordance with following minimum requirements

   1. Piping insulation section 3 foot long

      a. Concealed vapor-sealed insulation banded at ends and center

      b. Other concealed insulation banded at ends and center or stapled on 2 inches centers

   2. Pipe fitting insulation

      a. Loops of wire to secure mitered segments of insulation

      b. Wire spiraled on from end to end on blanket insulation

   3. Outdoor piping weatherproof aluminum jackets banded at circumferential joints and center of each section: Lap joint at bottom

3.04 EQUIPMENT INSULATION

A. Apply insulation close to equipment by grooving, scoring, and beveling insulation. Secure insulation to equipment with bands, welded-on anchors, ties or adhesive. Where access to equipment is required for testing or maintenance the insulation shall be installed so that it is removable and so that the vapor barrier can be remade after access.

B. Fill joints, cracks, seams, and depressions with bedding compound to form smooth surface. On cold equipment, use vapor barrier cement.

C. For cold equipment or equipment containing fluids below ambient temperature

   1. Insulate entire system

   2. Provide vapor barrier jackets, factory applied or field applied

   3. Finish with glass cloth and vapor barrier adhesive

   4. Cover with aluminum jacket where specified

D. For equipment containing fluids above ambient temperature

   1. Insulate entire system

2. Provide standard jackets, with or without vapor barrier, factory applied or field applied

3. Finish with glass cloth and adhesive

4. Cover with aluminum jacket where specified

5. For hot equipment containing fluids 140 degrees Fahrenheit or less, do not insulate flanges and unions, but bevel and seal ends of insulation

6. For hot equipment containing fluids over 140 degrees Fahrenheit, insulate flanges and unions with removable sections and jackets

E. Finish insulation at supports, protrusions, and interruptions

F. For equipment in mechanical equipment rooms or in finished spaces, finish with aluminum jacket

G. Do not insulate over nameplate or ASME stamps; bevel and seal insulation around such

H. General

1. Apply insulation with edges tightly butted

a. Joints staggered and secured in place by steel bands

b. Where necessary weld on suitable anchors

2. Seal with 520 adhesive

I. Special considerations

1. Strainers and suction diffusers: removable and replaceable covers to allow strainer removal

2. Pumps: removable and replaceable covers to allow impeller replacement

3. Provide sufficient clearance around openings for normal operation of equipment

3.05 DUCT & PLENUM INSULATION

A. Duct Insulation Type and Thickness Schedule

Location	Cooling or Heat/Cool Supply	Heating-only Supply	Return	Exhaust
Concealed in ceiling or return air plenum	1.5 inches DW-V	1.5 inches DW-V	–	–
In unconditioned spaces	1.5 inches DW-V	1.5 inches DW-V	1.5 inches DW-V	–
Exposed within conditioned space	–	–	–	–
In mechanical penthouse	1.5 inches DW-V	1.5 inches DW-V	–	–
Lined duct on drawings indicated to have 2 inch liner	2 inches 1.5 pounds per cubic foot AL	2 inches 1.5 pounds per cubic foot AL	2 inches 1.5 pounds per cubic foot AL	2 inches 1.5 pounds per cubic foot AL

Location	Cooling or Heat/Cool Supply	Heating-only Supply	Return	Exhaust
Lined duct on drawings (unless otherwise noted)	1 inch 1.5 pounds per cubic foot AL or RAL	1 inch 1.5 pounds per cubic foot AL or RAL	1 inch 1.5 pounds per cubic foot AL or RAL	1 inch 1.5 pounds per cubic foot AL or RAL
Terminal cans	0.5 inches 1.5 pounds per cubic foot AL	0.5 inches 1.5 pounds per cubic foot AL	0.5 inches 1.5 pounds per cubic foot AL	–
Flex duct	By manufacturer	By manufacturer	By manufacturer	–

B. Non-Insulated Ductwork

1. No insulation required for ducts so indicated in Duct Insulation Type and Thickness Schedule, plus

   a. Exhaust ducts, unless shown to be lined

   b. Outside air ducts

3.06 DUCT INSULATION INSTALLATION

A. General

1. Ensure that insulation is continuous through inside walls: See 230548 Vibration and Seismic Control for packing openings through walls

2. Finish insulation neatly at hangers, supports and other protrusions

3. Locate insulation joints or cover seams in least visible locations

4. Where ducts run in groups too close to be individually insulated and finished

   a. Completely fill all spaces between ducts with rigid or flexible insulating material

   b. Insulate and finish exterior surfaces of group as specified for particular service

5. Where ducts cannot be insulated after erection, insulate prior to installation

6. Where specified thickness of insulation and/or lining exceeds available thickness in single layer, provide insulation and/or lining in 2 or more layers with joints staggered

7. Preparation

   a. Do not install covering before ductwork and equipment has been tested and reviewed

   b. Ensure surface is clean and dry prior to installation

   c. Ensure insulation is dry before and during application

8. Mechanical fasteners

   a. Use spot weld anchors in all shop fabricated internally lined ducts

b. Adhered anchors

c. Clip off pin penetrations flush with insulation surface or facing

d. Seal pins and washers where pins penetrate vapor barriers

1) With 4 inch square pieces of vapor barrier material to match facing

2) Adhere with vaporseal adhesive

e. Spacing on rectangular ducts

1) Typical of horizontal and vertical, unless otherwise specified

2) Duct board

a) 3 inches in from edges

b) Intermediate fasteners: 12 inches on counter maximum spacing all directions

c) Not less than four pins per surface

3) Duct wrap

Side Dimension	Maximum Spacing
24 inches and under	None required.
25 to 32 inches	Horizontal - none. Vertical: 1 row centered, 12 inches on center
33 to 48 inches	2 rows, 12 inches on center.
49 to 60 inches	3 rows, 12 inches on center.
61 inches and over	16 inches on center, all directions.

4) Duct wrap spacing applicable to flat surfaces of flat oval ducts

9. Provide 24 gauge sheet metal Z section frames over edges of duct and plenum lining

a. At access openings and doors

b. Along edges exposed to air flow

B. Rectangular Duct Wrap

1. Without vapor barrier

a. Comply with published recommendations of manufacturer and with following

b. Secure with 4 inch strips of adhesive, 8 inches on center

c. For rectangular ducts 24 inches and wider, secure to bottom of duct with mechanical fasteners 18 inches on center

d. Wrap with 18 gauge galvanized wire, 16 inches on center

2. With Vapor Barrier

a. Vapor barrier and sealing continuous without breaks. Vapor proof seal around supports and bracing

b. 2 inches lap strip at one end

c. Peel insulation for 2 inch lap strip along longitudinal joints

d. Seal lap strips with vaporseal adhesive; Foster's 85-60 or equal

C. Round Duct Wrap

1. General

a. Adhere flexible insulation to ductwork with adhesive applied in 6 inch wide strips on 16 inch centers

b. Provide 16 gauge annealed tie wire tied, spiral wound or half hitched at 16 inch centers

c. Overlap insulation 2 inches and seal joints and breaks with 2 inch lap of foil adhered over joint

2. Apply duct wrap with vapor barrier as specified above for rectangular ducts

D. Duct Board

1. Comply with published recommendations of manufacturer

2. Secure on top, sides and bottom of duct with mechanical fasteners, spacing as scheduled

3. Secure with 4 inch strips of adhesive, 8 inch on center

E. Rectangular Duct and Plenum Lining

1. Comply with SMACNA Duct Liner Application Standard, published recommendations of manufacturer, and following:

2. Apply adhesive over 100 percent of surfaces to be lined

3. The coated surface shall face air stream

4. Surface adjacent to air flow, including at joints, to be uniformly flat

5. Insulation on floors of plenums and large ducts where access is required shall be protected by wire mesh so that lining is not damaged when walked or crawled on.

6. Blank-Off Panels: Insulation, enclosed with sheet metal on all sides; all joints with vapor barrier mastic and taped

7. Volume Dampers: Where volume dampers do not allow for continuous insulation, terminate insulation clear of handle sweep and finish edges to maintain vapor barrier and to prevent damage to the insulation

8. Seal butt joints and exposed edges of liner to prevent erosion

9. Edges at terminal points shall be provided with metal beading and heavily coated with adhesive

10. Damaged areas replaced or heavily coated with adhesive

11. Mechanical fasteners

    a. Use weld pins

    b. Install mechanical fasteners

        1) Weld pins flush with liner surface. Weld pins spaced maximum of 12-inch on center in both directions and within 2 inches of all corners and joints, except where SMACNA Standard requires closer spacing

        2) Within 2 inches of all edges

        3) Minimum 4 pins per side

        4) For field alterations of lined ducts, install adhesive and glued pins with washers. Clip-off pins after washers installed. Field installed pins shall be used for unusual conditions only and shall not exceed 1 percent of total pins.

3.07 PENETRATIONS THROUGH RATED WALLS

A. Refer to drawings for penetrations of rated assemblies.

B. Install per manufacturer's installation and listing requirements.

3.08 FIELD QUALITY CONTROL

A. Repair separation of joints or cracking of insulation due to thermal movement or poor workmanship

B. All vapor barriers shall be continuous; tears, holes, staples, etc. shall be coated with vapor barrier mastic and patch with facing or tape

C. See Section 23 31 00 Ducts for protection of lined duct during construction

END OF SECTION

SPECIFICATION 23 08 00
HVAC COMMISSIONING

PART 1 GENERAL

1.01 SUMMARY

A. Commissioning of selected systems and equipment specified under Division 23 Heating Ventilating and Air Conditioning

B. Acceptance Testing per California Title 24, Part 6 Building Energy Efficiency Standards

1.02 COMMISSIONING SCOPE

A. Fully commission the following equipment and systems

1. Air handler unit
2. Air to water heat pumps
3. Air distribution systems
4. Terminal units
5. Exhaust and transfer fans
6. Hydronic water pumps
7. Hydronic piping systems
8. Variable speed drives

1.03 TITLE 24 ACCEPTANCE TESTING SCOPE

A. Responsible Parties

1. Field Technician. Acceptance tests shall be conducted by a technician certified by an Acceptance Test Technician Certification Provider approved by the California Energy Commission. The Field Technician shall complete and sign all forms including the Certificate of Acceptance.

2. Responsible Person. The Certificate of Acceptance form shall be signed by a representative of the Contractor who is a licensed professional who is eligible under Division 3 of the Business and Professions code in the applicable classification. The Responsible Person shall assume responsibility for the acceptance testing work performed by the Field Technician, and if necessary shall interview the person who performed the acceptance test work in order to ascertain whether the testing work reported on the Certificate of Acceptance was completed as reported and is consistent with the Responsible Person's expectation.

B. Provide acceptance testing and complete documentation forms for the following tests and systems.

1. Test NA7.5.1.1 Variable Air Volume Systems Outdoor Air Acceptance.

a. VAV air handling unit

2. Test NA7.5.3 Air Distribution Systems

   a. As required per Title 24 2013 Section 140.4(l)

3. Test NA7.5.4 Economizer Controls

   a. VAV air handling unit with outdoor air economizers

4. Test NA7.5.5 Demand Control Ventilation (DCV) Systems

   a. VAV air handling unit with CO_2 sensors

5. Test NA7.5.6 Supply Fan Variable Flow Controls

   a. VAV air handling unit

6. Test NA7.5.7 Valve Leakage Test

   a. Hot water reheat systems

7. Test NA7.5.8 Supply Water Temperature Reset Controls

   a. All air to water heat pump systems

8. Test NA7.5.10 Automatic Demand Shed Control Acceptance

   a. BAS

9. Test NA7.5.15 Supply Air Temperature Reset Controls

   a. VAV air handling unit

1.04 RESOURCES

A. Provide required personnel with tools and equipment necessary to perform testing specified in this Section.

B. Provide equipment factory representative for startup work as necessary or as specified.

1.05 SUBMITTALS

A. See Section 23 05 01 Basic Mechanical Materials and Methods.

B. Submit product data, O&M data, and samples and show item on shop drawings (where shop drawings are required) according to the following table.

1. “R” means required.

2. “R2” means required only for products and equipment differing for the specified manufacturer and model and for “or equals” where specified.

Item	Product Data	O&M Manual	Samples	Shop Drawing
Prefunctional test reports		R	R	

Item	Product Data	O&M Manual	Samples	Shop Drawing
Functional test reports		R		
Training materials		R		

PART 2 PRODUCTS

2.01 GENERAL

A. Products and materials shall be as described in related sections.

PART 3 EXECUTION

3.01 GENERAL

A. All tests and readings during the equipment and system startups shall be recorded with signature of the Contractor's technician performing work and date work was performed.

B. Verify that operational manual/procedures are complete, on-site, and fully reviewed by Contractor's start-up technician prior to start-up and testing.

3.02 START-UP & INITIAL CHECKOUT

A. The Contractor shall follow the start-up and initial checkout procedures specified for each system and piece of equipment.

B. Inspect equipment and confirm that it is clean and ready for operation with all shipping tags and restraints removed.

C. This work shall be performed by the Contractor with the assistance of factory personnel where specified.

D. All tests and readings during the equipment and system startups shall be recorded with signature of the Contractor's technician performing work and date work was performed.

3.03 COMMISSIONING

A. See Section 01 91 00 Commissioning for description of Commissioning Team, Commissioning Provider, Commissioning Coordinator, Commissioning Schedule, and System/Equipment Matrix.

B. Participate as a member of the Commissioning Team

1. Assist the Commissioning Coordinator in the creation and maintenance of the Commissioning Schedule and System/Equipment Matrix.

2. Provide regular feedback to the Commissioning Coordinator as to the status of tasks identified in the Commissioning Schedule.

3. Attend Commissioning Team Meetings.

C. Pre-Functional Tests

1. Prepare pre-functional checklists for each piece of equipment and each system listed in Paragraph 1.02 using forms listed at the end of this Section. Where forms are not provided, prepare appropriate forms and submit to the Owner's Representative for review. Contractor may also use their own forms if they are submitted and approved by the Owner's Representative.

2. Verify that pre-functional testing is complete prior to startup.

3. Provide all materials and labor, including testing and inspection, to complete the pre-functional checklists.

4. Collect checklists and submit to the Owner's Representative for review and approval.

5. Address Owner's Representative punch list items before functional testing begins.

D. Startup: Start and test all equipment per manufacturers' installation instructions

E. Testing, Adjusting and Balancing:

1. See Section 23 05 93 Testing, Adjusting and Balancing.

2. Complete test and balance of all air or hydronic systems, including spot checks, with discrepancies and problems remedied before functional testing begins.

F. Functional Testing

1. Functional testing is specified under Division 25 Building Automation Systems

2. Review functional test procedures to ensure feasibility, safety and equipment protection and provide revisions deemed to be necessary in writing to Commissioning Coordinator.

3. Provide skilled personnel to assist Division 25 Building Automation Systems in the functional testing and demonstration of system performance. Coordinate required skills with Division 25 Building Automation Systems.

4. While functional testing is primarily performed under Division 25 Building Automation Systems, the installing Division 23 Contractors shall retain responsibility for complete and fully functional systems and sub-systems installed under their contract. Commissioning procedures and functional testing do not relieve or lessen this responsibility.

G. Demonstration Tests

1. Demonstration testing is specified under Division 25 Building Automation Systems; no work required under this section

H. Remedial Work: See Section 01 91 00 Commissioning

3.04 TITLE 24 ACCEPTANCE TESTING

A. The Contractor shall be responsible for providing all necessary instrumentation, measurement and monitoring, and performing all required acceptance requirement procedures in accordance with Title 24 Building Energy Efficiency Standards and Appendix NA of the Reference Appendices.

B. The Contractor shall be responsible for correcting all performance deficiencies and again implementing the acceptance requirement procedures until all specified systems and equipment are performing in accordance with the Standards.

C. The Contractor shall be responsible for documenting the results of the acceptance requirement procedures including paper and electronic copies of all measurement and monitoring results. The Contractor shall be responsible for performing data analysis, calculation of performance indices and crosschecking results with the requirements of the Standard.

D. The Contractor shall be responsible for preparing and issuing a Certificate of Acceptance for each test for each system. Each Certificate of Acceptance shall include the Contractor's signature and California License number.

E. For test procedures, see Appendix NA7 of the Title 24 Reference Appendices. For test forms, see 2013 Nonresidential Compliance Manual.

3.05 TRAINING

A. This Section applies to all Work performed under Division 23. See Division 25 Building Automation Systems for BAS training.

B. General

1. Comply with Training section in Division 1.

2. Training shall cover all systems and equipment that require expertise to operate and maintain including but not limited to training specified under individual Division 23 Sections.

3. Unless approved otherwise by the Owner's Representative, training sessions shall occur only after

a. Successful completion and approval of BAS Functional and Demonstration tests. See Division 25 Building Automation Systems.

b. Completion Requirements specified in Section 23 05 01 Basic Mechanical Materials and Methods have been fully submitted and approved.

C. Training Sessions

1. Engage a qualified trade or manufacturer's representative to provide the instructions on each major piece of equipment. This trainer may be the start-up technician for the piece of equipment, the installing contractor, or a manufacturer's representative. Where required by individual Division 23 Sections, trainers shall be factory-trained and authorized. Practical building operating expertise as well as in-depth knowledge of all modes of operation of the specific piece of equipment is required. More than one party may be required to execute the training.

2. Start training with classroom sessions followed by hands-on training on each piece of equipment.

a. Classroom training shall use slides, drawings, and O&M manuals to cover as a minimum:

1) The equipment's specific location in the building and in the mechanical system

2) Purpose and mechanical function of the equipment

3) A brief working knowledge of the operating theory of the equipment

4) Submittal drawings, catalog data, and O&M manual content and organization

5) Available parts lists, including recommendations regarding parts that should be readily available and stored on site

6) Local representatives for service, parts, and repair, including contact information

7) Startup, shutdown, normal operation, and emergency operating procedures

8) Safety and emergency procedures including proper precautions when around equipment

9) Daily, weekly, monthly, quarterly, semiannual and annual routine preventative maintenance requirements and procedures

10) Required equipment exercise procedures and intervals

11) Normal and major repair procedures

12) Equipment inspection and troubleshooting procedures including the use of applicable test instruments

13) Routine and long-term calibration procedures

b. Hands-on training shall be on-site and use O&M manuals as a guide to cover as a minimum:

1) Location of equipment

2) Piping connections and flow directions

3) Valves, including control and flow balancing valves, and their purpose

4) Instrumentation and controls, and interpretation of displayed information

5) Demonstrate startup and shutdown procedures

6) Identify location of all related equipment power disconnect switches, fuses and circuit breakers

7) Demonstrate required equipment exercise procedures

8) Demonstrate and perform standard operating procedures and checks

9) Demonstrate routine preventative maintenance activities including mechanical and electrical adjustments and calibration

10) Demonstrate routine disassembly and assembly of equipment if applicable

11) Identify and review safety items and perform safety procedures

D. Training Duration and Schedule

1. The length and quantity of training sessions will depend on the complexity of the system and equipment. Minimum training shall be 16 hours, but period shall be longer if required to complete the training tasks described herein and in individual Division 23 Sections.

2. Training sessions shall be scheduled with classroom sessions interspersed with hands-on field instruction in logical sequence.

3. Unless otherwise approved by Owner's Representative, training for a given system or piece of equipment shall be conducted on consecutive days with no more than 4 hours of training scheduled for any one day.

4. Training Plan Submittals & Timing

   a. Develop a preliminary training plan outline and schedule of training dates and submit to the Owner's Representative for review and approval a minimum of 60 days before the planned training sessions.

   b. Once the training plan outline is approved, submit one complete set of lesson plans, training manuals, handouts, visual aids and reference material organized in tabbed binder(s) to the Owner's Representative for review and approval a minimum of 30 days before the planned training sessions.

   c. Provide training materials to Owner's Representative 7 days before the planned training sessions. Provide one set of materials for each trainee as directed by Owner, up to a maximum of 10 copies. Additional copies shall be provided at the cost of reproduction without mark-up if requested by Owner's Representative.

5. Provide final training materials in electronic format copied to optical disk and to BAS Workstation per Section 23 05 01 Basic Mechanical Materials and Methods.

E. Training Video

1. Owner shall be authorized to record all demonstration and training sessions at Owner's option and expense.

3.06 COMMISSIONING REPORTS

A. For each piece of equipment or system listed in paragraph 1.02 of this Section, provide the following where applicable

1. Piping Pressure Test Reports: See Section 23 21 13 HVAC Piping

2. Pre-Functional Test Reports: See forms at end of this Section.

3. Start-up and Factory Test Reports: See individual Division 23 equipment sections.

4. Title 24 Acceptance Test Reports: See Title 24 2013 Nonresidential Compliance Manual.

5. Testing, Adjusting, and Balancing Report: See Section 23 05 93 Testing, Adjusting and Balancing

6. Training Manuals: See Division 1 Training

B. Provide reports to Owner's Representative in quantities and format specified in Section 23 05 01 Basic Mechanical Materials and Methods.

Air to Water Heat Pump
Pre-Functional Test Data Sheet

Air to Water Heat Pump Tag _____

Air to Water Heat Pump Data				
	As designed	**As found**	**Action required**	**Done**
Manufacturer				☐
Model number				☐
Serial number				
Nameplate tonnage				☐
Volts/phase				☐
Compressor data				
Type				☐
Quantity				☐
Condenser fan data				
Type	ODP ☐, TEFC ☐	ODP ☐, TEFC ☐		☐
Quantity				☐
HP/rpm				☐
Volts/phase				☐
Installation				
		As found	**Action required**	**Done**
Vibration isolation adjusted		yes ☐, no ☐, n/a ☐		☐
Shipping blocks removed		yes ☐, no ☐, n/a ☐		☐
Condenser fan motors installed and mounted properly and rotate freely		yes ☐, no ☐, n/a ☐		☐
Condenser fans and motors lubricated		yes ☐, no ☐, n/a ☐		☐
Piping complete and pressure tested		yes ☐, no ☐, n/a ☐		☐
Water treatment completed		yes ☐, no ☐, n/a ☐		☐
Primary pump(s) installed in the unit		yes ☐, no ☐, n/a ☐		☐
Pumps installed per drawings		yes ☐, no ☐, n/a ☐		☐
Piping connected properly with flexible piping connections and insulation per drawings		yes ☐, no ☐, n/a ☐		☐
Piping supported independently from fan		yes ☐, no ☐, n/a ☐		☐
Inlet/discharge piping connections installed correctly		yes ☐, no ☐, n/a ☐		☐
Closed system installed with back flow preventer, pressure regulating valve and expansion tank per drawings		yes ☐, no ☐, n/a ☐		☐
Chemical pot feeder installed per drawings		yes ☐, no ☐, n/a ☐		☐
Electrical connections complete & tight		yes ☐, no ☐		☐
Disconnect switch installed		yes ☐, no ☐		☐
Control transformer, gages, flow switch and sensors connected per drawings		yes ☐, no ☐, n/a ☐		☐
Controls and interlock completed per drawings		yes ☐, no ☐, n/a ☐		☐
Sign Off				
As found checked by (Print & Sign)			Date	
Remedial action checked by (Print & Sign)			Date	

Pump
Pre-Functional Test Data Sheet

Pump Tag _____

Pump Data				
	As designed	**As found**	**Action required**	**Done**
Manufacturer				☐
Model number				☐
Serial number				
Nameplate gpm/head				☐
Vibration isolation	yes ☐, no☐	yes ☐, no☐		☐
Motor Data				
Manufacturer/model				☐
Serial number				
Type	ODP ☐, TEFC ☐	ODP ☐, TEFC ☐		☐
HP/RPM				☐
Volts/phase				☐
Nameplate efficiency				☐
Installation				
		As found	**Action required**	**Done**
Vibration isolation adjusted		yes ☐, no ☐, n/a ☐		☐
Shipping blocks removed		yes ☐, no ☐, n/a ☐		☐
Pump & motor rotate freely		yes ☐, no ☐		☐
Strainers in place & screen cleaned		yes ☐, no ☐, n/a ☐		☐
Alignment verified by millwright/manufacturer		yes ☐, no ☐, n/a ☐		☐
Coupling guard in place		yes ☐, no ☐, n/a ☐		☐
Pump and motor lubricated		yes ☐, no ☐, n/a ☐		☐
Pressure gauge(s) installed		yes ☐, no ☐, n/a ☐		☐
Piping complete, aligned and tested		yes ☐, no ☐		☐
Pipe supported independently from pump		yes ☐, no ☐, n/a ☐		☐
Electrical connections complete & tight		yes ☐, no ☐		☐
Disconnect switch installed		yes ☐, no ☐		☐
Overload heaters correctly sized for motor		yes ☐, no ☐, n/a ☐		☐
Discharge check valve per drawings		yes ☐, no ☐, n/a ☐		☐
Inlet suction diffuser per drawings		yes ☐, no ☐, n/a ☐		☐
Control sensors and gages per drawings		yes ☐, no ☐, n/a ☐		☐
Sign Off				
As found checked by (Print & Sign)			Date	
Remedial action checked by (Print & Sign)			Date	

Hydronic System
Pre-Functional Test Data Sheet

System Tag _____

Hydronic System Data				
	As designed	**As found**	**Action required**	**Done**
Piping material				☐
Insulation material				☐
Insulation thickness				☐
Expansion tank	yes ☐, no ☐, n/a ☐	yes ☐, no ☐, n/a ☐		☐
Expansion tank pre-charge[psi]				☐
Pressure relief valve	yes ☐, no ☐, n/a ☐	yes ☐, no ☐, n/a ☐		☐
Pressure relief valve setting[psi				☐
Pressure test date				☐
Pressure test pressure [psi]				☐
Pressure test duration [hr]				☐
Pressure test successful?	yes ☐, no ☐	yes ☐, no ☐,		☐
Cleaning duration [hr]				☐
Water Treatment				
Manufacturer				☐
Model number				☐
Serial number				
Controller	yes ☐, no ☐, n/a ☐	yes ☐, no ☐, n/a ☐		☐
Inhibitor	yes ☐, no ☐, n/a ☐	yes ☐, no ☐, n/a ☐		☐
Inhibitor pump	yes ☐, no ☐, n/a ☐	yes ☐, no ☐, n/a ☐		☐
Biocide	yes ☐, no ☐, n/a ☐	yes ☐, no ☐, n/a ☐		☐
Biocide pump	yes ☐, no ☐, n/a ☐	yes ☐, no ☐, n/a ☐		☐
Auto drain valve	yes ☐, no ☐, n/a ☐	yes ☐, no ☐, n/a ☐		☐
Installation				
		As found	**Action required**	**Done**
Spring hangers		yes ☐, no ☐, n/a ☐		☐
Seismic supports		yes ☐, no ☐		☐
Dielectric unions or dielectric connections		yes ☐, no ☐, n/a ☐		☐
Exposed pipe insulation protected		yes ☐, no ☐		☐
Pipe insulation jacket per specifications		yes ☐, no ☐, n/a ☐		☐
Backflow preventer installed		yes ☐, no ☐		☐
Make-up shut off		yes ☐, no ☐, n/a ☐		☐
Water treatment controller tested by supplier		yes ☐, no ☐, n/a ☐		☐
Water treatment report submitted		yes ☐, no ☐, n/a ☐		☐
Air vents/removal system installed		yes ☐, no ☐		☐
Air removed from system		yes ☐, no ☐		☐
Piping identification & arrows installed		yes ☐, no ☐		☐
Valves tagged as specified		yes ☐, no ☐, n/a ☐		☐
Sign Off				
As found checked by (Print & Sign)			Date	
Remedial action checked by (Print & Sign)			Date	

Existing SF-1 Air Handling Unit
Pre-Functional Test Data Sheet

AHU Tag SF-1

Air Handling Units and Coils Data				
	As designed	**As found**	**Action required**	**Done**
Existing Fan Manufacturer				☐
Model number				☐
Serial number				
Nameplate airflow				☐
Cooling coil rows/fins				☐
Heating coil rows/fins				☐
Filters: qty / type / size				☐
Indoor Fan Data				
Quantity				☐
Drive Type	DD ☐, Belt ☐	DD ☐, Belt ☐		☐
Wheel type	propeller ☐, FC ☐ BI ☐, AF☐	propeller ☐, FC ☐ BI ☐, AF☐		☐
Motor Type	ODP ☐, TEFC ☐	ODP ☐, TEFC ☐		☐
HP/RPM				☐
Volts/phase				☐
Nameplate efficiency				☐
Indoor Fan Motor Variable Speed Drive Data				
Manufacturer				☐
Model number				☐
Serial number				
Manual bypass	yes ☐, no☐	yes ☐, no☐		☐
Relief Fan Data				
Relief Fan Manufacturer				☐
Model number				☐
Serial number				
Quantity				☐
Drive Type	DD ☐, Belt ☐	DD ☐, Belt ☐		☐
Wheel type	propeller ☐, FC ☐ BI ☐, AF☐	propeller ☐, FC ☐ BI ☐, AF☐		☐
Motor Type	ODP ☐, TEFC ☐	ODP ☐, TEFC ☐		☐
HP/RPM				☐
Volts/phase				☐
Nameplate efficiency				☐
Relief Variable Speed Drive Data (if applicable)				
Manufacturer				☐
Model number				☐
Serial number				
Manual bypass	yes ☐, no☐	yes ☐, no☐		☐
Installation				
		As found	**Action required**	**Done**
Vibration isolation adjusted		yes ☐, no ☐, n/a ☐		☐
Shipping blocks removed		yes ☐, no ☐, n/a ☐		☐
Air handling unit fan & motor installed and mounted properly and rotate freely		yes ☐, no ☐, n/a ☐		☐
Motor and drive aligned and tight		yes ☐, no ☐, n/a ☐		☐
Belt guard installed		yes ☐, no ☐, n/a ☐		☐
Fan motors lubricated		yes ☐, no ☐, n/a ☐		☐

Air Handling Units and Coils Data				
	As designed	**As found**	**Action required**	**Done**
Condensate drain piping installed with trap		yes ☐, no ☐, n/a ☐		☐
Filters installed with no air gaps		yes ☐, no ☐, n/a ☐		☐
Filter pressure gage installed		yes ☐, no ☐, n/a ☐		☐
Duct complete and sealed		yes ☐, no ☐, n/a ☐		☐
Ducts connected properly with flexible duct connections per drawings		yes ☐, no ☐, n/a ☐		☐
Duct supported independently from fan		yes ☐, no ☐, n/a ☐		☐
Inlet/discharge dampers installed correctly		yes ☐, no ☐, n/a ☐		☐
Piping complete and tested		yes ☐, no ☐, n/a ☐		☐
Pipe connected correctly at coils and supported independently from air handling units		yes ☐, no ☐, n/a ☐		☐
Coil fins combed or not damaged		yes ☐, no ☐, n/a ☐		☐
Vents and drains installed per drawings		yes ☐, no ☐, n/a ☐		☐
Electrical connections complete & tight		yes ☐, no ☐		☐
Disconnect switch installed		yes ☐, no ☐		☐
Control gages and tubing connected per drawings		yes ☐, no ☐, n/a ☐		☐
Controls and interlock completed per drawings		yes ☐, no ☐, n/a ☐		☐
Sign Off				
As found checked by (Print & Sign)			Date	
Remedial action checked by (Print & Sign)			Date	

Duct System
Pre-Functional Test Data Sheet

Duct System Name _____

Duct System Data				
	As designed	**As found/tested**	**Action required**	**Done**
Duct material				☐
Insulation wrap material				☐
Insulation wrap thickness				☐
Insulation lining material				☐
Insulation lining thickness				☐
Installation				
		As found	**Action required**	**Done**
Spring hangers where specified		yes ☐, no ☐, n/a ☐		☐
Seismic supports installed per spec's		yes ☐, no ☐, n/a ☐		☐
Longitudinal duct joints sealed		yes ☐, no ☐		☐
Transverse duct joints sealed		yes ☐, no ☐		☐
Duct penetrations sealed		yes ☐, no ☐		☐
Duct insulation completed and vapor barriers sealed		yes ☐, no ☐, n/a ☐		☐
Flexible duct connections installed properly		yes ☐, no ☐, n/a ☐		☐
Flexible ducts installed with no kinks		yes ☐, no ☐, n/a ☐		☐
Duct pressure tests performed and passed		yes ☐, no ☐, n/a ☐		☐
Duct leakage tests performed and passed		yes ☐, no ☐, n/a ☐		☐
Sign Off				
As found checked by (Print & Sign)			Date	
Remedial action checked by (Print & Sign)			Date	

Fan
Pre-Functional Test Data Sheet

Fan Tag _____

Fan Data				
	As designed	**As found**	**Action required**	**Done**
Manufacturer				☐
Model number				☐
Serial number				
Volts/phase				☐
Filters: qty / type / size				☐
Motor data				
	As designed	**As found**	**Action required**	**Done**
Manufacturer				☐
Model number				☐
Serial number				
Type	ODP ☐, TEFC ☐	ODP ☐, TEFC ☐		☐
HP/RPM				☐
Nameplate efficiency				☐
Variable speed drive data (if applicable)				
	As designed	**As found**	**Action required**	**Done**
Manufacturer				☐
Model number				☐
Serial number				
Manual bypass (yes/no)	yes ☐, no☐			☐
Installation				
		As found	**Action required**	**Done**
Vibration isolation adjusted		yes ☐, no ☐, n/a ☐		☐
Shipping blocks removed		yes ☐, no ☐, n/a ☐		☐
Fan, belts & motor installed and mounted properly and rotate freely		yes ☐, no ☐, n/a ☐		☐
Motor & drive adjusted and aligned properly		yes ☐, no ☐, n/a ☐		☐
Belt guard in place		yes ☐, no ☐, n/a ☐		☐
Fan and motor lubricated		yes ☐, no ☐, n/a ☐		☐
Duct complete and sealed		yes ☐, no ☐, n/a ☐		☐
Ducts connected properly with flexible duct connections per the drawings		yes ☐, no ☐, n/a ☐		☐
Duct supported independently from fan		yes ☐, no ☐, n/a ☐		☐
Inlet/discharge dampers installed correctly		yes ☐, no ☐, n/a ☐		☐
Electrical connections complete & tight		yes ☐, no ☐		☐
Disconnect switch installed		yes ☐, no ☐		☐
Controls and interlock completed per the drawings		yes ☐, no ☐, n/a ☐		☐
Sign Off				
As found checked by (Print & Sign)			Date	
Remedial action checked by (Print & Sign)			Date	

Air Terminal Unit
Pre-Functional Test Data Sheet

Air Terminal Unit Tag _____

Air Terminal Units Data				
	As designed	**As found**	**Action required**	**Done**
Manufacturer				☐
Model number / size				☐
Serial number				
Motor Data (fan powered)				
HP/RPM				☐
Volts/phase				☐
Reheat Coil Data				
Rows				☐
Installation				
		As found	**Action required**	**Done**
Vibration isolation adjusted		yes ☐, no ☐, n/a ☐		☐
Shipping blocks removed		yes ☐, no ☐, n/a ☐		☐
Motor installed and mounted properly and rotate freely		yes ☐, no ☐, n/a ☐		☐
Fan motor lubricated		yes ☐, no ☐, n/a ☐		☐
Duct complete and sealed		yes ☐, no ☐, n/a ☐		☐
Duct supported independently from air terminal units		yes ☐, no ☐, n/a ☐		☐
Inlet duct straight for proper length		yes ☐, no ☐, n/a ☐		☐
Piping & insulation complete and tested		yes ☐, no ☐, n/a ☐		☐
Piping supported independently from air terminal units		yes ☐, no ☐, n/a ☐		☐
Piping valve & fitting train as spec'd		yes ☐, no ☐, n/a ☐		☐
Electrical connections complete & tight		yes ☐, no ☐, n/a ☐		☐
Disconnect switch installed		yes ☐, no ☐, n/a ☐		☐
Controls connected and wired		yes ☐, no ☐, n/a ☐		☐
Damper actuator mounted and wired		yes ☐, no ☐, n/a ☐		☐
Hot water valve actuator mounted and wired		yes ☐, no ☐, n/a ☐		☐
Sign Off				
As found checked by (Print & Sign)			Date	
Remedial action checked by (Print & Sign)			Date	

END OF SECTION

SPECIFICATION 23 21 13
HVAC PIPING

PART 1 GENERAL

1.01 SUMMARY

A. Work included in this section: materials, equipment, fabrication, installation and tests in conformity with applicable codes and authorities having jurisdiction for the following:

1. Hot and chilled water system piping

2. Auxiliary and intermediate drain pan piping

1.02 REFERENCE STANDARDS

A. ANSI/ARI 495 – Refrigerant Liquid Receivers

B. ANSI/ARI 710 – Liquid Line Dryers

C. ANSI/ASHRAE 15 – Safety Code for Mechanical Refrigeration

D. ANSI/ASHRAE 34 – Number Designation of Refrigerants

E. ASTM A53 / A53M - 07 Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless

F. ASTM F2014-00 Standard Specification for Non-Reinforced Extruded Tee Connections for Piping Applications

G. ASTM A234 – Pipe Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures

H. ASTM D638 − Tensile Properties of Plastics

I. ASTM D2105 − Longitudinal Tensile Properties of “Fiberglass” (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe and Tube

J. ASTM D2143 − Cyclic Pressure Strength of Reinforced, Thermosetting Plastic Pipe

K. ASTM D2412 − Determination of External Loading Characteristics of Plastic Pipe by Parallel-Plate Loading

L. ASTM D2992 − Obtaining Hydrostatic or Pressure Design Basis for “Fiberglass” (Glass-Fiber-Reinforced Thermosetting Resin) Pipe and Fittings

M. ASTM D3517 − “Fiberglass” (Glass-Fiber-Reinforced Thermosetting-Resin) Pressure Pipe

N. ASTM D3567 − Determining Dimensions of Reinforced Thermosetting Resin Pipe (RTRP) and Fittings

O. ASTM D3681 − Chemical Resistance of Reinforced Thermosetting Resin Pipe in a Deflected Condition

P. ASTM G53 − Weathering of Non-Metallic Materials

Q. ANSI/ASME SEC 9 – Welding and Brazing Qualifications

R. ANSI/ASME B16.22 – Wrought Copper and Copper Alloy Solder Joint Pressure Fittings

S. ANSI/ASME B16.26 – Cast Copper Alloy Fittings For Flared Copper Tubes

T. ANSI/ASME B31.5 – Refrigeration Piping

U. ANSI/ASME B31.9 − Building Services Piping

V. ANSI/ASTM B32 – Solder Metal

W. ANSI/ASTM B88 – Seamless Copper Water Tube

X. ASTM B280 – Seamless Copper Tube for Air Conditioning and Refrigeration Field Service

Y. ANSI/AWS A5.8 – Brazing Filler Metal

Z. ANSI/AWS D1.1 – Structural Welding Code

AA. AWWA C950 − Fiberglass Pressure Pipe

1.03 QUALITY ASSURANCE

A. Welding materials and labor to conform to ASME Code and applicable state Labor Regulations

B. Use welders fully qualified and licensed by state authorities

C. Welders Certification: In accordance with ANSI/ASME SEC 9 and ANSI/AWS D1.1

D. Each length of pipe, fitting, trap, fixture or device used in any piping system shall be stamped or indelibly marked with

1. Weight or quality

2. Maker's name or mark

E. Examine piping layouts and determine requirements for piping offsets, loops or expansion joints to adequately protect systems.

1. Determine locations and design of anchors and pipe guides to maintain proper piping alignment.

2. Determine anchor reaction forces and coordinate locations of anchors with Owner’s Representative.

F. Coordinate expansion and flexibility requirements of this Section with seismic bracing requirements of Section 230548 Vibration and Seismic Control.

G. Conform to ANSI/ASME B31.9

1.04 SUBMITTALS

A. See Section 23 05 01 Basic Mechanical Materials and Methods.

B. Submit product data, O&M data, and samples and show item on shop drawings (where shop drawings are required) according to the following table.

1. "R" means required.

2. "R2" means required only for products and equipment differing for the specified manufacturer and model and for "or equals" where specified.

Item	Product Data	O&M Manual	Samples	Shop Drawing
Piping materials	R			
Pipe fittings	R			R
Solder	R2			

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Named manufacturer model numbers used as example of item and establish minimum level of quality and minimum standard options. Equivalent models of listed manufacturers are acceptable.

B. Welding Fittings

1. Babcock and Wilcox Tubular Products Division

2. Bonney Forge Foundry, Inc.

3. Landish Company

4. Taylor Company

5. Tube Turns Division Allegheny International Inc.

6. Or equal

C. Mechanical Couplings and Fittings

1. Victaulic Company of America

2. Grinnell

3. Viega

4. Or equal

D. Flange Gaskets

1. John Crane Company

2. Garlock Mechanical Packing Division

3. Goodrich

4. Manville
5. Or equal

E. Waterproofing Sleeve Assemblies

1. Thunderline Corp.
2. Link-Seal
3. Or equal

F. Solder

1. Westinghouse
2. J.W. Harris Co., Inc.
3. Handy & Harman
4. Engelhard
5. Lucas Milhaupt
6. Or equal

G. Pipe Joint Compound

1. Rectorseal
2. Permatec
3. John Crane
4. Or equal

2.02 PIPING AND FITTINGS

A. General

1. Piping shall
   a. Be commercially round and straight
   b. Be of uniform quality and workmanship
   c. Be free from all defects
   d. Be identified

B. Pressure Piping

1. Pressure piping shall conform to requirements of ANSI Safety Code for Pressure Piping, B31.9
2. Type PP-1: Black Steel

a. Schedule 40 or Standard Weight, ASTM A53 Type E Grade B (electric resistance welded)

b. 2-1/2 inches and larger

c. Welded joints

1) Steel welding-neck fittings, ANSI B16.9-93

2) Steel welding-neck flanges and flanged fittings, ANSI B16.5-88, 150 pounds per square inch

d. Mechanical joints

1) Machined groove or rolled

2) Fittings as hereinafter specified

e. 0.375 inch wall for sizes 12 inch and larger

3. Type PP-2: Galvanized Steel

a. Same as PP-1 except Hot-dipped Galvanized

4. Type PP-3: Copper Tubing

a. ASTM B88; Type M, L or K

b. Hard temper unless indicated otherwise

c. Wrought-copper, solder joint fittings, ANSI B16.22, in sizes available

d. Cast-bronze solder-joint fittings, ANSI B16.18, only in sizes not available in wrought copper

e. Cast-bronze, threaded, ground-joint unions, ANSI B16.15, 2 inches and smaller

f. Cast bronze, flanged unions, ANSI B16.24, 150 pounds per square inch class, 2-1/2 inches and larger

g. Copper tubing flared fittings: bronze castings for flared type joints, ANSI B-16.26

h. Refrigerant piping: cleaned, dehydrated and capped by piping manufacturer: ANSI/ASTM B280, Type L ACR, annealed

i. Mechanical joints
1) Press-fit
2) Fittings as hereinafter specified

5. Type PP-4: Plastic (PVC)

a. CPVC SDR 11 (CTS) pipe and fittings conform to requirements of ASTM D 2846 or CSA CAN/CSA B137.6 and ANSI/NSF 14 and 61 standards

b. Schedule 40 and 80 pipe conform to the requirements of ASTM F 441. SDR-PR pipe conform to requirements of ASTM F 442.

c. Schedule 40 socket fittings conform to ASTM F 438. Schedule 80 socket fittings conform to ASTM F 439.

d. Fittings shall be socket type (no threads) secured with CPVC solvent cements that conform to ASTM F 439.

C. Fittings and Flanges: Standard products of respective manufacturer of piping as hereinbefore specified.

D. Flange Gaskets

1. Full faced or flat ring type to suit flange facings, selected from one of following materials

2. Gaskets for flanged joints shall comply with ANSI B16.21

3. Full faced for cast iron flanges

4. Raised face for steel flanges

5. SBR or EPDM, 1/16 inch thick

6. Gaskets coated with thread lubricant when being installed

E. Flange Bolts: Open-hearth bolt steel

F. Unions

1. Steel Piping 2 inches and smaller

a. 250 pounds per square inch: ground joint

b. Equal to Grinnell Fig. 554

2. Steel Piping Larger than 2 inches: Welding flanges

3. Copper Piping: Equal to Nibco No. 633

G. Dielectric Connections

1. Unions

a. Only allowed where union is required elsewhere in specifications or on drawings. Use nipple specified below otherwise.

b. 2 inches and smaller

1) 250 pounds per square inch

2) Standard gaskets for plumbing

3) High temperature gaskets for heating

4) Equal to EPCO Model FX

c. 2-1/2 inches and larger

1) Brass

a) Brass half-union, ANSI B16.1, 1989, 175 pounds per square inch

b) To welding flange as hereinbefore specified

c) Equal to EPCO Model X

2) Copper

a) Half union with EPDM insulator gasket

b) 150 pounds per square inch

c) The Copper component of the flange adapter shall be Third Party Classified by Underwriters Laboratories Inc.

2. Nipples

a. For open circuit hydronic systems:

1) Minimum 4 inch long galvanized steel, stainless steel, brass, or copper nipple with non-conducting thermo-plastic internal lining

2) ASTM Standard F-492 for continuous use at temperatures up to 225°F

3) ClearFlow, Victaulic Style 47 Dielectric Waterway, or equal

b. For closed-circuit hydronic systems: minimum 6 inch long brass nipple

H. Grooved End Fittings and Couplings

1. Fittings

a. Designed for use with grooved- or rolled-end pipe and couplings

b. Materials

1) Steel: ASTM A53 or A106, Grade B

2) Malleable Iron: ASTM A47

3) Ductile Iron: ASTM A536

2. Couplings

a. Mechanical type designed to

1) Engage and lock grooved pipe or fitting ends

2) Form leak-proof joint

3) Allow angular deflection, expansion, contraction, and vibration isolation (flexible type, Victaulic Style 77, Style 177, or equal)

a) Exception: At contractor's option and risk, rigid couplings (Victaulic Style 107 or equal) may be used except at the following locations:

1. Mechanical equipment connections where the couplings are being used in lieu of flexible coupling for vibration isolation

2. Risers, for which we use flexible couplings for expansion and contraction

3. Straight horizontal runs over 20 feet long, for which we use flexible couplings for expansion and contraction

b. Housings

1) Malleable Iron: ASTM A47

2) Ductile or Nodular Iron

c. Gaskets

1) EPDM

2) Materials required for specific service, minimum 230°F operating temperature

3) Product of coupling manufacturer

d. Bolts and Nuts

1) Track-head or oval neck type bolts

2) Standard hexagon nuts

3) Heat treated carbon steel conforming to ASTM A183

4) Minimum tensile strength: 110,000 pounds per square inch

3. Pressure Ratings

a. 3/4 inch to 6 inches: 1000 pounds per square inch

b. 8 to 12 inches: 800 pounds per square inch

c. 14 to 24 inches: 300 pounds per square inch

4. Equal to Victaulic Company of America

I. Press-Fit Fittings and Couplings

1. For ½" to 4" copper piping

2. Smart Connect feature to provide clear visual indication of which connections have not been pressed prior to putting the system into operation

3. EPDM sealing element suitable for application

4. Listings and certifications

a. NSF-61-372

b. IAPMO PS 117

c. UL 213

d. FM Class 1920

e. ABS 1.1.2

5. Compliant with

a. California Mechanical Code

b. California Plumbing Code

c. NFPA 13, 13D and 13R

6. Operating ranges

a. 0°F to 250°F

b. 200 psi

7. Equal to Viega ProPress

2.03 PIPING SPECIALTIES

A. See Section 232114 Piping Specialties

2.04 SOLDER

A. S-1: Silfos or Silvaloy 15 silver solder (brazing) with 15 percent silver, 80 percent copper and 5 percent phosphorous

B. S-1A: Safety Silv 56 cadmium-free silver solder (brazing) with 55 to 57 percent silver, 21 -23 percent copper, 15 to 19 percent zinc, 4 to 6 percent tin, and 0.15 percent other metals.

C. S-2: 95 percent tin 5 percent antimony solder, lead free, or

D. S-2A: 95.6 percent tin, 4 percent copper, 0.4 percent silver, lead free

PART 3 EXECUTION

3.01 PIPE SERVICES

A. Piping type shall be in accordance with the table below. Where multiple types are listed, any may be used at Contractor's option.

Service	Location	Type of Pipe	Remarks
Hot and chilled water	Above ground	PP-1; PP-3 Type L	
Domestic water	Above ground	PP-1; PP-3 Type M	

Service	Location	Type of Pipe	Remarks
Condensate drain	Auxiliary pan drains	PP-3 Type M or L	

3.02 INSTALLATION

A. Coordinate with work of other trades.

B. Install pipes and pipe fittings in accordance with recognized industry practices which will achieve permanently leak resistant piping systems, capable of performing each indicated service without piping failure. Install each run with minimum joints and couplings but with adequate and accessible unions for disassembly and maintenance/replacement of valves and equipment. Reduce sizes where indicated by use of reducing fittings. Align piping accurately at connections, within 1/16-inch misalignment tolerance.

C. Arrangement

1. Except for large scale details piping is diagrammatically indicated. Install generally as shown.

2. Do not scale drawings for exact location of piping.

3. Install piping to best suit field conditions, in coordination with other trades.

4. Piping Arrangement

a. Arrange piping neatly along walls

b. In neat, horizontal groups

c. Each group to be in one plane, insofar as possible

d. Maintain required slope

5. Do not sleeve structural members without consent of Owner's Representative.

6. Maintain minimum l inch clearance from adjacent work, including insulation, except as noted.

7. Install piping concealed above ceilings or in walls unless otherwise indicated.

8. Installation of piping shall be made with use of appropriate fittings. Bending of piping will not be allowed.

9. Unions installed shall be accessible.

10. Locate piping runs vertically and horizontally; avoid diagonal runs wherever possible. Orient horizontal runs parallel with walls and column lines. In finished and occupied spaces, conceal piping from view by locating in column enclosures, in hollow wall construction, or above suspended ceilings; do not encase horizontal runs in solid partitions, except as indicated.

11. Electrical equipment spaces: Do not run piping through transformer vaults and other electrical or electronic equipment spaces and enclosures unless the piping serves equipment in the room.

12. Use tapered reducers where any change in pipe size occurs. Bushings shall not be used.

13. Conceal piping in finished portions of building, above the floor line. Cutting of walls and floors shall be held to the minimum possible to secure the proper installation.

14. Provide concealed high points with air chambers with 1/4-inch copper tube vent line and stop cock carried to accessible point.

15. Install piping subject to expansion or contraction in a manner permitting strains to be evenly distributed and alleviated.

16. Pipe the discharge of each relief valve, air vent, backflow preventer, and similar device to floor sink or drain.

17. Pipe coils with inlet at bottom, outlet from top, unless otherwise directed by coil manufacturer.

D. Penetrations

1. Escutcheons

a. Provide stainless steel escutcheons at piping penetrations of walls that are exposed public view and required for proper appearance. Provide galvanized steel escutcheons at penetrations of masonry walls elsewhere.

1) Clearance from duct to opening shall not exceed 1 inch.

2) Escutcheons shall overlap wall, floor, or ceiling surface by ½ inch minimum.

b. Escutcheons are not required at drywall penetrations where not exposed to public view.

2. Caulk and seal all piping penetrations through acoustical walls and partitions. See Section 23 05 48 Vibration and Seismic Control.

3. Firestopping at penetrations of fire rated floors and partitions

a. The fire-resistance rating of penetrations and fire-resistant joint systems shall be firestopped with a UL listed firestop system that will maintain the fire rating of the assembly. Through-penetrations and membrane penetrations shall be protected by an approved system installed as required by the system listing or as otherwise permitted by CBC Section 714. Listed through-penetration firestop systems and membrane penetrations shall be installed in accordance with the installation details for the listed system to be installed. Fire protection system installation details and listings shall be submitted for approval prior to the start of system installation.

b. Manufacturer

1) 3M Penetration Sealing Systems (PSS 7909) and 3M Fire Barrier Caulk and Putty

2) Dow-Corning LTV Silicone foam

3) Or equal

4. At all below-grade penetrations, provide mechanical seal complete with wall sleeve with wall anchor, and water stop plate. Seals shall be modular mechanical type, consisting of interlocking synthetic rubber links shaped to fill the annular space between pipe and sleeve, complete with pressure plates and cadmium plated nuts and bolts.

E. Sloping, Air Venting and Draining

1. Slope piping as indicated, true to line and grade, and free of traps and air pockets.

2. Reducers/increasers

a. Eccentric

1) All open condenser water piping upstream of pump

2) At pump suction where reducer is required

3) Top side flat

b. Concentric: All other locations

3. Connect branch piping to bottom of mains in closed systems.

4. Provide drain valves and hose adapters as indicated on drawings and at the bottom of all risers.

5. Vents: See Section 23 05 23 Valves.

F. Piping Specialties: See Section 23 21 14 Piping Specialties.

G. Pipe Hanging and Supports: See Section 23 05 29 Hangers and Supports.

H. Flashing and Sleeves: See Section 23 05 29 Hangers and Supports.

I. Painting: See Section 23 05 01 Basic Mechanical Materials and Methods.

J. Pipe Identification: See Section 23 05 53 Mechanical Identification

K. Copper

1. Crimping of copper tubing prohibited.

2. Isolate copper tubing from ferrous materials and hangers with two thicknesses of 1 inch wide 10 mil polyvinyl tape, spiral-wrapped around pipe. Total width shall be a minimum of 3 inches.

L. Coatings: Reapply coal-tar coating on buried piping, after installation, to surfaces from which coating has been removed or scraped.

M. Care of Floors

1. Do not set pipe vises or threading machines on unprotected concrete floors.

2. Cover floor when making plumbing connections to avoid staining floors with oil, white or red lead or other substances.

3. Remove any stains at no additional cost to the Owner.

3.03 COPPER AND STEEL WATER PIPING

A. Fittings

1. Provide standard, manufacturing fittings in all cases.

2. Prohibited fittings

a. Field fabricated

b. Bushings on pressure piping

c. Clamp-on branch connections

3. Provide dielectric nipples or dielectric unions at all connections of ferrous piping to non-ferrous piping.

4. Branch connections, steel piping

a. Equal to main and to two pipe sizes smaller: Weld tees, same weight as piping

b. Three or more pipe sizes smaller than main, but 2-1/2 inches and larger: Bonney Weld-o-lets

c. Two inches and smaller: Bonney Weld-o-lets, or steel couplings

5. Branch connections, copper piping

a. Seamless tee or

b. Press-fit tee or

c. Mechanically formed tee connection

1) ASTM Designation F2014-00

2) Per ASME B31.9 Section 930.2

3) Equal to T-Drill T-D35

B. Provide unions or flanges to render all items in systems easily removable, including

1. Control valves

2. Both sides of pumps and equipment

3. Where indicated on drawings

4. Use mechanical (Victaulic) couplings at all connections on tube-pull side of chiller to allow for temporary removal of piping to provide full access to the water box for tube pull.

5. Exceptions

a. Copper water piping 1-inch or less, at Contractor's options, since the copper can be easily cut and the union is a less secure joint than a soldered joint

b. Unions not allowed

1) Where not allowed by code

C. Pipe Ends

1. Perform pipe cutting and end preparation to result in clean ends with full inside diameter

2. Grind and ream as necessary

D. Nipples

1. Close nipples not permitted.

2. Provide extra heavy pipe for nipples where unthreaded portion is less than 1-1/2 inch long.

E. Threaded Joints: Not allowed other than unions and accessories (e.g. gauges, test plugs)

F. Welded Joints

1. Welded joints shall not be substituted for mechanical (Victaulic) joints where mechanical joints are specifically called out in specifications or on Drawings (for example to provide expansion/contraction or chiller tube pull access).

2. Weld pipe joints in accordance with recognized industry practice and as follows

a. Welding shall be done by qualified welders in a first-class, workmanlike manner, conforming to the American Standard Code for Pressure Piping USA B-31.1 and B-31.1A.

b. Bevel pipe ends at a 37.5 degree angle where possible, smooth rough cuts, and clean to remove slag, metal particles, and dirt.

c. Do not weld-out piping system imperfections by tack-welding procedures; re-fabricate to comply with requirements.

d. Standards: Conform to Section UI, Chapter 4, "Welding of Pipe Joints", ANSI B31.9 and applicable portion of ASME Boiler and Pressure Vessel Code, Section IX.

e. Operator's qualifications: All welders engaged in work under this Section shall be qualified in accordance with State requirements. Each operator's certificate shall be on file at site and made available to State upon request. Welding of pressure piping shall be done by-welders who have been qualified by recognized agency within 6 months prior to date of Contract.

f. Preparation for welding: Bevel piping on both ends before welding; both ends shall have 1-1/6 inch land at bottom of bevel. Pipe with a 3/4 inch wall thickness or less shall be beveled to a standard 37.5 degrees.

g. Use backing rings on all butt-welding joints 6-inches and larger.

h. State employed Inspector will visually inspect welds. Any weld judged defective by visual inspection shall be cut out and tested in presence of Inspector. If percentage of defective coupons is deemed excessive, contractor shall cut additional coupons as directed by the Owner's Representative or the State Inspector. Removal and replacement of test coupons and samplings shall be done at no additional cost to the Owner. At the option of the State Inspector or the Owner's Representative, certain welds may be required to be radiographed.

3. Where required, peen and wheel-grind welds.

4. Ends of pipe may be burned for welding

   a. Grind bevel and remove scale between welding joint.

   b. Ragged edges with metal beads, poor alignment other inferior work will be rejected.

5. Perform welding with oxyacetylene or electric arc process.

G. Grooved and Rolled-End Joints

1. Perform following in accordance with manufacturer's instructions

   a. Cut or roll pipe

   b. Install couplings and fittings

2. Determine that gasket material and lubricant are compatible with service of pipe.

H. Press-Fit Joints

1. Use only on above-ground applications.

2. Strictly comply with manufacturer's instructions and recommendations.

3. Pressure test with water

   a. First test for any unpressed fittings using a pressure range of 15 psig to 85 psig.

   b. Once all fittings are confirmed to be pressed, pressure test as required herein and per code.

I. Soldered and Brazed Joints

1. Solder

   a. Use Solder S-1 for

      1) Underground copper piping

      2) Mechanically formed tee connection (T-drill)

   b. Use Solder S-1 or S-2A for

      1) Piping 3 inch and larger

   c. Use Solder S-2 or S-2A other than above.

2. Clean surfaces to be jointed, of oil, grease, rust and oxides

    a. Remove grease from fittings by washing in solution of 1/16 sodium carbonate and three gallons hot water (except as otherwise specified for medical gas piping)

    b. Clean socket of fitting and end of pipe thoroughly with emery cloth to remove rust and oxides.

    c. Wipe excess solder from joint before it hardens.

3. When soldering or brazing materials that could be damaged by heat, remove sensitive parts and protect parts from heat. Joints shall be cool before reassembling.

4. Cut tubing square, reamed, and burrs removed.

5. Prevent annealing of fittings and tubing when making connections.

3.04 EXPANSION CONTROL

A. General

1. Install piping to permit free expansion and contraction without damaging piping or construction.

2. Provide offsets, expansion loops, anchors, guides and supports to permit expansion, within stress limits of ANSI 31.1 Pressure Piping for temperature ranges specified.

3. Where pipe loops or changes in direction of piping cannot be employed to absorb expansion and contraction, provide expansion joints.

4. Install pipe guides so that movement takes place along axis of pipe only. Pipe moves laterally at expansion elbows.

5. Make riser offsets in manner to avoid pocket forming due to expansion.

B. Expansion Calculations

1. Thermal Expansion

    a. Determine thermal linear expansion of each segment of piping systems.

    b. Base expansion calculations on following temperatures, plus 30 percent safety factor

        1) Hot Water Heating

            a) Idle temperature: 40 degrees Fahrenheit

            b) Maximum temperature: 150 degrees Fahrenheit

        2) Chilled Water

            a) Operating temperature: 40 degrees Fahrenheit

            b) Maximum temperature: 150 degrees Fahrenheit

    c. Determine effect of linear expansion upon piping layout in building

1) If resulting stresses exceed maximum allowable limits introduce additional loops and/or offsets.

2) Where space limitations preclude installation of loops and/or offsets provide expansion joints.

2. Structural Considerations

a. Install pipe anchors to provide required restraints on expanding piping systems.

b. Install pipe guides to provide required restraints against lateral action of expanding piping systems

1) Spacing for expansion joints: per manufacturer's recommendations.

2) Spacing for pipe loops and/or offsets: as required to maintain alignment within allowable stress limits.

c. Locate anchors and guides only at building structural members capable of taking imposed reaction loads.

d. Determine horizontal and vertical reaction loads of anchors and guides to building structure

1) Coordinate details and reaction loads with structural engineer for building.

2) If necessary, revise location and number of anchors and guides as recommended by structural engineer to result in allowable reaction loads to building.

C. Provision for Expansion

1. Loops, bends, offsets

a. As indicated or because of job required relocation of piping and equipment.

b. Design as follows

1) Use spring type loop U-bend or offset U-bend.

2) Corner radii five to six times pipe diameters.

3) Join bends only by welding

a) Welding-steel piping

b) Brazing-copper or bronze piping

2. Mechanical Joint System

a. Grooved- or rolled-joint piping systems with provisions for expansion control methods incorporating inherent flexibility of couplings and fittings may be provided, under conditions specified below

1) Submit design considerations published by manufacturer of couplings and fittings.

2) Conditions specified below must comply with published design considerations.

3) Rolled-joint piping expansion accommodation is generally less than for grooved-joint systems. Verify sufficient joints are provided.

b. Perform calculations as specified elsewhere in this section, along with determining any other data required to assure that longitudinal motion, angular deflection and resultant forces do not exceed recommendations in manufacturer's design considerations.

c. Provide required anchors and guides spaced per manufacturer's design considerations.

d. Install with gap settings of all couplings and fittings to permit full range of expansion, contraction and/or angular deflection as recommended by manufacturer to take place without excessive displacement and forces.

3. See Section 23 05 48 Vibration and Seismic Control

3.05 TESTING

A. Test of Water Piping

1. Test water piping at completion of roughing in, in accordance with the following schedule and show no loss in pressure or visible leaks after a minimum duration of four hours, or time as indicated, at the test pressures indicated.

2. Make connections to existing systems with flanged connection. During testing of the new work, provide a slip-in plate to restrict test pressure to new systems only. Remove plate and complete connection to existing system at completion of testing.

3. Inspect pressure piping in accordance with procedures of ANSI B31.

4. Hydrostatic test pressure

a. Less than 100 psi operating pressure: 150 psi

b. Over 100 psi operating pressure: 1-1/2 times operating pressure

c. Never exceed test pressure ANSI B16.1 basis

5. Duration: 2 hours

6. With system valves capped and pressure apparatus disconnected

a. Pressure change: none

b. Compensate for temperature change

7. Leaks and defects

a. Repair or replace as directed by the Owner’s Representative

b. At no additional cost to the Owner

8. Notify Owner’s Representative in writing one week before test.

9. Furnish written report and certification that tests have been satisfactorily completed to the Owner's Representative.

3.06 WATER PIPING SYSTEM CLEANING

A. During Construction

1. Keep openings in piping closed to prevent entrance of foreign matter

2. Clean pipe, fittings and valves internally

3. Hammer welds to remove slag and weld beads

B. Cleaning Procedure

1. Cleaning shall be supervised by water treatment supplier. See Section 232500 Water Treatment. When approved, procedure below may be modified based on recommendations of supplier.

2. Clean system immediately after pressure test.

3. Protect against damage from freeze up or discharge of water.

4. Closed Circuit Piping Systems

a. Open all valves (including control valves) in all legs so circulation goes through all sections.

1) For 3-way valves, either set to 50% open position or begin procedure with valves full open to coil and change to full open to bypass halfway through cleaning period.

b. Install temporary filter bags or fine-mesh start-up strainer screen in all line strainers during cleaning.

c. Fill with clean water.

d. Start pumps and operate at design flow rate or greater.

e. Simultaneously drain at low points and fill the loop until effluent is clear.

f. Shut off makeup water.

g. Circulate for a minimum of two 48-hour periods. For each period:

1) Add alkaline detergent via pot feeder. See Section 232500 Water Treatment.

2) At end of period

a) Remove and clean strainers.

b) Drain at low points.

h. After last circulation period

1) Shut off pumps.

2) Completely drain out entire system of cleaning solution.

3) Remove filters at strainers or replace start-up screen with final strainer screen.

4) Fill system with clean water.

5) Start pumps, and simultaneously drain at low points for 8 hours.

6) Test

a) Alkalinity not more than 200 parts per million in excess of alkalinity of rinsing water

b) Effluent visually clear; no visible particles or color

7) Repeat flushing of water until tests are met.

i. Should any pipe be plugged, disconnect piping, clean again, and reconnect at no additional cost to the Owner.

j. Upon completion of cleaning, chemically treat water before placing system into service. Do NOT leave system filled with untreated water for more than 4 hours.

1) Do NOT leave the system filled with untreated water for more than 4 hours.

5. All open circuit systems shall be flushed until water runs clean.

3.07 COMPLETION REQUIREMENTS

A. Complete Pre-Functional Test Data Sheet for each hydronic system. See Section 230800 Mechanical Commissioning.

B. Makeup water shut off (closed loop systems). After the system is filled for the final time, all manual isolation valves in the makeup water connection shall be shut (e.g. isolation valves at the PRV and at the PRV bypass) to mitigate the impact of a catastrophic leak in the piping.

END OF SECTION

SPECIFICATION 23 21 14
PIPING SPECIALTIES

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes: Materials, equipment, fabrication, installation and tests in conformity with applicable codes and authorities having jurisdiction for the following:

1. Escutcheons
2. Expansion tanks
3. Buffer tanks
4. Suction diffusers
5. Pressure gauges
6. Test plugs

1.02 SUBMITTALS

A. See Section 23 05 01 Basic Mechanical Materials and Methods.

B. Submit product data, O&M data, and samples and show item on shop drawings (where shop drawings are required) according to the following table.

1. "R" means required.
2. "R2" means required only for products and equipment differing for the specified manufacturer and model and for "or equals" where specified.

Item	Product Data	O&M Manual	Samples	Shop Drawing
Escutcheons	R2			
Expansion tanks	R	R		R
Buffer tanks	R			R
Suction diffusers	R			
Pressure gages	R	R		
Test plugs	R			

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Named manufacturer model numbers used as example of item and establish minimum level of quality and minimum standard options. Equivalent models of listed manufacturers are acceptable.

B. Expansion tanks

1. Wessels

2. Taco Inc.

3. Or equal

C. Buffer Tanks

1. Cemline Corporation

2. Wessels

3. Or equal

D. Suction Diffusers

1. Bell and Gossett ITT

2. Taco Inc.

3. Or equal

E. Pressure gauges

1. Weksler

2. Weiss Instruments, Inc.

3. Dresser Industries, Ashcroft

4. H. O. Trerice Company

5. Or equal

F. Pressure-temperature test plugs

1. Peterson Engineering Company

2. Taco, Inc.

3. Or equal

2.02 ESCUTCHEONS

A. Provide escutcheons with inside diameter closely fitting pipe outside diameter or outside of pipe insulation where pipe is insulated. Select outside diameter of escutcheon to completely cover pipe penetration hole in floors, walls, ceilings, or pipe sleeve extension, if any. Furnish pipe escutcheons with nickel or chrome finish and screw or spring clamping device with concealed hinge.

1. Pipe escutcheons for moist areas: For water resistant floors, and areas where water and condensation can be expected to accumulate, provide cast brass or sheet brass escutcheons, solid or split hinged. Split hinged type shall not be used in areas with security requirements.

2. Pipe escutcheons for dry areas: Provide sheet steel escutcheons, solid or split hinged. Split hinged type shall not be used in areas with security requirements.

2.03 EXPANSION TANKS

A. Bladder type

1. Welded Steel
2. Working pressure: 125 pounds per square inch
3. Cleaned, prime coated
4. Steel base for floor mounted tanks
5. ASME Code
6. Bladder
   a. Flexible
   b. Replaceable
   c. Permanent sealed-in air cushion
   d. Full acceptance volume or other means to prevent bladder damage upon loss of air charge
7. Sight glass if required by code
8. With required tappings
9. Precharge as indicated on drawings, if available as a standard option

2.04 BUFFER TANK

A. The steel storage tank shall be constructed in accordance with Section IV of the ASME Code for 125 psig working pressure.

B. Legs or base ring for vertical installation

C. Air Vent

D. Factory or field insulated per other equipment in piping circuit

E. Wessels CBT or equal

2.05 SUCTION DIFFUSER

A. Angle type suction guide fitting

1. Flanged cast iron body
2. 125 pounds per square inch
3. Steel or cast iron guide vanes
4. Bronze start-up strainer

5. Free area five times cross section area of pump suction opening
6. Vane length no less than 2-1/2 times pump connection diameter
7. Adjustable support foot to carry weight of suction
8. System side connection size same as incoming pipe size
9. Permanent perforated stainless steel strainer/cylinder
10. Disposable start-up screen

B. Use product manufactured by associated pump manufacturer if available

2.06 PRESSURE GAUGES

A. Pipe or equipment mounted type

1. Diameter: 4 1/2 inch, except as noted
2. Case: black finished cast aluminum with flangeless back
3. Threaded black cast aluminum ring with gasketed glass face
4. Type 316 stainless steel spring tube
5. Stainless steel precision movement: Micrometer adjustment on needle
6. Accuracy: 0.5 percent full scale range
7. With calibration adjustment
8. Quarter turn stop cock: Materials compatible with service
9. Pressure snubbers
    a. Filter type
    b. For liquid, air and gas
10. Weksler Type AA44 or equal

B. Pressure gauge ranges in pounds per square inch gauge

1. Heating water pump: 0-60
2. City water connection, connection to equipment: 0-100
3. Pressure gauges indicated on drawings or in specifications not indicated above to be submitted with appropriate range for review

2.07 PRESSURE/TEMPERATURE TEST PLUG

A. Solid brass with valve core

B. Valve core: Nordel or EPDM

C. Fitted with a color coded and marked cap with gasket

D. Suitable for 500 pounds per square inch gage and 275ºF for water systems

E. Pete's Plug: No. 110 with yellow cap or equal

2.08 FLANGES

A. Convoluted

B. Carbon steel, cold-formed

C. Weld-neck and blind flanges in conformance with the design criteria of Section VIII, Division I of the ASME Pressure Valve Code

D. Flanges drilled and tapped to match ANSI 150

E. All material to comply with requirements of ASTM A516

F. Gaskets: Teflon or as recommended by the flange manufacturer and suitable for the service involved

G. Slip-on flanges will not be permitted

H. 150-pound and 300-pound weld-neck and screwed steel flanges on steel lines to conform to ANSI Standard B16.5 for dimensions and ASTM A 181 Material Standard

PART 3 EXECUTION

3.01 INSTALLATION

A. Install items in accordance with manufacturer's instructions.

3.02 ESCUTCHEONS

A. Install at piping penetrations of walls, floors and ceilings

1. Where exposed to public view

2. At penetrations of exterior walls

B. Where piping is insulated, escutcheons shall fit insulation outside diameter.

3.03 EXPANSION TANKS

A. Support from structure as indicated.

B. Make piping connections as indicated.

1. Expansion tank connection to the piping main shall be on the side of the pipe (3 o’clock or 9 o’clock).

2. On hot water systems, provide an anti-thermosyphon loop to prevent warm water from migrating to the tank.

C. Connect with ball valve with locked guard.

1. Relief valve shall be located on system-side of expansion tank isolation valve.

D. Precharge pressure

1. If factory set:

a. Verify with manual gauge before connecting to system.

2. If not factory set or if set incorrectly:

a. Cause system to be as cold as will occur in normal operation

1) Chilled water systems: Turn all fans off, run air to water heat pumps at design chilled water supply temperature.

2) Hot water: Turn all fans off, run air to water heat pumps at design hot water supply temperature.

b. Expansion Tank

1) Isolate expansion tank from system and fully drain.

2) Use air compressor or hand pump to increase air pressure to the precharge pressure specified on Drawings.

c. Makeup Water

1) Adjust makeup water PRV to the specified precharge pressure.

2) Observe pressure using gauge at the expansion tank; if it is above the specified precharge pressure, then drain water from system until pressure falls to the specified precharge pressure.

d. Reopen expansion tank isolation valve.

3.04 BUFFER TANK

A. See Section 230700 Mechanical Insulation for tank insulation.

B. Contractor shall provide seismic calculations for mounting and bracing.

3.05 SUCTION DIFFUSERS

A. Provide on suction side of centrifugal pumps where indicated on Drawings.

B. Support with pipe and flange supports off of the floor or off of pump isolation base where provided.

C. Remove temporary start-up strainer/screen after system startup, replace with operating screen and clean prior to TAB work.

3.06 INSTRUMENTATION

A. Install sensors and sensor wells to piping using thread-o-lets welded or soldered to pipe, or other approved means. For piping smaller than 1.5 times well depth, wells shall be installed in the end of an elbow, or tee used in place of an elbow, to minimize obstruction.

B. Pressure Gauges

1. Provide gauges where shown on drawings.

2. Install gauges on non-vibrating backing.

3. Provide instrument cocks for isolation and removal of gauge at each pressure connection point.

4. Install gauges for easy readability (height, distance, view angle) from floor, except gauges at ceiling coils

5. At pumps, install a single pressure gauge only piped to pump taps at the inlet and outlet of pump. Using two gauges or connecting to piping rather than pump taps is not acceptable.

C. Pressure-Temperature Test Plugs

1. Provide pressure/temperature test plugs where shown on drawings.

2. Also locate at all temperature and pressure sensors for calibration, see Section 250000 Building Automation Systems.

3. Mount using threadolet welded or braised to pipe.

3.07 INSPECTION

A. Verify that adequate clearance between piping specialties and adjacent walls or equipment is available to permit maintenance and repairs.

3.08 TESTING AND ADJUSTING

A. Test pressure gauges for accurate indication with known calibrated master; calibrate or replace if not within 5 percent of reading.

B. Test air vent points to insure all air has been vented.

C. Test other piping specialties for proper operation.

D. See Section 23 08 00 Mechanical Commissioning.

END OF SECTION

SPECIFICATION 23 21 23
PUMPS

PART 1 GENERAL

1.01 SUMMARY

A. Work included in this section: materials, equipment, fabrication, installation and tests in conformity with applicable codes and authorities having jurisdiction for all water pumps except

1. Where integral with manufactured piece of equipment

2. Where specialty pumps applicable to specific systems are specified under the relevant Section

1.02 REFERENCE STANDARDS

A. Underwriters' Laboratories, Inc.: UL 778 – Motor Operated Water Pumps

B. American Society of Mechanical Engineers: ASME Section VIII – Boiler and Pressure Vessel Code – Pressure Vessels

C. ANSI/HI Pump Standards

1.03 SUBMITTALS

A. See Section 23 05 01 Basic Mechanical Materials and Methods.

B. Submit product data, O&M data, and samples and show item on shop drawings (where shop drawings are required) according to the following table.

1. “R” means required.

2. “R2” means required only for products and equipment differing for the specified manufacturer and model and for “or equals” where specified.

Item	Product Data	O&M Manual	Samples	Shop Drawing
Pump data	R	R		R
Mounting details				R

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Named manufacturer model numbers used as example of item and establish minimum level of quality and minimum standard options. Equivalent models of listed manufacturers are acceptable.

B. Bell and Gossett

C. PACO

D. Patterson

E. Or equal

2.02 GENERAL

A. Centrifugal, single stage, unless otherwise noted

B. Bronze fitted (impeller and wear rings)

C. Statically and dynamically balance rotating parts

D. Construction to permit complete servicing without breaking piping connections

E. Pumps to operate at 1750 rpm unless specified otherwise

F. Bearings: Grease lubricated roller or ball bearings

G. Shaft seals

1. Mechanical, internally flushed

2. Single, inside mounted, end face rubber bellows type

3. Springs: stainless steel

4. Seal head: brass or stainless steel

5. Carbon face rotating against a stationary ceramic face

6. Elastomer: Buna or EPDM

H. Substitutions

1. Brake horsepower rating at design conditions shall be no more than 10 percent above that scheduled.

2. Motor horsepower shall be no larger than that scheduled, or compensate Division 26 contractor for any associated cost to increasing motor size.

I. Motors: See pump schedule and Section 23 05 13 Motors and Controllers

J. Pump characteristics

1. Pump curve shall rise continuously from maximum capacity to shutoff

2. Shutoff head approximately 10 percent greater than design head

3. Operation between 65% and 115% of GPM at best efficiency point (BEP) for the indicated impeller size, ideally between 85% and 105% of GPM at BEP

4. For pumps serving variable flow (2-way valve) systems; or where multiple pumps operate in parallel other than lead/standby applications

a. Pump shall be capable of operating at 40 percent beyond design flow rate without exceeding break off point

b. Motors shall be selected for non-overloading operation at a flow rate 40 percent beyond design flow rate

5. Impeller diameter

a. Minimum tip to cutwater clearance: 4%

b. Constant speed pumps: Trim to duty

K. Pumps and flanges tested and rated to withstand 1-1/2 times specified working pressures based on both inlet pressures scheduled and pump shut-off head or 175 pounds per square inch working pressure at 250 degrees Fahrenheit, whichever is greater.

L. Pumps to be suitable for handling fluids at scheduled temperatures

M. Pressure taps on both inlet and outlet for gauge connection mounted in the pump casing (not in external piping)

N. Factory tested

O. Painted with at least one coat of high-grade machinery enamel

2.03 END SUCTION

A. Base/motor type as scheduled

1. Close-coupled

a. Back pullout feature for easy replacement of seals

b. Mounting base that provides sufficient height so the pump casing is above the bottom of the base feet (not requiring the pump to hang out over the front of the inertia base or housekeeping pad).

2. Flex-coupled

a. Removable OSHA coupling guards

b. Flexible couplings

1) General: EPDM equal to Woods Sure-Flex

c. Foot mounted volute

d. Groutable base

B. Shaft: stainless or carbon steel

C. Casing wearing ring: None

D. Suction and discharge connections: flanged or threaded

PART 3 EXECUTION

3.01 INSTALLATION

A. Coordinate with work of other trades

B. Install pump in accordance with manufacturer's written installation instructions

C. Provide access space around pumps for service. Provide no less than minimum as recommended by manufacturer

D. Install on isolation base or housekeeping pad as specified. See 230548 Vibration and Seismic Control

E. Decrease to pump suction from line size with flat-top eccentric reducers on horizontal inlet piping (or suction diffuser where indicated on drawings), concentric reducers elsewhere

F. Support piping adjacent to pump such that no weight is carried on pump casings

G. Allow at least 5 pipe diameters between pump suction entry and closest elbow, unless a pump suction diffuser is installed

H. Inlet and discharge valves and other piping specialties shall be pipe size, not pump inlet or discharge connection size

I. See Section 23 21 14 Piping Specialties

J. See Section 25 00 00 Building Automation Systems

K. See Section 23 08 00 Mechanical Commissioning

3.02 MOUNTING AND ALIGNMENT

A. See Section 23 05 48 Vibration and Seismic Control

B. Floor mounted pumps: mount base to foundation or inertia base

1. Bolts in embedded pipe sleeve

2. Double nuts or shims to form level assembly

C. Align pump and motor shafts by adjusting shims or double nuts in accordance with manufacturer's recommendations.

D. Pour non-shrink grout under base, filling voids, and allow to set.

E. Recheck alignment after operation when the pump and the driver are at operating temperature.

3.03 INSPECTION

A. Verify that adequate clearance between pump and adjacent walls or equipment is available to permit maintenance and repairs.

B. Check that pump is suspended from building structure and not supported by piping.

C. Flex Coupled Pumps Alignment Verification

1. By pump manufacturer's millwright at start-up
2. With dial indicator of plus or minus 0.002 inch accuracy
3. Certify in writing that alignment work has been performed

3.04 PRE-OPERATING CHECKS

A. Before operating pumps

1. See Section 019100 Commissioning
2. Complete the Pre-Functional Test Data Sheet for each pump; see Commissioning specs.
3. Assure that piping is clear of debris which might clog pump
4. Vent air from pump system to assure water in pump and piping system
5. Check for proper and sufficient lubrication
6. Check for correct operation of check valve
7. Check for correct rotation
8. Confirm alignment again after grouting has properly set and re-align if required
9. Check packing nut adjustment for proper leakage rate and packing lubrication
10. Assure that strainer is clean before commencing testing
11. Check for proper adjustment of vibration isolation

3.05 TESTING AND ADJUSTING

A. Before starting pump: See Section 01 91 00 Commissioning

B. After starting pumps

1. Check for high bearing temperatures
2. Check temperature of packing gland or mechanical seal for proper cooling operation
3. Check for motor overload by taking ampere reading at maximum operating conditions, i.e. all valves open and individual pump running
4. Check shut-off head to ensure impellers properly trimmed

C. See Section 23 05 93 Testing, Adjusting, and Balancing

D. See Section 23 08 00 Mechanical Commissioning

3.06 TRAINING

A. See Section 23 08 00 Mechanical Commissioning

B. Engage a factory-authorized service representative to train Owner's maintenance personnel on:

1. Procedures for starting and stopping and troubleshooting pumps

2. Procedures and schedules for maintaining and servicing pumps

3. Organization and content of Operations & Maintenance Manuals

END OF SECTION

SPECIFICATION 23 25 00
WATER TREATMENT

PART 1 GENERAL

1.01 SUMMARY

A. Work Included in This Section: Materials, equipment, fabrication, installation and tests in conformity with applicable codes and authorities having jurisdiction for the following:

1. Services of water treatment firm
2. Chemicals
3. Systems provided with water treatment prior to testing and starting for regular operation

B. Intent of this Section is to provide complete chemical treatment to protect following systems from scale formations, corrosion, algae and slime growth

1. Air to water heat pump loops

1.02 WATER TREATMENT SERVICES

A. Retain qualified water treatment specialist for complete water treatment service including:

1. Recommend methods and materials required to comply with Paragraph 1.01B above, including cleaning and passivation procedures as applicable.
2. Furnish all water treatment chemicals.
3. Supervise installation of water treatment chemicals and systems.

B. Warranty Treatment Period

1. Water treatment applied concurrently with operation of each system of not less than one year from date of start-up, covering replacement or repair of materials found to be defective in workmanship or quality.
2. Upon completion of the Warranty Treatment Period, inform Owner in writing of various types of service agreements available. Include a program that addresses controlling *Legionella* bacteria.

1.03 SUBMITTALS

A. See Section 23 05 01 Basic Mechanical Materials and Methods.

B. Submit product data, O&M data, and samples and show item on shop drawings (where shop drawings are required) according to the following table.

1. “R” means required.
2. “R2” means required only for products and equipment differing for the specified manufacturer and model and for “or equals” where specified.

Item	Product Data	O&M Manual	Samples	Shop Drawing
Chemicals	R	R		R

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Water Treatment Service and Chemicals

1. Garratt-Callahan
2. Nalco Chemical Co.
3. GE Betz Laboratories
4. Western Water Associates, Inc.
5. Equal

2.02 WATER TREATMENT EQUIPMENT SUMMARY

A. Closed Systems

1. Bypass feeder

2.03 BYPASS CHEMICAL FEEDER

A. Existing

2.04 WATER TREATMENT CHEMICALS

A. Pipe cleaning: Alkaline detergent

1. Sodium silicate and/or sodium phosphate with non-foaming wetting agent
2. Phenolphthalein alkalinity to 2000 to 5000 ppm as CaCo/3
3. Injected by piping contractor: See Section 23 21 13 HVAC Piping

B. Provide supply of following chemical for treatment of water systems during the treatment period identified in 1.02B.1.

1. Corrosion inhibitor: Per water treatment specialist recommendation
2. Microbiocides

a. Per water treatment specialist recommendation

b. Non copper-based

c. Effective over pH range of 7.0 to 8.9

d. Provide two types, fast-acting, to be alternately injected.

e. Effective in controlling *Legionella* bacteria

C. All products shall be properly registered with the US Environmental Protection Agency and EPA registration number shall be clearly shown on all product literature and drum labels. Include MSDS for each chemicals in product Submittals.

PART 3 EXECUTION

3.01 INSTALLATION

A. Per manufacturer's recommendations

B. Valves and Piping

1. See Section See Section 23 21 13 HVAC Piping for piping materials and installation.

2. See drawings; arrangement to be confirmed by manufacturer.

3.02 INITIAL CLEANING OF SYSTEMS

A. Prior to operation, clean system as specified in Section 23 21 13 HVAC Piping.

B. Upon completion of cleaning, dose system with chemicals to obtain specified corrosion inhibition conditions.

3.03 START-UP AND SUPERVISION

A. Provide installation supervision and start-up of automatic water treatment systems by qualified representative of water treatment equipment/chemical supplier.

3.04 TRAINING

A. See Section 23 08 00 Mechanical Commissioning

B. Engage a factory-authorized service representative to train Owner's maintenance personnel on:

1. Procedures for programming and troubleshooting controllers

2. Procedures and schedules for testing and maintaining water quality

3. Organization and content of Operations & Maintenance Manuals

END OF SECTION

SPECIFICATION 23 31 00
DUCTS

PART 1 GENERAL

1.01 SUMMARY

A. Work included in this section: materials, equipment, fabrication, installation and tests in conformity with applicable codes and authorities having jurisdiction for the following:

1. Ductwork

2. Fasteners and Sealants

3. Exceptions: Where integral with manufactured piece of equipment

1.02 REFERENCE STANDARDS

A. SMACNA HVAC Duct Construction Standards, latest edition

1.03 DEFINITIONS

A. Seam: locks or weld applied longitudinally to close section of duct, for example longitudinal seam, spiral seam.

B. Joint: abutting connection between duct sections for continuity of air passage, for example cross joint, transverse joint, coupling.

C. Reinforcement: hardware applied to strengthen duct, for example girth angles, tie rods, fasteners (not connectors), and the like.

D. Stiffening: folding, bending, beading, cross-breaking or corrugating of sheets to achieve strength through shape.

E. Duct Classification

1. Terms used in this specification are defined as follows:

a. Low Pressure: 1/2 inch static pressure

1) Supply duct downstream of VAV boxes

2) Return duct

3) Exhaust duct

b. Medium Pressure: 2 inch static pressure, all other duct that is not low pressure including supply duct upstream of VAV boxes

c. High Pressure: None

1.04 SUBMITTALS

A. See Section 23 05 01 Basic Mechanical Materials and Methods.

B. Submit product data, O&M data, and samples and show item on shop drawings (where shop drawings are required) according to the following table.

1. "R" means required.

2. "R2" means required only for products and equipment differing for the specified manufacturer and model and for "or equals" where specified.

Item	Product Data	O&M Manual	Samples	Shop Drawing
Ductwork materials and fittings	R			R
Flexible ducts	R			R
Duct sealants	R			

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Named manufacturer model numbers used as example of item and establish minimum level of quality and minimum standard options. Equivalent models of listed manufacturers are acceptable.

B. Spiral oval and round ducts

1. United Sheet Metal Division, United McGill

2. Semco Manufacturing, Inc.

3. Metco

4. Contractor fabricated

5. Or equal

C. Duct Connection Systems

1. Ductmate Industries, Inc.

2. Fabriduct Transverse Duct Connection system

3. Ward Industries, Inc.

4. Or equal

D. Flexible Ducts

1. Thermaflex

2. Flexmaster

3. Or equal

E. Duct Sealants

1. Minnesota Mining and Manufacturing Company

2. Foster
3. Childers
4. Miracle Adhesive Corporation
5. United Sheet Metal Division United McGill Corporation
6. Hardcast Products Group
7. Mon Eco Industries
8. Nashua
9. 3M
10. Or equal

F. Flexible Duct Clamps

1. Panduit
2. Aeroquip Corporation
3. Ideal Division Parker Hannifin Corporation
4. Tridon Corporation
5. Young Regulator Company
6. Or equal

G. Duct Support Systems

1. CEAS Wedgy Support Systems
2. Gripple
3. Or equal

2.02 MATERIALS

A. Galvanized Steel Sheet Metal

1. Cold rolled soft steel sheets
2. ASTM A653 and A924
3. Galvanizing:
    a. General: minimum G-60
    b. Exposed to weather or outdoor air, or as indicated herein or on Drawings: minimum G-90
4. Lock-forming quality

B. Miscellaneous Products

1. Screws and rivets

a. Same material as sheet, except as indicated on the Drawings

b. On aluminum sheets, provide cadmium plated or stainless steel

c. Zinc or cadmium plated, permitted on galvanized sheets

d. Minimum screw size: No. 10

e. Minimum rivet size: 4 pound

2. Duct Sealants

a. Duct Sealing Compound. UL-181 listed, water-based

1) Foster Safetee Duct Sealant 32-19

2) Childers CP-146

3) Design Polymerics DP-1010

4) Hardcast Products Group Flex-Grip 550 or 601

5) Or equal

b. Rolled Elastomeric Duct Sealant: Hardcast Products Group Foil-Grip 1403-181BFX, Aluma-Grip AFT-701 or equal, UL-181 listed

c. Gaskets

1) Continuous, reinforced, inert self-conforming type

2) 1/8 inch thick

3) Width: to match angle connection.

4) 3M Weatherban Ribbon Sealant PF5422 or equal

d. Two-Part Hard-Setting Joint Tape

1) Two part process includes tape and hard setting sealant

2) Mineral impregnated woven fiber tape

3) Impregnated with activator/adhesive of polyvinyl acetate type

4) UL Listed

5) Flame spread: 10

6) Smoke contributed: 0

7) Equal to Hardcast 550 or 601 sealant and Aluma-Grip AFT-701 tape

3. Spring Fasteners

    a. Oval head stud and receptacle

    b. Screwdriver slot

    c. Self-ejecting

    d. Dzus or equal

4. Angles, tie rod and shapes for reinforcing ducts: In accordance with SMACNA HVAC Duct Construction Standards

5. Duct connection system

    a. Transverse bolted duct joints

    b. Flanges with permanent, non-hardening sealant

    c. Ductmate Industries Ductmate 25 and 35, Fabriduct TDC, or equal

C. Turning vanes

1. Galvanized steel ductwork: galvanized steel or painted black steel, except as indicated on the Drawings

2. Other ductwork: same material as ductwork

3. Construction per SMACNA HVAC Duct Construction Standards for

    a. Single wall vanes with 3/4 inch trailing edge

    b. Double wall vanes: Not acceptable

    c. Vane length: Provide separate equal size sections for vane length greater than those indicated in referenced Standards.

    d. Vane runners: Type 1 or 2 acceptable

4. Vane radius

    a. 2 inch radius: duct width up to 36 inches

    b. 4 inch radius: duct width 36 inches or larger

5. Vanes shall be at the correct angle for airflow (leading edge in line with the entering duct section; leaving edge in line with exiting duct section). If only 45º angles are available, turning vanes shall only be used in 90º elbows where the entering width equals the exiting width; all other elbows shall be full radius type unless otherwise indicated on the drawings.

D. Low pressure round duct take-off fittings in rectangular duct

1. Factory-fabricated spin-in fitting

2. Die-formed galvanized steel

3. Balancing damper
    a. Spring loaded
    b. Locking regulator
    c. Sealed at both ends to prevent leakage
4. No scoop allowed for any application
5. Noll Manufacturing, Young Manufacturing or equal

2.03 ROUND AND OVAL DUCTWORK

A. General

1. Construction
    a. Factory- or shop-fabricated spiral lock seam duct; no snap lock
    b. Factory-fabricated longitudinal seam
        1) Acceptable for ducts larger than standard factory sizes
        2) Welded duct
2. Fittings
    a. Same material and construction as duct in which installed
    b. For ductwork exposed to occupant view, do not use fabricated fitting at taps to VAV boxes and outlets. Instead use saddle tap cut into continuous spiral duct. Intent is for spiral duct to be continuous for aesthetic reasons. Saddle tap flange width shall be 0.5 inches or less.
    c. Tees and taps
        1) 45 degree conical or shoe tap
        2) 90 degree conical tap
            a) Inlet diameter shall be minimum 2 inches wider than the round duct diameter
            b) Maximum 14º taper angle
        3) 90 degree straight tap
    d. Elbows
        1) Seams
            a) Spot welded with bonded seams or spiral seam except as indicated below
            b) Adjustable elbows with sealed gores are acceptable on low pressure ducts where concealed from occupant view

2) Minimum gores as follows:

a) 2 gores - less than or equal to 30 degrees

b) 3 gores - 31 degrees through 45 degrees

c) 4 gores - 46 degrees through 60 degrees

d) 5 gores (or solid full radius) - over 61 degrees

3) Throat radius to diameter ratio shall not be less than 1.0 except:

a) Where shown otherwise on Drawings

b) Short radius adjustable elbows with sealed gores are acceptable on low pressure ducts where concealed from occupant view

2.04 FLEXIBLE DUCTS

A. Flexible ducts

1. UL 181, Class I Air Duct

a. Products categorized as only Flexible Air Connectors under UL 181 are prohibited.

2. Labeled for compliance with CMC

3. Minimum working pressure

a. 2 inch positive static pressure class: 4 inches

b. 0 to 1 inch negative static pressure class: 1 inch

4. Insulated Flexible Duct

a. Chlorinated polyethylene (CPE) inner liner duct permanently bonded to a vinyl or zinc coated spring steel wire helix

b. Fiberglass insulating blanket; minimum R-value

1) Ducts outside the conditioned space and in conditioned envelope: 4.2

2) Ducts outside conditioned space and conditioned envelope: 8.0

c. Low permeability outer vapor barrier of fiberglass bi-directional reinforced metallized film laminate

d. Inner and outer liners shall provide a double air seal

e. Minimum Insertion Loss, 10 feet straight duct, 2500 fpm

Duct ID (in.)	Frequency (Hz)						
	125	250	500	1000	2000	4000	8000
6	11	33	37	39	37	19	14
8	13	35	34	39	29	17	14
≥12	10	26	26	35	24	11	9

f. Warranty: free of defects in material and factory workmanship for a period of 10 years from the date of manufacture

g. Thermaflex M-KE or equal

5. Uninsulated Flexible Duct

a. Woven fiberglass fabric with flame retardant coating permanently bonded to a vinyl or zinc coated spring steel wire helix

b. Thermaflex S-LP-10 or equal

B. Flexible ductwork clamps

1. Straps listed for use with flexible ductwork

2. 2 inches and greater SP Class: Galvanized steel strap

a. Adjustable toggle type

b. Young Quick-Clamps or equal

3. Less than 2 inches SP class: Adjustable nylon strap

a. With factory furnished installed tool

b. Panduit PAN-TY Cable Ties, Heat Stabilized Nylon 6/6

PART 3 EXECUTION

3.01 INSTALLATION

A. Coordinate with work of other trades

B. See Division 25 Building Automation Systems

C. See Section 23 08 00 Mechanical Commissioning

3.02 MOUNTING AND ALIGNMENT

A. See Section 23 05 48 Vibration and Seismic Control

3.03 DUCT CLASSIFICATION

A. Minimum operating pressure for each duct system, general

1. Scheduled static pressure for each fan or unit, positive or negative, unless otherwise indicated on the Drawings

2. Adjust upward to nearest pressure class tabulated in SMACNA HVAC Duct Construction Standards

B. Static pressure class, unless otherwise indicated on the Drawings

Application	SMACNA Pressure Class

Application	SMACNA Pressure Class
VAV supply air duct and risers from AHU thru VAV boxes	2 inches
Downstream of VAV boxes, etc.	1/2 inch
Toilet exhaust	-1/2 inches
Other fans systems	Per fan static
Return air transfers	1/2 inch

3.04 DUCTWORK INSTALLATION

A. General

1. Install ducts in accordance with manufacturer's written installation instructions

2. Construct with gages, joints, bracing, reinforcing, and other details per current CMC and SMACNA, unless specified otherwise

    a. Comply with most stringent

    b. Provide ducts with CMC gages or thicker when traversing rated corridors

3. Construct of galvanized sheet metal, except where otherwise indicated herein or on Drawings

4. Provide for duct rigidity by either of these methods

    a. Beading at 12 inches on center, maximum

    b. Crossbreak outward in ducts having positive internal pressure

    c. Crossbreak inward in ducts having negative internal pressure

        1) Exception: All ducts exposed to rain shall outward crossbreak on top of the duct.

5. Duct dimensions indicated are outside duct dimensions (OD) unless indicated on the Drawings as inside dimension (ID or net, clear dimension).

6. Alter duct sizes on basis of equal friction where required to facilitate installation. Reflect changes in shop drawings for review by Owner's Representative.

7. At duct penetrations of walls, floors and ceilings where exposed to occupant view, provide sheet metal angle type escutcheons with no sharp corners or edges.

    a. Clearance from duct to opening shall not exceed 2 inches.

    b. Escutcheons shall overlap wall, floor, or ceiling surface by 1/2 inch minimum.

8. Frame, trim, caulk and seal all duct penetrations through acoustical walls and partitions. See Section 23 05 48 Vibration and Seismic Control.

9. Firestopping at penetrations of fire rated floors and partitions

    a. The fire-resistance rating of penetrations and fire-resistant joint systems shall be firestopped with a UL listed firestop system that will maintain the fire rating of the assembly. Through-penetrations and membrane penetrations shall be protected by an approved system installed as required by the system listing or as otherwise

permitted by CBC Section 714. Listed through-penetration firestop systems and membrane penetrations shall be installed in accordance with the installation details for the listed system to be installed. Fire protection system installation details and listings shall be submitted for approval prior to the start of system installation.

b. Manufacturer

1) 3M Penetration Sealing Systems (PSS 7909) and 3M Fire Barrier Caulk and Putty

2) Dow-Corning LTV Silicone foam

3) Or equal

10. Tapers

a. Pitch sides of duct in diverging or converging airflow maximum of 1 to 4 taper

b. Abrupt, bushing type fitting not allowed

11. Duct openings

a. Provide openings where required to accommodate thermometers, smoke detectors, controllers, and the like. Insert through airtight rubber grommets.

b. Where openings are provided in insulated ductwork for insertion of instruments, install insulation material inside metal ring for use as plug.

c. At fire dampers allow adequate length of duct to install access door.

12. Avoid penetration of ducts; provide airtight seal at unavoidable penetrations of hanger rods and tie rods.

13. No exposed sharp metal allowed

a. All exposed pins, screws and sharp objects shall be covered with hardening silicon

b. All exposed sheet metal edges shall be hemmed with exposed corners rounded smooth

c. Remove all sheet metal fish hooks

d. Dryer ducts shall have no screws or other elements protruding into ducts that might catch lint.

14. Install lining in ducts and plenums as specified in Section 230700 Mechanical Insulation.

15. Volume dampers: Install dampers as specified in Section 233300 Duct Accessories

16. Ducts exposed to occupant view

a. Use only spiral round or oval ducts; no rectangular duct or flex duct unless specifically shown on Drawings.

b. Use Gripple hangers.

c. Duct sealant shall be clear and concealed in the joint, invisible to occupants.

d. Run ducts parallel to the structure unless specifically shown on Drawings.

e. Ducts shall not intersect wall corners or run parallel to and within a full height wall.

f. Where painting is shown on architectural drawings, materials shall be de-greased or otherwise ready to paint (paint by others).

g. Ducts shall have no external markings or tags.

h. Saddle taps and other taps to grilles, tees, wyes, etc.:

1) Have flanges at duct connection inside the duct concealed from view

2) Do not break the duct, i.e. use taps cut into a continuous spiral duct, not factory constructed tees.

B. Rectangular Elbows

1. Use radius elbows in rectangular ducts unless otherwise indicated on the Drawings based on ratio of inner throat radius (R) to duct width in plane of radius (W):

a. Low pressure: R/W shall not be less than 0.5

b. Medium pressure: R/W shall not be less than 1.0

c. Where space does not permit radius specified above, install short radius splitter vanes per SMACNA HVAC Duct Construction Standard with number of splitter vanes determined by R/W ratio

1) One vane: R/W above 0.3

2) Two vanes: R/W between 0.1 to 0.3

3) Three vanes: R/W 0.1 and smaller

2. Square turns with turning vanes in rectangular ductwork may only be used as follows:

a. Where shown on drawings. Note: turning vanes are not required on return air transfer boots unless shown on Drawings.

b. Where radius elbow specified above cannot fit.

c. Where close to inlets at fans (to minimize system effect).

C. Rectangular Ductwork

1. Transverse Joints: Standard: Fabriduct TDC or Ductmate or equal. Low pressure ductwork may be slip & drive (S&D) per SMACNA.

2. Longitudinal Joints: Standard: Pittsburgh. Snap lock not allowed.

3. Branch take-offs

a. Medium pressure riser taps: double 45 degree (upstream and downstream)

b. Other medium pressure: 45 degree upstream

c. Low pressure: straight 90 degrees

D. Round and Oval Ductwork

1. Joints

a. Standard: Beaded sleeve joints mechanically fastened with sheet metal screws or pop rivets

b. Welded. Where indicated herein or on plans

2. Longitudinal

a. Standard: Spiral lock

b. Welded. Where indicated herein or on plans

3. Branch take-offs

a. Medium pressure: 45 degrees or conical 90 degrees

b. Low pressure: straight 90 degrees. Branch connections may be made with spin-in fittings

c. Center-line take-off, unless otherwise indicated on the Drawings

E. Flexible ductwork

1. Use only where shown on drawings

2. Type

a. Insulated acoustical type shall be used for all

1) Supply air

2) Return air

3) Exhaust air (for acoustical dampening) except rooms with showers or other high moisture sources

b. Uninsulated type shall be used for all

1) Exhaust air from rooms with showers or other high moisture sources

3. Not allowed for

a. Product conveying systems such as kitchen exhaust and laboratory exhaust

b. Medium pressure ducts upstream of VAV boxes

4. Continuous, single pieces

5. Length

a. Maximum: 5 feet

b. Minimum

1) Insulated acoustical type: 5 feet

2) Uninsulated type: 3 feet

6. End Connections

a. Connect to duct collars, terminal unit connections and round air outlets per manufacturer's instructions.

b. Secure with strap clamps and seal as specified herein.

7. Installation

a. Support adequately to avoid excessive droop

b. Minimum inside bending radius not less than one duct diameter

c. Install as straight as possible except as shown on drawings for sound attenuation

d. Cut ducts to lengths required rather than create bends to take up excess lengths except as shown on drawings for sound attenuation

F. Grille Connections

1. Provide at entry to diffuser collar either

a. Straight duct for 1 duct diameters or greater

b. Full radius elbow

c. Side inlet plenum

1) Height: 4 inches minimum taller than top of grille to provide room for uniform airflow to grille

2) Width/length: 2 inches wider than duct or round diffuser collar, whichever is larger

3) For supply air grilles, internal surfaces lined with minimum 1/2 inch thick Type AL duct liner as specified under Section 230700 Mechanical Insulation

4) At contractor’s option, where plenum is required at round neck diffuser, square neck diffuser with length and width equal to diffuser diameter may be substituted

d. Thermaflex FlexFlow Elbow or equal

2. Connections at grilles shall be insulated to the extent the duct is insulated including the final register box.

3. Seal connections at grilles per seal class of upstream ductwork.

G. Duct Hangers and Supports

1. General

    a. Support horizontal ducts with hangers of size and spacing as indicated in pertinent SMACNA HVAC Duct Construction Standards

    b. Attachment to structure: See Section 23 05 29 Hangers and Supports

    c. Seismic restraints: See Section 23 05 48 Vibration and Seismic Control

2. Horizontal Duct Supports

    a. Install hangers at each change in direction of duct

    b. Strap hangers

        1) Extend strap down both sides of ducts

        2) Turn under bottom one inch minimum

        3) Metal screw hangers to

            a) Bottom of duct

            b) Upper and lower sides of ducts

            c) Not more than 12 inches on center

    c. Angle Hangers

        1) Provide angle hangers formed by extended vertical bracing angles

        2) Or by rods connecting to bottom angles if size or bracing angles conform to hanger schedule

3. Vertical Duct Supports

    a. Support vertical ducts at every floor

    b. Use angles or channels mechanically fastened to ducts with screws or pop rivets.

    c. Set angles or channels on floor slab or structural steel members placed in opening, unless otherwise indicated on the Drawings

H. General Ductwork

1. Applies to ductwork not specifically listed in Paragraphs below

2. Standard galvanized construction

3. Standard seams and joints

I. Ducts Exposed to Weather

1. Galvanized steel G-90, 304 stainless steel, or aluminum

2. Make ducts subject to rain watertight.

3. Construct as follows to assure water run-off

    a. Arrange standing seams to not act as dams

    b. Longitudinal seams at bottom of duct

    c. Construct all ducts subject to rain watertight and to insure water runoff by one or more of following techniques

        1) Slope entire top of duct down toward side

        2) Vertical struts within duct to bow top panels of duct into convex shape

        3) Sheet metal cap where shown on Drawings

J. Sound-Rated Duct Packing

1. Wherever possible avoid duct penetrations through sound-rated walls, floors and ceilings.

2. Provide packing for unavoidable duct penetrations per Section 230548 Vibration and Seismic Control.

K. Joint Sealing

1. Seal ducts per the Seal Levels tables below

    a. Seal factory fabricated ducts and plenums, including terminal boxes, if not factory sealed to Seal Level listed

Seal Level Requirement				
Duct Location	Duct Type			
	Supply		Exhaust/ outdoor air	Return
	<2 in. water column[b]	≥2 in. water column[b]		
Outdoors	A	A	A	A
Unconditioned Spaces	A	A	A	A
Return Air Plenums	A	A	A	A
Conditioned Spaces	A	A	A	A

[b]Duct design static pressure classification.

Seal Level Definitions	
Seal Level	Sealing Requirements
A	All transverse joints, longitudinal seams, and duct wall penetrations
B	All transverse joints and longitudinal seams
C	Transverse joints only

Longitudinal seams are joints oriented in the direction of airflow. Transverse joints are connections of two duct sections oriented perpendicular to airflow. Duct wall penetrations are openings made by any screw fastener, pipe, rod or wire. Spiral lock seams in round and flat oval duct need not be sealed. All other connections are considered transverse joints, including but not limited to spin-ins, taps and other branch connections, access door frames and jambs, duct connections to equipment, gores of elbows, etc.

2. Ducts Not Exposed to Weather

    a. General: Seal using one of the following:

        1) Duct Sealing Compound

        2) Gasketed TDC or Duct-Mate

        3) Two-Part Hard-Setting Joint Tape

        4) Rolled Elastomeric Duct Sealant if and only if

            a) Joint is not exposed to occupant view

            b) Pressure class is less than 2 inches

            c) Surface is clean, dry, and grease/oil-free

            d) Extensive pressure is applied, working the tape into the duct surface using an application tool recommended by the Rolled Elastomeric Duct Sealant manufacturer.

    b. Flexible duct

        1) Secure with straps or clamps as specified herein.

2) Supplement with Rolled Elastomeric Duct Sealant, both inner and outer liner.

c. Indoor duct where exposed to occupant view: Sealant shall be within joint only and not visible.

d. Fire and fire/smoke dampers: Sealant shall be listed as SFM approved on manufacturer's UL installation sheet.

3. Duct Exposed to Weather

a. TDC or Duct-Mate joints: Utilize interior joint gasket material plus a bead of butyl rubber sealant at the joint and continuous metal clip or cleat over the top of all four joints (top bottom and sides).

b. Other joints: Apply Two-Part Hard-Setting Joint Tape to

1) Longitudinal joints

2) Transverse joints

3) Duct penetrations

4) Screws through duct

5) Gores of elbows

4. After installation and testing reseal joints found to be leaking at no additional cost to the Owner.

3.05 PROTECTION

A. Adhere to SMACNA Duct Cleanliness for New Construction Guidelines for Intermediate Level Duct Cleanliness unless more stringent requirements are indicated herein.

B. Storage: Porous materials, such as lined and flexible duct, shall be stored where they will not be exposed to rain or other moisture sources.

C. Temporary closure: Provide temporary closure of polyethylene film or other covering which will prevent entrance of dust and debris at the following conditions:

1. Exposed ends of unlined installed ducts at the end of each day

2. Exposed ends of lined ducts or plenums whether in storage or installed

D. Duct Cleaning

1. Perform for each phase of work.

2. Using the connected fan(s) force air at high velocity through duct to remove accumulated dust

3. Protect equipment and spaces, which may be harmed by excessive dirt with filters, or bypass during cleaning

4. In areas, which must be kept dust free, seal all outlets duct tight. When closures are removed avoid spilling dust in room

3.06 INSPECTION

A. Verify that adequate clearance between ducts and adjacent walls or equipment is available to permit proper sealing, maintenance and repairs.

3.07 PRE-OPERATING CHECKS

A. Before operating the duct systems: Set all manual dampers in full open position

B. Complete the Pre-Functional Test Data Sheet (Section 23 08 00 HVAC Commissioning) for each duct system.

3.08 TESTING AND ADJUSTING

A. Before starting the duct systems

1. Clean the duct system. See Paragraph 3.05D

2. See Section 01 91 00 Commissioning

B. After starting the duct systems: Check for noise and leakage. Repair as required at no additional cost to the Owner.

C. See Section 23 05 93 Testing, Adjusting, and Balancing: Coordination with Balance Agency:

1. Provide services of a sheet metal installer familiar with the system ductwork to provide assistance to the balancing agency during the initial phases of air balancing in locating all sheet metal dampers

2. Install missing dampers

D. See Section 23 08 00 Mechanical Commissioning

END OF SECTION

SPECIFICATION 23 33 00
DUCT ACCESSORIES

PART 1 GENERAL

1.01 SUMMARY

A. Work included in this section: materials, equipment, fabrication, installation and tests in conformity with applicable codes and authorities having jurisdiction for the following:

1. Access Doors
2. Balancing Dampers
3. Automatic Dampers
4. Backdraft Dampers
5. Fire Dampers
6. Fire/Smoke Dampers
7. Sound Attenuators
8. Drain Pans
9. All duct accessories except, where integral with manufactured piece of equipment.

1.02 QUALITY ASSURANCE

A. Fire, smoke, and fire/smoke dampers shall be UL listed and constructed in accordance with UL Standard 555 Fire Dampers and UL Standard 555S.

B. Demonstrate operation of smoke dampers to authorities having jurisdiction and Owner's representative as part of life safety testing.

C. Access doors shall be UL labeled.

D. Damper pressure drop and leakage ratings shall be based on tests and procedures performed in accordance with AMCA 500 - Test Methods for Louvers, Dampers and Shutters.

1.03 SUBMITTALS

A. See Section 23 05 01 Basic Mechanical Materials and Methods.

B. Submit product data, O&M data, and samples and show item on shop drawings (where shop drawings are required) according to the following table.

1. “R” means required.
2. “R2” means required only for products and equipment differing for the specified manufacturer and model and for “or equals” where specified.

Item	Product Data	O&M Manual	Samples	Shop Drawing
Access doors	R2			R
Balancing dampers	R2			R
Automatic dampers	R	R		R
Backdraft dampers	R2			R
Fire dampers	R	R		R
Fire/Smoke dampers	R	R		R
Sound attenuators	R			R
Drain pans	R2			R

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Named manufacturer model numbers used as example of item and establish minimum level of quality and minimum standard options. Equivalent models of listed manufacturers are acceptable.

B. Access Doors, Ducts

1. Ventfabrics, Inc.
2. Duo Dyne, Corporation
3. Ruskin Mfg. Company
4. PCI Industries – Pottorff
5. Ductmate
6. Or equal

C. Access Doors, Plenum

1. Ventfabrics, Inc.
2. Duo Dyne, Corporation
3. Elgen Manufacturing Company
4. Or equal

D. Balancing and Automatic Dampers

1. Ruskin Manufacturing Company
2. Greenheck
3. Air Balance Inc.
4. American Warming and Ventilating Inc.
5. Johnson Controls

6. PCI Industries - Pottorff
7. Or equal

E. Backdraft Dampers

1. Greenheck Fan Corp
2. Ruskin Manufacturing Company
3. Air Balance, Inc.
4. American Warming and Ventilating Inc.
5. Or equal

F. Damper Hardware

1. Ventfabrics, Inc.
2. Duo Dyne, Corporation
3. Young Regulator Company
4. Or equal

G. Fire Dampers and Combination Smoke and Fire Dampers

1. Ruskin Manufacturing Company
2. Greenheck
3. Air Balance Inc.
4. PCI Industries - Pottorff
5. Or equal

H. Sound Attenuators

1. Vibro-Acoustics
2. Dynasonics
3. Industrial Acoustics, Inc.
4. Or equal

2.02 DUCT ACCESS DOORS

A. In accordance with SMACNA Duct Construction Manuals, except as indicated in the Drawings

B. In Ductwork

1. Construction

a. Same material as duct

b. Rating same as duct pressure class

c. Where duct is insulated

1) Fiberglass insulation, thickness to match duct insulation installed R-value, see 23 07 00 Mechanical Insulation

2) Double wall

d. Positive seal polyethylene gasket

e. Paired progressive cam-locks, quantity as required for tight, low leakage fit

f. No tools required for opening and closing

2. Size

a. 20 inches x 14 inches unless otherwise indicated in the Drawings

b. Ducts less than 16 inches: one dimension 20 inches; other dimension 2 inch less than duct width

c. Larger sizes where required for access

2.03 DAMPERS

A. Volume Dampers

1. Conform to requirements of SMACNA HVAC Duct Construction Standards.

2. General

a. Blades of same material as duct where damper is located

b. Damper Hardware

1) Ventlok 400 and 4000 series or equal; for low pressure systems 2 inch SMACNA pressure class and less

2) Ventlok HiVel hardware or equal; for greater than 2 inch SMACNA pressure class

c. Actuating quadrants typical for single and multi-blade dampers; provide closed bearing on opposite end from quadrant to prevent air leakage: Ventlok No. 609 or equal

d. Bearing at one end of damper rod: Ventlok No. 609 or equal

e. Sealed bushings installed at both ends to avoid duct leakage

f. Accessible quadrant at other end of damper rod

1) With lever and lock screw: Ventlok No. 635 or equal

2) Insulated ducts

a) Quadrants mounted on collar to clear insulation

b) Ventlok Nos. 637, 638, or 639 or equal

c) Selection based on insulation thickness

g. For volume dampers above non-removable (inaccessible) ceilings

1) Use ceiling access panels if provided for another purpose and located within reach of the damper; do not provide access panels whose sole purpose is for damper access.

2) Otherwise provide either:

a) Ventlok No. 677, MAT Roto-Twist 200, or equal mechanical concealed damper regulator with

1. Required interconnecting hardware and cable

b) Greenheck RBDR-50, MAT Electro-Balance 200 or equal electrically actuated balancing damper assembly (position feedback not required) with

1. Required interconnecting hardware and cable

2. Battery powered controller

c) With either device, controller connection shall be located in a concealed location as follows:

1. In the diffuser/grille backpan or plenum where accessible through the diffuser/grille

2. Above the ceiling at the terminal box that serves the damper. This may be a ganged connector for multiple dampers served by the terminal box.

3. Above the ceiling at the nearest accessible location, such as next to a fire/smoke damper ceiling access panel

3. Single blade dampers

a. Galvanized steel ductwork: galvanized steel, except as indicated in the Drawings

b. Blade: Two gages heavier than duct gage, or 18 gage, whichever is lighter

4. Multi-blade Dampers

a. Low Pressure/Low Velocity Systems (2 inch water column or less static pressure class and 1500 fpm or less face velocity)

1) Opposed blade damper

2) Ruskin Model CD35 or equal

b. High Pressure/High Velocity Systems (greater than 2 inch water column static pressure class or greater than 1500 fpm face velocity):

1) Rectangular

a) Opposed blade damper

b) Ruskin Model CD60 or equal

2) Round and Oval

a) Oval: Ruskin Model CDR25 and DO25 or equal

b) Round: Up to 20 inch diameter: Ruskin Model MDRS25 or equal

c) Round: Larger than 20 inch diameter: Ruskin Model CDRS25 or equal

B. Automatic Dampers

1. Field installed dampers

a. Blade Action

1) Throttling duty: opposed

2) Mixing duty: parallel

3) Two-position: parallel or opposed

b. Bearings: Molded synthetic or stainless steel sleeve, turning in extruded hole in frame.

c. Seals:

1) Blade: Inflatable PVC coated fiberglass material, silicone, or neoprene mechanically attached to blade edge.

2) Jamb: Flexible metal compression type.

d. Linkage: concealed in frame. External linkage, jump-over brackets, jackshafts and any other elements in the airstream will not be accepted.

e. Axles: Minimum 1/2 inch diameter plated steel, hex-shaped, mechanically attached to blade. Side access for direct-coupled actuator.

f. Finish: Mill galvanized.

g. Where stainless steel dampers are indicated on drawings, dampers shall have stainless steel blades, stainless steel bearings, stainless steel jamb seals.

h. Where aluminum dampers are indicated on drawings, dampers shall have aluminum blades, aluminum frame, synthetic or stainless steel bearings, stainless steel jamb seals.

2. Actuators: Direct coupled type specified under Division 25 Building Automation Systems

3. Damper area: See Drawings

4. Damper type: See Drawings

C. Backdraft Dampers

1. Required locations

a. Where indicated on the Drawings

b. In suction or discharge of all exhaust fans as listed in equipment schedule

1) Integral, heavy-duty factory-installed type acceptable unless otherwise scheduled

2. General Applications

a. Construction

1) Extruded aluminum construction, minimum 4 inch 12 gage frame

2) Extruded vinyl locked into blade edge.

3) Blade ends overlapping frame

b. Performance

1) Start to open: .02 inches w.g. or less

2) Fully open: .05 inches w.g. or less

3) Leakage for 24 inch wide damper: 25 cfm per ft^2 or less

c. Ruskin Series CBD4 or equal

3. High Velocity Applications

a. Applies to discharge of air handlers and where velocity exceeds 1500 fpm. Damper shall be specifically designed for location at turbulent fan discharge.

b. Frame

1) Minimum 12 gage galvanized steel channel

2) Bolt Holes: Both flanges

c. Blades

1) Airfoil-shaped with integral structural reinforcing tube running full length of each blade

2) Material: 7 inches x minimum 0.080 inch Alloy 6063-T5 extruded aluminum

3) For multiple section dampers, provide galvanized steel or aluminum bracket to link dampers so they operate together.

d. Axles: Minimum 3/4 inch (19 mm) diameter plated steel

e. Bearings: Bolt-on bearings with re-lube ball bearings

f. Linkage

1) 3/16 inch thick x 3/4 inch plated steel tie bar with minimum 16 gage plated steel linkage arms; stainless steel pivot pins

2) Located out of airstream (side or external linkage)

g. Counterbalance: Located out of airstream

h. Seals

1) Blade

a) Mechanically attach blade seals to blade

b) Silicone rubber, rated for 300 degrees Fahrenheit

2) Jamb: Vinyl

i. Ruskin CBS92 or equal

j. For Fume Hood Exhaust Fans only

1) As above except stainless steel blades, stainless steel bearings, stainless steel linkage and axles, silicone blade edge seals, and no jamb seals.

2) Greenheck HB-230 or equal

2.04 FIRE DAMPERS

A. Ratings (test conditions and label) per UL Standard 555

1. 250 degrees Fahrenheit minimum

2. 1-1/2 hour fire rating, unless otherwise indicated in the Drawings

3. Dynamic (closes against air flow) where required by code or where scheduled

B. Factory sleeve

C. Damper

1. Multi-bladed, equipped with fusible link, spring loaded type

D. Fusible link

1. UL listed

2. Fusible links on fire dampers shall be constructed to UL Standard 33 – Fusible Links for Fire Protection Service

3. Temperature rating: Per code

E. Type:

1. Rectangular type up to 1000 feet per minute: Greenheck DFD-150X Style A or equal

2. Rectangular type 1000 feet per minute and higher: Greenheck DFD-150X Style B or equal

2.05 COMBINATION FIRE AND SMOKE DAMPERS

A. Fire ratings (test conditions and label) per UL Standard 555S

1. 250 degrees Fahrenheit minimum

2. 1-1/2 hour fire rating, unless otherwise indicated in the Drawings

B. Factory sleeve

C. Damper

1. Two-position duty: Either parallel blade or opposed blade

2. Leakage class as scheduled, minimum Class 2, rated per UL 555S

3. Locate damper in sleeve starting at approximately 3” from end of the sleeve opposite the damper actuator end. (Damper shall be installed with this end protruding 3 inches out from inside surface of wall.)

4. Horizontal dampers shown on Drawings to be supported by a drywall rated enclosure (rather than a framed concrete opening) shall be listed for this application.

D. Actuator

1. UL 555S listed

a. 120 volt two position unless otherwise indicated on drawings

2. Spring return normally closed unless otherwise indicated on drawings

3. Electronic cut-out at full-open so that actuator creates no noise holding open

4. Permanently lubricated gears

5. Direct coupled with cold-weld steel clamp; aluminum clamp and external linkage not acceptable

6. For multiple damper sections using one actuator, jackshafts between sections shall be welded, not bolted or screwed.

E. Controls

1. Heat-actuated electric release

a. Controlled closure to prevent duct and HVAC component damage

b. Damper to automatically reopen after a test, smoke detection or power failure condition. In the event of heat activated closure, the damper must be manually reset at the damper.

c. Release temperature: as scheduled on drawings.

d. Ruskin EFL or equal

2. Status End Switches

a. Where scheduled on Drawings

b. Built into the direct-coupled actuator; blade mounted end switch packages are not acceptable.

c. For dampers with multiple actuators, status switches are required for each independent damper section; sections that have multiple actuators and that also have jackshafts connecting the dampers in each section together shall have actuator end switches on only one actuator.

d. UL 555S listed

e. California State Fire Marshal approved

F. Type: as indicated on the Drawings

2.06 SOUND ATTENUATORS

A. Factory prefabricated

B. Shell

1. Galvanized steel: minimum 22 gage

2. Leakproof at pressure differential of 8 inches water gage

C. Media

1. Flamespread: maximum 25

2. Fuel contributed and smoke developed: maximum 50

3. Minimum 4.5 pounds per cubic foot density glass or mineral fiber packed under 5 percent compression

4. Media shall meet erosion test method described in UP Publication No. 181

5. Filler to be inert, vermin and moisture proof

D. Internal construction: Galvanized perforated steel baffles: minimum 24 gauge

E. Attenuator Performance

1. See schedule on the Drawings for

a. Net insertion ratings

b. Maximum allowable air pressure drop

c. Model number

F. Certified tests

1. Submit a laboratory certified test data for pressure drop and insertion loss ratings
    a. For square or rectangular attenuators: 24 inch x 24 inch cross-section attenuator
    b. For round attenuators: 24 inch diameter conical attenuator
    c. Certification data for pressure drop and net insertion loss: based on tests of same attenuator
    d. Attenuators and tests: subject to inspection upon request

G. Industrial Acoustics, Inc. Quiet-Duct or equal

2.07 DRAIN PANS

A. Field Installed Drain Pans
    1. Required at field installed cooling coils
    2. Pan material
        a. 20 gage Type 304 stainless steel
    3. Supports: galvanized steel
    4. Extend under coil casing
        a. Upstream: minimum 3 inches
        b. Downstream: minimum 18 inches or half the coil finned-height, whichever is larger
    5. Extend on sides
        a. To wall of casing
        b. To accommodate chilled water control valve(s)
        c. To receive condensate from piping and controls
    6. Provide additional intermediate pans for coils mounted more than one section high
    7. Slope to drain. Level installation not acceptable
    8. Drain Connection
        a. Size per California Mechanical Code based on coil capacity
        b. Mounted in bottom of pan at lowest point or outside with a flush mount that allows complete draining

B. Auxiliary Drain Pans
    1. Required where scheduled or shown on plans
    2. Sized to capture any overflow from unit condensate drain pan and extended to capture drips from condensate pumps, control valves, strainers, and unions

3. Construction: 20 gage Type 304 stainless steel

2.08 CONDENSATE PUMP

A. Manufacturer: Little Giant, Diversitech, or equal

B. Provide where scheduled

C. Contractor shall verify pumping head requirements.

D. Features

1. Discharge check valve

2. 120V unless otherwise scheduled

3. High level alarm contact

2.09 BELT GUARDS

A. Fabricated per SMACNA Duct Construction Standards

B. Reuse the existing SF-1 belt guard

PART 3 EXECUTION

3.01 INSTALLATION

A. Coordinate with work of other trades

B. Install duct accessories in accordance with manufacturer's written installation instructions

C. See Section 23 31 00 Ducts

D. Provide access doors in following locations:

1. Coils in ducts (including at VAV boxes)

a. Entering side for heating coils

2. Automatic dampers: linkage side

3. Fire/smoke dampers

4. Fire dampers

5. Smoke detection heads enclosed in ducts

6. Sprinkler heads in ducts

7. Where otherwise indicated on the Drawings

E. Volume Dampers

1. Provide at locations indicated on the Drawings

    a. Volume dampers shall be installed as far away from air outlets as functionally reasonable to avoid noise in the occupied space.

    b. Provide also in wyes and tap-ins to outlets whether indicated on the Drawings or not, except

        1) Where dampers are not indicated on the Drawings above inaccessible ceilings

        2) To sidewall outlets in exposed ducts (opposed blade dampers in outlets shall be provided where scheduled)

2. Additional locations where dampers appear to be required for balancing, place request for information with Engineer prior to construction.

3. For ductwork exposed to occupant view, volume damper handles shall be on top of duct or otherwise concealed from occupant view.

4. For dampers above non-removable ceilings that are not accessible from ceiling access panels or removable diffusers, provide concealed damper regulator as specified herein or detailed on Drawings.

F. Fire and Smoke Dampers

1. Provide in ducts and openings as indicated in the Drawings

2. Provide access door in duct adjacent to each in location where damper may be inspected and internal fusible link or fire-stat may be replaced

3. Install duct smoke detector provided by Division 26 if required; see Division 26 drawings

4. Smoke and fire dampers installed in tunnel corridors shall have weight of damper supported from structure above.

G. Control Dampers

1. Field mounted control dampers installed with concealed linkage shaft accessible on side of damper with space for direct-coupled actuator

2. Actuator installation: See Division 25 Building Automation Systems

H. Install belt guards at all exposed belts

I. Drain pans

1. Condensate drain pans at air handling unit cooling coils

    a. Slope to drain connection to allow complete draining of pan

    b. Piping from intermediate drain pan to lowest pan

        1) Piping: See Section 23 21 13 HVAC Piping

        2) Pipe to within 1 inch of and discharge into lowest drain pan

c. Provide condensate pump where scheduled

d. Piping from lowest pan drain connection to sewer

1) Trap height and offset must allow water seal to remain and to allow complete drainage of pan both when fan is operating or not

e. Field test

1) See post-installation tests performed under Section 230593 Testing, Adjusting and Balancing.

2. Auxiliary drain pans

a. Piping: See Section 23 21 13 HVAC Piping.

b. Separate drain from main drain pan.

c. Discharge where water flow is readily observed but not over any material or equipment that may be damaged by water.

3.02 MOUNTING AND ALIGNMENT

A. Install all accessories to prevent air leakage.

B. Install closed bearing end on all damper blades that penetrate duct to prevent air leakage.

C. Support extra weight of duct accessories. See Section 23 05 48 Vibration and Seismic Control

3.03 INSPECTION

A. Verify that adequate clearance between duct accessories and adjacent walls or equipment is available to permit maintenance and repairs.

3.04 PRE-OPERATING CHECKS

A. Before operating duct accessories: Set all components in normal operating condition

3.05 TESTING AND ADJUSTING

A. Before operating duct accessories see Section 01 91 00 Commissioning

B. After starting duct accessories

1. Check for noise and leakage; repair as required at no additional cost to the Owner

2. Operation test: Test each piece of equipment to show that it will operate in accordance with requirements.

C. See Section 23 05 93 Testing, Adjusting, and Balancing

D. See Section 23 08 00 Mechanical Commissioning

END OF SECTION

SPECIFICATION 23 34 00
FANS

PART 1 GENERAL

1.01 SUMMARY

A. Work included in this section: materials, equipment, fabrication, installation and tests in conformity with applicable codes and authorities having jurisdiction for the following:

1. All fans except where integral with manufactured piece of equipment

2. SF-1: Refurbish the existing fan

1.02 REFERENCE STANDARDS

A. ANSI/ABMA Standard 9 – Load Rating and Fatigue Life for Ball Bearings

B. AMCA 99 – Standards Handbook

C. AMCA 210 – Laboratory Methods of Testing Fans for Aerodynamic Performance Rating

D. AMCA 300 – Reverberant Room Method for Sound Testing of Fans

E. AMCA 301 – Methods for Calculating Fan Sound

F. ANSI/ABMA 11 – Load Ratings and Fatigue Life for Roller Bearings

1.03 QUALITY ASSURANCE

A. AMCA certified ratings per applicable AMCA standard based on the testing conducted in an independent laboratory

B. Performance Ratings: Conform to AMCA 210 and bear the AMCA Certified Rating Seal

C. Sound Ratings: AMCA 301; tested to AMCA 300 and bear the AMCA Certified Sound Rating Seal

D. Fabrication: Conform the AMCA 99

E. Conform to AMCA Bulletins regarding construction and testing

1. Fans shall bear AMCA certified rating seal

F. Scheduled equipment performance is minimum capacity required.

G. Scheduled electrical capacity shall be considered as maximum available.

H. Scheduled static pressure is external to the fan and does not include the pressure drop of accessories specified to be provided with the fan, such as backdraft dampers, inlet screens, belt tubes, etc. The manufacturer shall include these pressure drops in the fan total pressure such that the scheduled airflow can be achieved at the scheduled external static pressure.

1.04 SUBMITTALS

A. See Section 23 05 01 Basic Mechanical Materials and Methods.

B. Submit product data, O&M data, and samples and show item on shop drawings (where shop drawings are required) according to the following table.

1. "R" means required.

2. "R2" means required only for products and equipment differing for the specified manufacturer and model and for "or equals" where specified.

Item	Product Data	O&M Manual	Samples	Shop Drawing
Fans	R	R		R
Fan Accessories	R	R		

C. Include

1. Complete graph of fan curves, not just curve for design conditions

2. Sound power levels

a. Fans 1 horsepower and larger: dB by octave bands

b. Fans less than 1 horsepower: sones

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Named manufacturer model numbers used as example of item and establish minimum level of quality and minimum standard options. Equivalent models of listed manufacturers are acceptable.

B. Greenheck

C. Loren Cook

D. Twin City

E. Or equal

2.02 GENERAL

A. Fans shall bear the AMCA certified ratings seal for sound and air performance and be certified in accordance with ARI Standard 210 and 211, and AMCA Standard 2408 for centrifugal fans

B. Fans used shall not increase motor size, increase noise level, or increase tip speed by more than 10 percent, or increase inlet air velocity by more than 20 percent, from specified criteria.

C. Performance

1. See fan schedule on the Drawings

2. Capacities: minimum as scheduled on the Drawings

3. Brake horsepower rating: Maximum 10 percent above that scheduled on the Drawings

4. Fans and drives shall be capable of accommodating static pressure variations of plus or minus 10 percent

5. Motor horsepower: No larger than that scheduled on the Drawings, or compensate Division 26 contractor for any associated cost to increasing motor size

6. Sound power: No greater than that scheduled on the drawings

D. Wheels

1. Class as indicated on the Drawings or as required for duty

2. Formed steel or extruded aluminum

3. Statically and dynamically balanced in accordance with AMCA Standard 204-96 Balance Quality and Vibration Levels for Fans

4. Exposed fan wheels protected by finger proof screen where scheduled

E. Shafts

1. AISI C-1045 hot rolled and accurately turned, ground, and polished

2. Sized for a critical speed of at least 125% of maximum RPM

F. Motors

1. Comply with Section 230513 Motors and Controllers.

2. Provide electrically commutated motor (ECM) where scheduled

G. Housing

1. Bolted and welded construction utilizing corrosion resistant fasteners

2. Scroll wrapper and scroll side panels shall be a minimum 12 gauge steel

3. The entire fan housing shall have continuously welded seams

4. Spun inlet bell and shaped cut-off for centrifugal fans

5. Weatherproof drive covers at utility sets shall have access doors

H. Belt Drive

1. Matched, multiple V-belt

2. Capacity: minimum 1.5 times motor horsepower

3. Pulleys

a. Cast iron

b. Variable pitch diameter

1) Except motors with variable speed drives

2) Fans up to 7-1/2 hp motor

3) Fans from 10 hp to 25 hp, under 1000 rpm

c. Fixed pitch diameter

1) All motors with variable speed drives

2) Fans 10 hp and over 1000 rpm

d. Select at mid-point of range

4. Companion sheaves to maintain belts parallel

5. Drive guards

a. Comply with requirements of State COSHA

b. Provide holes in belt guards for tachometer readings

c. Indoor Belt Drives: 16 gage expanded metal or wire screen enclosure with 70 percent free area and steel frame

d. Outdoor Belt Drives: Provide enclosure over entire motor and drive assembly.

I. Bearings

1. Designed and tested specifically for use in air handling applications

2. Heavy duty regreasable ball or roller type in a cast iron pillow block housing

3. Bearing shaft mounting mechanism shall be concentric mount, not set screw mount.

4. Grease fittings extended to accessible locations outside housing

5. Life rating: minimum 200,000 hours per ABMA Standard 9 or 11 L_{50} rating, at maximum catalog speed

J. Painting

1. Electrostatically applied, baked polyester powder coating, minimum 2 mil thick

2. Paint must exceed 1,000 hour salt spray under ASTM B117 test method

PART 3 EXECUTION

3.01 INSTALLATION

A. Coordinate with work of other trades

B. Install fans in accordance with manufacturer's written installation instructions.

C. See Section 23 31 00 Ducts for duct connections

D. See Division 25 Building Automation Systems

E. See Section 23 08 00 Mechanical Commissioning

F. Flexible duct connection at inlet and outlet: See Section 23 05 48 Vibration and Seismic Control.

G. Backdraft Dampers

1. Comply with Title 24 Energy Standards and CMC

2. Provide backdraft or shutoff dampers for suction or discharge of every exhaust fan as scheduled on the Drawings

3. See schedules on the Drawings and Section 233300 Duct Accessories for where fan manufacturer may provide dampers and when specialty damper manufacturer must provide them.

H. Roof Mounted Fans and Ventilators

1. Install on factory fabricated curbs

a. Exception: Install Utility fans as indicated on the Drawings

b. Secured to structure with hold down methods as detailed

c. Made fully weatherproof. See Division 7 Thermal and Moisture Protection for waterproofing and roofing.

3.02 MOUNTING AND ALIGNMENT

A. See Section 23 05 48 Vibration and Seismic Control

3.03 INSPECTION

A. Verify that adequate clearance between fans and adjacent walls or equipment is available to permit maintenance and repairs.

3.04 REFURBISH SF-1

A. Refurbish the existing SF-1 fan as follows

1. Replace fan shaft

2. Replace shaft bearings

3. Dynamically balance the existing fan wheel

4. Replace the fan drive with a new pulley matching the existing fan pulley

5. Replace the motor sheave with a new sheave matching the existing motor sheave

6. Replace all the belts with all new belts matching the existing belts

7. Remove and reinstall the belt guard

8. Advise owner of any recommended modifications to the existing fan, fan accessories and belt guard, including a fee proposal

3.05 PRE-OPERATING CHECKS

A. Before operating fans

1. See Section 23 08 00 Mechanical Commissioning.

B. Do not operate fans for any purpose, temporary or permanent, until

1. Ductwork is clean

2. Filters in place

3. Bearings lubricated

3.06 TESTING AND ADJUSTING

A. Before starting fans

1. See Paragraph 3.05B

2. See Section 01 91 00 Commissioning

3. Install belt and motor guards

B. Start and test fans in accordance with manufacturers written installation instructions.

C. Start up and adjust fans to insure proper operation.

D. The submitted sound power level shall be verified through actual measurements and calculations in accordance with AMCA standards 300 and 301.

1. In the event the sound power level data measured or being submitted exceeds the designed level, provide additional sound traps or other sound attenuating devices to supplement the design in order to comply with sound power level specifications. Perform this work, including the additional noise control and any increase in motors Hp and increase in electrical service at no additional cost to the Owner. Submit calculations or measurement results to the Owner's Representative, which substantiate that sound power level produced by the submitted equipment and any required sound attenuating devices do not exceed the specified sound power levels.

E. After starting fans: Check for objectionable noise or vibration. Correct as needed at no additional cost to the Owner.

F. Balancing: See Section 23 05 93 Testing, Adjusting and Balancing

G. Commissioning: See Section 23 08 00 Mechanical Commissioning

3.07 TRAINING

A. See Section 23 08 00 Mechanical Commissioning

END OF SECTION

SPECIFICATION 23 36 00
AIR TERMINAL UNITS

PART 1 GENERAL

1.01 SUMMARY

A. Work included in this section: materials, equipment, fabrication, installation and tests in conformity with applicable codes and authorities having jurisdiction for the following: All air terminal units including

1. Variable air volume boxes

2. Fan powered boxes

1.02 REFERENCE STANDARDS

A. ARI Standard 885 – Procedure for Estimating Occupied Space Sound Levels in the Application of Air Terminal and Air Outlets

B. ARI Standard 410 – Standard for Forced-Circulation Air-cooling and Air Heating Coils

C. UL Standard 1995 − Standard for Safety Heating and Cooling Equipment

D. ASHRAE Standard 130 − Methods of Testing for Rating Ducted Air Terminal Units

1.03 QUALITY ASSURANCE

A. Terminal units rated and certified in accordance with ARI Standard 880-98 Certification Program

B. Heating coils rated in accordance with ARI Standard 410

C. All electrical components shall be UL listed and installed in accordance with the UL Standard 1995.

1.04 SUBMITTALS

A. See Section 23 05 01 Basic Mechanical Materials and Methods.

B. Submit product data, O&M data, and samples and show item on shop drawings (where shop drawings are required) according to the following table.

1. “R” means required.

2. “R2” means required only for products and equipment differing for the specified manufacturer and model and for “or equals” where specified.

Item	Product Data	O&M Manual	Samples	Shop Drawing
VAV boxes	R	R		R
Fan powered boxes	R	R		R
Hot water coils	R			R
Air terminal unit accessories	R	R		

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Named manufacturer model numbers used as example of item and establish minimum level of quality and minimum standard options. Equivalent models of listed manufacturers are acceptable.

B. VAV Boxes

1. Price
2. Titus
3. Envirotech
4. Or equal

2.02 VAV BOXES

A. General

1. Ship as a complete assembly requiring no field assembly (including accessories)
2. Casings
   a. Minimum 22-gage, galvanized steel
   b. Leakage rating: 10 cubic feet per minute maximum leakage at 1 inch water column, when tested per ASHRAE Standard 130
   c. Acoustic lining
      1) Material: Fiberglass with high density facing
      2) Minimum thickness:
         a) Terminals located in conditioned space or return air plenum: 1/2 inch
      3) Minimum 1.5 pound per cubic foot density
      4) Maximum thermal conductivity: 0.28 Btu-in per hour per foot squared per degree Fahrenheit (BTU-inch/h·ft^2·°F) measured on a horizontal plane in accordance with ASTM C518 at a mean temperature of 75 degrees Fahrenheit
      5) Meet erosion test method described in UL publication No. 181
      6) Meet smoke developed and flame spread rating requirements of NFPA-90A
      7) Meet ASTM C1136 and ASTM C665 for biological growth in insulation
   d. Gasketed access door
      1) For actuators inspection, repair and replacement if mounted internally
      2) Upstream of reheat coil for inspection and cleaning

e. Discharge duct connection

3. Controls unit mounted by manufacturer

   a. Multi-point, double axis cross-flow, center averaging sensor

      1) The minimum amplification factors shall be as indicated in the table below. Provide documentation with submittal that substantiates this requirement.

Duct Diameter (in.)	Price
4	1.06
6	2.82
8	2.47
10	2.16
12	2.16
14	1.98
16	1.88

      2) Be rated for inlet or discharge duty, as indicated on the Drawings

      3) Provide accurate flow sensing regardless of inlet duct configuration

      4) Brass balancing taps and unit mounted airflow versus flow sensor pressure signal charts for field airflow measurements

      5) Be removable for cleaning when box is used for return or exhaust applications

   b. Control Panel

      1) For VAV boxes exposed to public view, include control panel with cover to fully enclose VAV box controller

      2) Otherwise provide flat mounting bracket for controller

   c. For Direct Digital Controls, see Division 25 Building Automation Systems

4. Radiated and discharge sound power

   a. Equal or less in each octave band than terminal selections scheduled on the Drawings at noted capacities assuming 1.0 inch inlet static pressure, with a tolerance of + 2 dB in any band.

   b. Due to added space and pressure drop, providing additional plenums or attenuators to meet sound power ratings is not acceptable.

5. Total Pressure Drop

   a. Equal or less than terminal selections scheduled on the Drawings at noted capacities, with a tolerance of 0.02 inches of water.

   b. This limitation is in total, not static, pressure. Where total pressure is not listed on certified performance documents, provide a table of manual adjustments of static pressure with velocity pressure calculated from inlet and outlet velocities.

6. Dampers

    a. Heavy gage steel.

    b. Single blade damper; opposed blade dampers are not acceptable.

    c. Shaft rotating in self-lubricating Delrin or equal bearings; nylon bearings are not acceptable. Shaft shall be clearly marked on the end to indicate damper position.

    d. Damper shall have durable synthetic seal. Foam seals are not acceptable.

    e. Close-off leakage rating: 5 cubic feet per minute maximum leakage at 1.50 inches water column.

7. Hot water heating coils

    a. Removable type

    b. Hot water coils and discharge plenum shall be one size larger than standard (Price HSG option; e.g. for an 8” inlet, use plenum and coil normally used with 10” inlet box). The discharge plenum OD may be equal to the coil OD.

    c. Tubes

        1) Rows as scheduled on the Drawings. Coils shall be fully overall counterflow.

        2) Copper, 0.015 inches minimum tube wall thickness.

        3) Connections: external, same end, solder type connection, minimum 1/2 inch outside diameter.

    d. Fins

        1) Aluminum, with full fin collars

        2) As scheduled on the Drawings or as required to provide heating capacity listed

        3) 10 fins per inch unless otherwise indicated on schedules

    e. Counterflow circuiting, 1 circuit preferred, 2 circuits maximum

    f. Factory leak-tested at 300 pounds per square inch

    g. Access panel for coil inspection and cleaning; see Paragraph 2.02A.2.d.2)

B. Variable Air Volume Terminal Units

1. Single duct: Equal to Price SDV

2. Options and features: As scheduled on the drawings

C. Fan Powered VAV Terminal Units

1. As specified above, amended as follows

2. Fan and motor

a. Units ETL or UL listed and labeled

b. Forward curved, direct drive fan

c. Mounted with vibration isolators

d. Motor

1) Voltage as scheduled on the drawings

2) Comply with Section 23 05 13 Motors and Controllers

3) Series type, and parallel type where scheduled on Drawings

a) Electrically commutated motor (ECM)

b) Controller to accept 0-10 volt direct current (Vdc) signal from EMCS to vary cfm setpoint proportional to signal; less than 2 Vdc signal to shut motor off

e. Anti-backward wheel rotation device

f. Housing: minimum 22-gage steel

g. Fan mounting deck/board: minimum 18-gage steel

h. Unless otherwise indicated on Drawings, heating coil shall be located as follows:

1) Parallel fan: Fan (plenum) inlet

2) Series fan: Fan (unit) discharge

3. Accessories

a. Filter

1) Type 1: as specified in Section 234000 Air Cleaning Devices

2) 1 inch filter is acceptable

b. Other options as scheduled on the Drawings

4. Electrical Services (factory mounted)

a. One point wiring connection for all electrical devices

b. Control panel

c. ETL or UL listed

PART 3 EXECUTION

3.01 INSTALLATION

A. Coordinate work and access with respective trades

B. Install terminal units in accordance with manufacturer's written installation instructions.

C. Duct connections

1. See Section 23 31 00 Ducts

2. Provide sheet metal duct connections at VAV box inlet; flexible duct not acceptable

3. No flexible connection required on duct outlet

D. Piping connections

1. See Section 23 21 13 HVAC Piping

2. All coils piped counterflow

E. See Division 25 Building Automation Systems

F. See Section 23 08 00 Mechanical Commissioning

3.02 MOUNTING AND ALIGNMENT

A. Support VAV boxes at four corners with minimum, 1" x 18 gage sheet metal straps or 3/8 inch all-thread rod. Secure lower end of strap to the side of unit casing with minimum two #10 sheet metal screws, or bolt through casing with washers to prevent leakage. Bend end of strap and secure to bottom of casing with one #10 sheet metal screws.

B. See Section 23 05 48 – Vibration and Seismic Control for vibration isolation requirements.

3.03 INSPECTION

A. Verify that adequate clearance between air terminal units and adjacent walls or equipment is available to permit maintenance and repairs.

3.04 TESTING AND ADJUSTING

A. Before operating air terminal units, complete the attached Pre-Functional Test Data Sheet for each air terminal unit. See Section 01 91 00 Commissioning

B. Start and test fans in accordance with manufacturers written installation instructions.

C. Start up and adjust fans to insure proper operation.

D. After starting air terminal units: Check for objectionable noise or vibration. Correct as needed at no additional cost to the Owner.

E. See Section 23 05 93 Testing, Adjusting, and Balancing

F. See Section 23 08 00 Mechanical Commissioning

3.05 TRAINING

A. See Section 23 08 00 Mechanical Commissioning

END OF SECTION

SPECIFICATION 23 37 00
AIR OUTLETS AND INLETS

PART 1 GENERAL

1.01 SUMMARY

A. Work included in this section: materials, equipment, fabrication, installation and tests in conformity with applicable codes and authorities having jurisdiction for the following: All air outlets, inlets, grilles, registers and diffusers except where integral with manufactured piece of equipment

1.02 REFERENCE STANDARDS

A. ARI Standard 650 – Air Outlets and Inlets

B. ASHRAE Standard 70 – Methods of Testing for Rating the Airflow Performance of Outlets and Inlets

C. AMCA Standard 500 – Laboratory Methods of Testing dampers for Rating

D. NFPA Standard 90A – Installation of Air Conditioning and Ventilating Systems

E. NFPA Standard 90B – Standard for the Installation of Warm Air Heating and Air Conditioning Systems

1.03 QUALITY ASSURANCE

A. Comply with ARI Standard 650, ASHRAE Standard 70, AMCA Standard 500, NFPA Standard 90A, and NFPA Standard 90B.

B. Provide outlets and inlets that have, as minimum, throw and noise criteria ratings for each size device as listed in manufacturer's current data, rated as required by the above standards.

1.04 SUBMITTALS

A. See Section 23 05 01 Basic Mechanical Materials and Methods.

B. Submit product data, O&M data, and samples and show item on shop drawings (where shop drawings are required) according to the following table.

1. “R” means required.

2. “R2” means required only for products and equipment differing for the specified manufacturer and model and for “or equals” where specified.

Item	Product Data	O&M Manual	Samples	Shop Drawing
Grilles, registers, and diffusers	R			R
Accessories	R			

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Named manufacturer model numbers used as example of item and establish minimum level of quality and minimum standard options. Equivalent models of listed manufacturers are acceptable.

B. Price

C. Titus

D. Krueger

E. Nailor

F. Or equal

2.02 GENERAL

A. Manufacturer shall examine and approve of application of each outlet.

B. Noise level at design capacities: no larger than diffuser selection indicated on the drawings.

C. Diffuser frame and other options shall be as indicated herein unless otherwise indicated on Drawings.

D. Volume Dampers

1. Do not provide dampers built into grille or directly attached to the grille unless specifically called out on Drawings or in this Section.

2. Volume damper key-operated adjustable from face of diffuser on register except as noted

3. Opposed blade

E. Diffuser Frame

1. Frame type shall be coordinated with ceiling type. Refer to architectural reflected ceiling Drawings.

a. At plaster or drywall ceilings, use lay-in diffuser with drywall frame (Price SPF or APF to match diffuser material). Drywall frame to match diffuser color.

2. No visible screw allowed on diffusers or frames, unless otherwise indicated on Drawings or in this Section.

3. Linear and bar diffusers shown as one collinear piece on plans shall be constructed as one piece within manufacturing limitations and to appear as one section if manufacturing limitations require multiple pieces.

F. Outlets may be steel or aluminum unless otherwise indicated on the Drawings.

G. Color

1. Face and frame: Unless otherwise indicated on the Drawings:

a. General: Factory-baked #26 white enamel

b. Mounted in exposed unpainted galvanized steel ducts: aluminum

2. Internal parts of grille visible from occupied space, including all visible parts behind the diffuser face such as pattern controllers, back pans of perforated diffusers, and visible parts of plenums: flat black

2.03 STYLES

A. General

1. See diffuser schedule on the Drawings for outlet style and size

2. Throw pattern per the Drawings

3. Specific frame, border, and other product references refer to Price

B. Perforated diffusers and grilles - Steel

1. Supply: Star-pattern diffuser, Price PDSP

a. Deflectors factory adjusted for corner blow pattern unless otherwise indicated on Drawings.

2. Ducted Return/Exhaust: Price PDDR

3. Plenum Return

a. Price PFRF

b. Light shield

C. Architectural (Plaque) Ceiling Diffusers

1. Price SPD

2.04 SCREENED OPENINGS

A. Mesh

1. 3/4 in. square pattern

2. No. 16 galvanized wire

3. Interwoven

4. Welded or secured to frame

B. Frames: Optional

1. 1 inch by 1 inch by 1/8 inch galvanized steel angles

2. Continuous around perimeter of screen

PART 3 EXECUTION

3.01 INSTALLATION

A. Coordinate with work of other trades.

B. Install air outlets and inlets in accordance with manufacturer's written installation instructions and Section 23 31 00 Ducts.

C. Return and exhaust registers: Install with blades oriented to prevent sight through outlets.

D. Grille backs or plenums visible through grilles painted flat black

E. Transfer Grilles

1. See indications on the Drawings

2. Wall installations, unless otherwise indicated, provide two grilles

a. One on each side of wall, except where open to return air plenum

b. Connecting sheet metal collar with 18 inch elevation offset for sound and light attenuation

F. Provide duct screens at termination ducts as indicated on the Drawings

3.02 MOUNTING AND ALIGNMENT

A. See Section 23 05 48 Vibration and Seismic Control

B. All air outlets and inlets shall be secured to building

1. Ceiling grilles shall be secured to prevent falling from ceiling during construction or service with minimum of two 16-gage ceiling wires, two 22-gage by 1 inch galvanized sheet metal strap or two #10 sheet metal screws.

2. Comply with CBC.

C. Mount directional grilles as indicated on the Drawings.

D. Adjust grille throw patterns prior to test and balance. See Section 23 05 93 Testing, Adjusting and Balancing.

3.03 INSPECTION

A. Verify mounting, direction and adjustments are installed as indicated on the Drawings.

3.04 TESTING AND ADJUSTING

A. See Section 01 91 00 Commissioning

B. See Section 23 05 93 Testing, Adjusting and Balancing

C. See Section 23 08 00 Mechanical Commissioning

END OF SECTION

SPECIFICATION 23 40 00
AIR CLEANING DEVICES

PART 1 GENERAL

1.01 WORK INCLUDED

A. Work included in this section: materials, equipment, fabrication, installation and tests in conformity with applicable codes and authorities having jurisdiction for the following:

1. Filter media

1.02 REFERENCE STANDARDS

A. ASHRAE Standard 52.2 – Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size

B. ANSI/UL 900 – Test Performance of Air Filter Units

1.03 QUALITY ASSURANCE

A. Filters shall have MERV-A and dust loading ratings in accordance with ASHRAE Standard 52.2 with preconditioning as specified in Appendix J of that Standard.

1.04 SUBMITTALS

A. See Section 23 05 01 Basic Mechanical Materials and Methods.

B. Submit product data, O&M data, and samples and show item on shop drawings (where shop drawings are required) according to the following table.

1. “R” means required.

2. “R2” means required only for products and equipment differing for the specified manufacturer and model and for “or equals” where specified.

Item	Product Data	O&M Manual	Samples	Shop Drawing
Filters	R	R		R

1.05 Spare Filter

A. Furnish four new complete set of filters Type 1 for each filter bank, two set of filters for each phase of work and one set for work completion*.*

B. Furnish two sets of outdoor air filters Type 2 for each filter bank, one set of filters during roof replacement, one set during a wildfire event during construction, and none for work completion*.*

C. Any unused filters shall be left at the jobsite for future use.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Named manufacturer model numbers used as example of item and establish minimum level of quality and minimum standard options. Equivalent models of listed manufacturers are acceptable.

B. Filter Media

1. Camfil Filtration Group
2. Flanders/Precisionaire
3. American Air Filter
4. Filtration Group
5. Or equal

2.02 FILTERS

A. General

1. UL 900 listed
2. Disposable type
3. Each filter shall consist of media, media support grid and enclosing frame
4. Each filter shall have flow direction and MERV rating permanently affixed to frame

B. Type 1: Pleated Filter

1. 2 inch pleat as scheduled
2. Media: Cotton & synthetic media (no polyester)
3. Minimum performance: MERV-A 13
4. Maximum initial pressure drop at 500 feet per minute face velocity shall not to exceed 0.3 inches water column. Final pressure drop shall be no less than 1.0 inch water column.
5. Camfil AP-Thirteen or equal

C. Type 2: Pleated Outdoor Air Carbon Filter

1. 2 inch pleat as scheduled
2. Media: Impregnated Carbon at least 20 g/sqft
3. Maximum initial pressure drop at 500 feet per minute face velocity shall not to exceed 0.3 inches water column. Final pressure drop shall be no less than 1.0 inch water column.
4. Air Handler 6BD875 or equal

PART 3 EXECUTION

3.01 FILTER MEDIA

A. Media as selected in equipment schedules on the Drawings

B. Filters

1. Type 1 for all equipment; roll media not acceptable

a. Seven sets required

2. Type 2 are provided during times requiring special outdoor air filtration

a. Two sets required

3.02 INSTALLATION

A. Field installed in air handling equipment

B. Coordinate with work of other trades

C. Change filters after each phase of work and at work completion

D. Install Type 1 filters during each phase of work, change the start of each phase of work and as required during work

E. Install Type 2 filters prior to roof replacement, remove at the end of roof replacement.

F. Install Type 2 filters when requested by the owner, engineer of record, commissioning provider, or when outdoor air quality levels are unhealthy due to wildfire smoke. Remove Type 2 filters when requested by the owner, engineer of record, or commissioning provider.

G. Install Air Cleaning Devices in accordance with manufacturer's written installation instructions.

H. See Division 25 Building Automation Systems

I. See Section 23 05 93 Testing, Adjusting and Balancing

J. See Section 23 08 00 Mechanical Commissioning

3.03 START-UP PROCEDURES

A. Do not operate air handling unit fan systems for any reason until spaces served have been cleaned of dust and debris, to avoid contamination of supply air or return air paths and equipment.

B. Supply fans shall not be operated unless filters are installed, including temporary filters for use during test and balance.

C. If the final pressure drop of the temporary filters is reached during test and balance, replace them with a spare set.

D. Before final air balancing, and immediately before post-construction outdoor air purge if required by Section 23 05 01 Basic Mechanical Materials and Methods remove temporary construction filters and install clean final filters:

   1. Remove prefilters/construction filters in front of main filters after construction and do not replace. Prefilters/construction filters shall not be used during for normal operation.

   2. See Section 23 05 93 Testing, Adjusting and Balancing and Section 23 05 01 Basic Mechanical Materials and Methods for media installation during test and balance period.

E. Change out all filters with new just prior to turning project over to the Owner. Install only when directed by Owner's representative.

3.04 INSPECTION

A. Verify that adequate clearance between Air Cleaning Devices and adjacent walls or equipment is available to permit maintenance and replacement of filters.

B. Verify that filters are firmly seated in frame to minimize bypass.

3.05 TRAINING

A. See Section 23 08 00 Mechanical Commissioning

END OF SECTION

SPECIFICATION 23 64 10
AIR-SOURCE HEAT PUMP CHILLERS

PART 1 GENERAL

1.01 WORK INCLUDED

A. Work Included in This Section: Materials, equipment, fabrication, installation and tests in conformity with applicable codes and authorities having jurisdiction for the following:

1. Packaged air-source changeover (2-pipe) heat pump/chillers
2. Packaged air-source heat recovery (4-pipe) heat pump/chillers
3. Ancillary equipment such as starters and controls as specified herein
4. Field start-up and testing

1.02 REFERENCE STANDARDS

A. ANSI/ARI 550/590 – Water-Chilling Packages Using the Vapor Compression Cycle

B. ANSI/ASHRAE 15 – Safety Code for Mechanical Refrigeration

C. ANSI B-9.1 – Safety Code for Mechanical Refrigeration

D. ANSI/ASME SEC 8 – Boiler and Pressure Vessel Code

E. ANSI/NEMA MG 1 – Motors and Generators

1.03 QUALITY ASSURANCE

A. Scheduled equipment performance is minimum capacity required

B. UL or ETL listed

C. Scheduled electrical capacity shall be considered as maximum available

D. Units shall be rated in accordance with ARI Standard 550/590

E. Chillers shall be manufactured in an ISO 9001 certified facility.

F. Each unit shall be factory performance tested, full load efficiency and full load capacity. Test reports shall be made available upon request.

1.04 SUBMITTALS

A. See Section 23 05 01 Basic Mechanical Materials and Methods.

B. Submit product data, O&M data, and samples and show item on shop drawings (where shop drawings are required) according to the following table.

1. “R” means required.

2. “R2” means required only for products and equipment differing for the specified manufacturer and model and for “or equals” where specified.

Item	Product Data	O&M Manual	Samples	Shop Drawing
Air-source changeover (2-pipe) heat pump/chiller	R	R		R
Air-source heat recovery (4-pipe) heat pump/chiller	R	R		R

C. Include

1. Shop drawings and product data
2. Manufacturer's installation instructions
3. Manufacturer's descriptive literature, operating instructions, and maintenance and repair data
4. Performance data
5. Details
    a. Compressor motor data
    b. Oil pump data
    c. Foundations: detailed and dimensional
    d. Controls
    e. Wiring diagrams
    f. Factory installation recommendations
6. BACnet PICs

1.05 WARRANTYChiller manufacturer is to provide one year parts and labor warranty from Notice of Completion or upon beneficial use. See Section 23 05 01 Basic Mechanical Materials and Methods.

B. Warranty shall include replacement refrigerant if charge is lost due to a fault covered by the warranty.

1.06 SUBSTITUTIONS AND PRODUCT OPTIONS

A. See spec 230501 for general substitution requirements

B. Air-Source Heat Pump Chiller substitutions shall not be considered at bid time. Bids shall provide AWHP-1 and AWHR-2 specified on the HVAC and Plumbing Schedules sheet M0.02.

C. Air-Source Heat Pump Chiller substitutions shall be considered after the contractor has been selected prior to submittals per section 1.04.

D. If a contractor wishes to propose an Air-Source Heat Pump Chiller substitution, the contractor shall submit the following documentation for review and approval by the owner and design team.

1. Manufacturer Product Data for the proposed Air-Source Heat Pump Chillers

2. The Air-Source Heat Pump Substitution matrix linked here: https://tayloreng.egnyte.com/dl/XNPYG2icgw

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Named manufacturer model numbers used as example of item and establish minimum level of quality and minimum standard options. Equivalent models of listed manufacturers are acceptable.

B. Aermec Corporation

C. Multistack LLC

D. ClimaCool Corp.

E. Or equal

2.02 GENERAL

A. The unit shall be completely factory packaged including evaporator, condenser, compressor, motor, starter, lubrication system, control system, and all interconnecting unit piping and wiring. Any field installation required, other than piping and normal control and power wiring, shall be clearly identified with the bid and shall be included in the vendors pricing.

2.03 CABINET

A. Base: Galvanized-steel base extending the perimeter of water chiller. Secure frame, compressors, evaporator, and condenser to base to provide a single-piece unit.

B. Frame: Rigid galvanized-steel frame secured to base and designed to support cabinet, condenser/evaporator coils, control panel, and other chiller components not directly supported from base.

C. Casing: Galvanized steel.

D. Finish: Coat base, frame, and casing with rustproof polyester paint.

2.04 COMPRESSORS

A. Positive-displacement direct drive scroll with hermetically sealed casing.

B. Each compressor provided with suction and discharge service valves, crankcase oil heater, and suction strainer.

C. Capacity Control: On-off compressor cycling.

D. Oil Lubrication System: Automatic pump with strainer, sight glass, filling connection, filter with magnetic plug, and initial oil charge.

E. Vibration Isolation: Mount individual compressors on vibration isolators.

F. Compressors must be enclosed in acoustically insulated and weatherproof compartment.

2.05 REFRIGERATION

A. Refrigerant

1. Refrigerant shall meet the Lifecycle Ozone Depletion Potential and Lifecycle Direct Global Warming Potential requirements of USGBC LEED EA Credit 4.

2. Classified as Safety Group A1 according to ASHRAE 34.

3. Parts exposed to refrigerants shall be fully compatible with refrigerants, and pressure components shall be rated for refrigerant pressures.

B. The unit shall have minimum two independent refrigerant circuits with single or multiple compressors in tandem per circuit.

C. Each Refrigerant Circuit shall include:

1. Heat Recovery Type (4-pipe)

a. Two thermostatic expansion valves (one used in cooling and simultaneous mode and the other used in heating mode)

b. 4-way refrigerant inversion valve

c. A mechanical dehydrator filter

d. Liquid accumulator

e. Liquid separator

f. Liquid indicator

g. Relief valves

h. Solenoid valves

i. One way valves

j. High pressure switch (manual reset)

k. High pressure transducer

l. Low pressure transducer

2. Changeover Type (2-pipe)

a. Thermostatic expansion valve

b. Reverse cycle valve

c. Liquid accumulator

d. Liquid separator

e. Liquid indicator

f. Relief valves

g. Solenoid valves

h. One way valves

i. High pressure switch (manual reset)

j. High pressure transducer

k. Low pressure transducer

2.06 EVAPORATOR AND CONDENSER FOR 4-PIPE UNIT

A. Brazed Plate

1. Type 316 stainless-steel construction.

2. Externally insulated with minimum 3/4 in. thick closed cell foam insulation

3. Tested and stamped according to ASME Boiler and Pressure Vessel Code.

B. Heater: Factory-installed and wired electric heater with integral controls designed for freeze protection.

C. Provided with factory installed inlet strainer and flow switch.

2.07 AIR-SIDE HEAT EXCHANGER

A. Coils shall be constructed from seamless copper tubes mechanically expanded into aluminum fins and shall have integral subcooling circuits.

B. Fans shall be direct-drive axial type, aerodynamically designed for ultra-low noise level generation, vertical air discharge.

C. Fan motors and drives

1. Inverter driven, variable speed

2. Totally enclosed non-ventilating (TENV) or totally enclosed air over (TEAO) enclosure

3. Permanently lubricated bearings

4. Built-in overcurrent- and thermal-overload protection

D. Fan Guards: Steel safety guards with corrosion-resistant coating.

E. Unit shall be able to modulate the fan speed based on high pressure when in cooling mode, and based on low pressure when in heating mode.

2.08 DEFROST

A. The units must include intelligent defrost. This allows the unit to go in defrost only when is needed, avoiding unnecessary defrost cycles. This shall be achieved by monitoring the suction pressure decay and the outdoor air temperature.

B. The unit must have the ability to defrost one circuit at the time.

2.09 INTEGRAL PRIMARY PUMPS

A. Where scheduled only

B. Primary constant speed pump(s) integral to unit complete with power and automatic controls

C. Low head sized for no more than 10 feet of pressure drop above internal pressure drop

D. Pump and pump parts shall be readily available from local US suppliers. Repair/replacement shall not require pump or piping modifications.

2.10 NOISE LEVEL

A. Sound Power level from the unit, in accordance with EN ISO 9614-2, shall be less than 96 dB(A).

2.11 ELECTRICAL

A. Centrally located weatherproof control panel shall contain the unit control system, control interlock terminals and field-power connection points. Hinged control panel access doors shall be tool-lockable. Barrier panels shall be provided to protect against accidental contact with line voltage when accessing the control system.

B. Power and starting components shall include:

1. Individual contactors and circuit breakers for fan motors

2. Circuit breakers and factory mounted transformers for each control circuit

3. Unit power terminal blocks for connection to remote disconnect switch.

4. Fan motors shall have inherent overload protection.

5. Compressor motors shall have three-phase motor overload protection.

C. Wiring shall be numbered and color-coded to match wiring diagram.

D. Phase-Failure and Undervoltage: Solid-state sensing with adjustable settings.

2.12 CONTROLS

A. Unit shall be equipped with a standalone microprocessor based control system. The control logic shall be designed to maximize operating efficiency and equipment life with protections for operation under unusual conditions. The system shall intelligently stage the unit to sustain leaving water temperature precision and stability while minimizing compressor cycling.

B. The controller shall support the following safety and operating controls: high pressure switches for each refrigerant circuit; loss of flow in the evaporator or condenser water circuit; condenser fan staging by head pressure or low pressure; digital setting of low evaporator

water temperature cutout, high pressure cutout, suction pressure cutout, and freeze protection cutout; compressor soft loading; demand limit control based on 4-20 mA DC signal input; automatic circuit lead/lag based on fewest operating hours (with manual override); chilled water reset based on an externally applied 4-20 mA signal.

C. The keypad/display shall provide access to all vital equipment data. Data shall include full description of current unit status, set point parameters, and alarms.

D. Control system shall continuously perform self-diagnostic checks; monitor all system temperatures, pressures and safeties; and shall automatically shut down a compressor, refrigerant circuit or entire unit should a fault occur. Diagnostic function shall provide operator with a pre-alarm status indication allowing time to take corrective action prior to a safety shutdown.

E. The chiller shall be capable of communications with any Building Automation System supporting BACnet/IP communications protocol over Ethernet. The information communicated between the BAS and the factory mounted unit controllers shall include the reading and writing of data to allow unit monitoring, control and alarm notification as specified in the unit sequence of operation and the unit points list. See Section 250000 Building Automation System.

2.13 SHIPMENT

A. The unit shall be completely assembled, with all main, auxiliary, and control piping installed, controls wired, leak tests completed, air runs tested, and charged with dry nitrogen (2 to 3 psig) or with refrigerant. If charged with nitrogen, the refrigerant charge shall be shipped concurrently or separately in cylinders for field evacuation and charging of unit.

B. Include all freight charges to the jobsite.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install unit and accessories piping in accordance with recommendations of manufacturer.

B. Coordinate with work of other trades

C. See Section 23 08 00 Mechanical Commissioning

D. See Section 23 05 48 Vibration and Seismic Control.

E. See Section 25 00 00 Building Automation Systems

3.02 PIPING

A. See Section 23 21 13 HVAC Piping

B. Main piping connections: flanged or grooved elbow as required to allow removal of headers and tubes without major removal of piping.

3.03 STARTUP, TESTING, AND ADJUSTING

A. A factory trained and authorized field service representative shall supervise final leak testing, charging, and initial startup and conduct concurrent operator instruction.

1. Lubrication: Charge equipment with recommended oil.

2. Refrigerant: Charge equipment with complete refrigerant charge. If factory charged, test charge in field to ensure proper charge was maintained during shipping and installation.

3. Start and test chiller in accordance with manufacturers written installation instructions by a factory-authorized representative.

B. Check for objectionable noise or vibration; correct as needed at no additional cost to the Owner

C. Balancing: See Section 23 05 93 Testing, Adjusting, and Balancing

D. Commissioning: See Section 23 080 0 Mechanical Commissioning

3.04 TRAINING

A. See Section 23 08 00 Mechanical Commissioning.

B. Engage a factory-authorized service representative to train Owner's maintenance personnel on:

1. Procedures for starting and stopping and troubleshooting chillers

2. Procedures and schedules for maintaining and servicing chillers

3. Procedures for programming chiller control panel

4. Organization and content of Operations & Maintenance Manuals

END OF SECTION

SPECIFICATION 237300
COILS

PART 1 GENERAL

1.01 SUMMARY

A. Work included in this section: materials, equipment, fabrication, installation and tests in conformity with applicable codes and authorities having jurisdiction for the following:

1. Chilled water coils

2. Reheat coils: See Section 23 36 00 Air Terminal Units

1.02 REFERENCE STANDARDS

A. AMCA 99 – Standards Handbook

B. AMCA Standard 203

C. ANSI/AMCA 210 – Laboratory Methods of Testing Fans for Aerodynamic Performance Rating

D. AHRI 410 – Standard for Forced-Circulation Air-cooling and Air Heating Coils

E. ASHRAE/ANSI Standard 111

F. ASHRAE Standard 52

G. ASTM A525 – Specification for General Requirements for Steel Sheet, Zinc Coated (Galvanized) by the Hot-Dip Process

H. NFPA 90A – Installation of Air Conditioning and Ventilation Systems

I. SMACNA – Low Pressure Duct Construction Standards

J. UL Standard 1995

1.03 QUALITY ASSURANCE

A. AMCA certified ratings per applicable AMCA standard based on the testing conducted in an independent laboratory.

B. Conform to AMCA Bulletins regarding construction and testing. Fans shall bear AMCA certified rating seal for both sound and performance.

C. Units shall be designed and manufactured in strict accordance with UL 1995, Standard for Heating and Cooling Equipment. Air handler shall be ETL or UL listed in accordance with UL 1995, or the current equivalent by UL, and shall carry the ETL or UL label. If manufacturer cannot provide ETL/UL sticker on air handler, it will be the sole responsibility of the contractor to arrange for local, on-site, ETL or UL approval and labeling at no additional cost to the Owner.

D. Scheduled equipment performance is minimum capacity required.

1.04 SUBMITTALS

A. See Section 230501 Basic Mechanical Materials and Methods.

B. Submit product data, O&M data, and samples and show item on shop drawings (where shop drawings are required) according to the following table.

1. "R" means required.

2. "R2" means required only for products and equipment differing for the specified manufacturer and model and for "or equals" where specified.

Item	Product Data	O&M Manual	Samples	Shop Drawing
Chilled water coils	R	R		R

C. Coil performance and flow rates

1. Casing materials of construction and methods of assembly

2. Complete dimensional data including exterior dimensions and dimensions of internal components

3. Coil performance and flow rates

4. Pressure drop for water and air at design conditions

5. Casing materials of construction and methods of assembly

6. The number of shipping sections requiring field reassembly

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Named manufacturer model numbers used as example of item and establish minimum level of quality and minimum standard options. Equivalent models of listed manufacturers are acceptable.

B. Coils

1. Envirotech/Johnson Controls

2. Trane Company

3. Daikin

4. Carrier Corporation

5. York/Johnson Controls

6. Heatcraft

7. Or equal

2.02 CHILLED WATER COILS

A. General

1. Coil capacity as scheduled

2. Drain pan

a. Sloped for positive drainage

b. Heavy gauge Type 304 stainless steel

B. Extended surface type coils

1. Copper Tubes

a. Brazed or welded joints

b. Minimum thickness: 0.025 inches

c. Outside diameter: 1/2 inch or 5/8 inch

d. The use of internal restrictive devices such as turbolater springs or ribbons to obtain turbulent construction is not acceptable.

2. Plate fins of aluminum, unless otherwise indicated on the Drawings

a. Minimum thickness 0.0075 inches

3. Coating

a. Where specified on drawings only

b. Electrofin or acceptable equivalent

C. Rows and fin spacing

1. To meet performance scheduled at similar pressure drop; no fewer rows than that scheduled

2. Selected with tube fouling factor of 0.0001

3. Maximum fin spacing: Meet Standard 62.1 maximum pressure drop requirement (≤0.75 in.w.c. at 500 fpm, dry coil)

4. Select to avoid moisture carryover

D. Circuiting: full row (passes = rows), single circuit, fully overall counterflow

E. Headers

1. Copper with red brass piping connections

F. Certified by AHRI per current Standard 410

G. For field installed coils, coil frame designed for bolting to other sections or ductwork:

H. Coil Casing

1. Minimum 16-gage

2. Type 304 stainless steel casing and tube sheet

3. Intermediate supports of same material as casing

I. Design for 200 pounds per square inch, 250 degrees Fahrenheit unless otherwise indicated on the Drawings

J. Factory tested to

1. 300 pounds per square inch for water coils

2. 450 pounds per square inch for refrigeration condenser coils

3. 300 pounds per square inch for refrigeration evaporator coils

K. Factory cleaned, degreased, and flushed. Piping connections shall be capped with removable caps.

PART 3 EXECUTION

3.01 INSTALLATION

A. Coordinate with work of other trades.

B. Units shall ship with all openings securely covered and watertight. Protection shall be retained until completion of construction or until opening is field connected to ductwork.

C. Provide auxiliary drain pans where required; see Section 233300 Duct Accessories.

D. Provide condensate pump where scheduled. See Section 233300 Duct Accessories.

E. Mounting and alignment: See Section 230548 Vibration and Seismic Control. Provide accurate alignment between units and connected ducts.

F. Install coils in accordance with manufacturer’s written installation instructions.

G. Mount units sufficiently high to allow for proper condensate trapping and drainage.

H. Piping

1. See Section 232113 HVAC Piping

2. See piping diagrams

3. Do not block access doors with piping. Access doors shall be capable of opening 90 degrees.

4. All coils piped counterflow

5. Pipe condensate to nearest appropriate drain.

I. See Division 25 Building Automation Systems

3.02 INSPECTION

A. Verify that adequate clearance between coils and adjacent walls or equipment is available to permit maintenance and repairs.

3.03 PRE-OPERATING CHECKS

A. Before operating coils:

1. See Section 230800 HVAC Commissioning.

2. Complete Pre-Functional Test Data Sheet for each unit.

3.04 CLEANING

A. After completing startup service, clean air-handling units internally to remove foreign material and construction dirt and dust. Clean all components including fan wheels, cabinets, dampers, coils, and filter housings.

B. Install new, clean filters in accordance with Section 234000 Air Cleaning Devices.

3.05 TESTING AND ADJUSTING

A. Do not operate fans for any purpose, temporary or permanent until

1. Ductwork is clean

2. Filters are in place

3. Bearings are lubricated

4. Fan has been run under observation

B. Test cooling coil drain pans. See Section 230593 Testing, Adjusting and Balancing.

C. See Section 230593 Testing, Adjusting, and Balancing

D. Commissioning: See Section 230800 Mechanical Commissioning.

END OF SECTION

SPECIFICATION 250000
BUILDING AUTOMATION SYSTEMS

PART 1 GENERAL

1.01 SUMMARY

A. Furnish and install a digital Building Automation System (BAS) as specified herein.

B. Coordination with other Divisions: See coordination matrix in Section 230501 Basic Mechanical Materials and Methods.

C. Perform work in 3 job phases.

1.02 INTEGRATION WITH EXISTING SYSTEM

A. Include all services required to integrate this building into existing BAS for a fully operational system.

B. Procedure

1. BACnet devices

   a. Create new building database following the BACnet device instance numbering scheme specified under Paragraph 3.13B.4.

   b. Double check existing database to ensure there are no duplicate BACnet device instance numbers. This includes 3rd party equipment such as VFDs.

2. Graphics

   a. For new or modified graphics custom to the new building, ensure file template name do not duplicate any existing file names.

3. Programming

   a. For standard sequences covered by ASHRAE Guideline 36, use the programming provided by the BAS manufacturer (see Paragraph 2.01A.1), first ensuring they have been updated by the manufacturer to reflect the latest issue and all addenda published when programming work is initiated.

   b. For other typical applications, first review those used for similar applications in other county buildings to use as a starting point, then edit to reflect sequences specified herein. The intent is to have standard programming throughout the county to the extent possible.

   c. Double check existing database to ensure program file names do not duplicate any existing file names.

4. If a BACnet/IP Broadcast Management Device (BBMD) router is required, check the existing Broadcast Distribution Tables (BDT) to ensure that a BBMD router is not already assigned to the relevant network before adding a new one.

5. Install building database and control programming on a temporary portable operator's terminal provided by the Contractor. The POT shall be used for start-up, testing, and commissioning. The POT shall remain the property of the Contractor after final completion of the project.

6. Once the building BAS has been fully commissioned and accepted by the Owner, create a new backup of the existing county database.

7. Provide high level password for Owner operator access to the system only at this point; Owner will not have access to the system prior to system acceptance and integration.

1.03 CONTRACTOR PROPOSALS

A. The system requirements described in this specification are generally performance based. Where requirements are prescriptive, the intent is to provide minimum quality, not to give unfair advantage to any given manufacturer or product. If a contractor finds that a certain requirement is unduly difficult or expensive to meet, contact the Engineer prior to bid due date and an addendum modifying the requirement will be considered.

B. Where requirements are unclear, the contractor shall clarify the requirements with the Engineer before the bid due date. Where requirements continue to be unclear, the contractor's proposal must accurately describe what is included and excluded.

C. By submitting a proposal, contractor guarantees that their proposal is in full compliance with these specifications except as specifically excluded in their proposal.

1.04 REFERENCE STANDARDS

A. Nothing in Contract Documents shall be construed to permit Work not conforming to applicable laws, ordinances, rules, and regulations. When Contract Documents differ from requirements of applicable laws, ordinances, rules and regulations, comply with documents establishing the more stringent requirement.

B. The latest published or effective editions, including approved addenda or amendments, of the following codes and standard shall apply to the BAS design and installation as applicable.

C. State, Local, and City Codes

1. CBC − California Building Code

2. CMC − California Mechanical Code

3. CEC – California Electrical Code

4. Local City and County Codes

D. American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)

1. ANSI/ASHRAE 135 – BACnet - A Data Communication Protocol for Building Automation and Control Networks

2. ANSI/ASHRAE Standard 135.1− Method of Test for Conformance to BACnet

3. ANSI/ASHRAE Standard 15 – Safety Standard for Refrigeration Systems

E. Electronics Industries Alliance

1. EIA-232 – Interface Between Data Terminal Equipment and Data Circuit-Terminating Equipment Employing Serial Binary Data Interchange.

2. EIA-458 – Standard Optical Fiber Material Classes and Preferred Sizes.

3. EIA-485 – Standard for Electrical Characteristics of Generator and Receivers for use in Balanced Digital Multipoint Systems.

4. EIA-472 – General and Sectional Specifications for Fiber Optic Cable.

5. EIA-475 – Generic and Sectional Specifications for Fiber Optic Connectors and all Sectional Specifications.

6. EIA-573 – Generic and Sectional Specifications for Field Portable Polishing Device for Preparation Optical Fiber and all Sectional Specifications.

7. EIA-590 – Standard for Physical Location and Protection of Below-Ground Fiber Optic Cable Plant and all Sectional Specifications.

F. Underwriters Laboratories

1. UL 916 – Energy Management Systems.

G. National Electrical Manufacturers Association

1. NEMA 250 – Enclosure for Electrical Equipment.

H. Institute of Electrical and Electronics Engineers (IEEE)

1. IEEE 142 – Recommended Practice for Grounding of Industrial and Commercial Power Systems.

2. IEEE 802.3 – CSMA/CD (Ethernet – Based) LAN.

3. IEEE 802.4 – Token Bus Working Group (ARCNET – Based) LAN.

1.05 DEFINITIONS

A. Acronyms

AAC	Advanced Application Controller
AH	Air Handler
AHU	Air Handling Unit
AI	Analog Input
ANSI	American National Standards Institute
AO	Analog Output
ASC	Application Specific Controllers
ASCII	American Standard Code for Information Interchange
ASHRAE	American Society of Heating, Refrigeration and Air Conditioning Engineers
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials

A-to-D	Analog-to-Digital
BACnet	Data Communications Protocol for Building Automation and Control Systems
BC	Building Controller
BIBB	BACnet Interoperability Building Blocks
BTL	BACnet Testing Laboratory
CAD	Computer Aided Drafting
CHW	Chilled Water
CHWR	Chilled Water Return
CHWS	Chilled Water Supply
COV	Change of Value
CSS	Control Systems Server
CU	Controller or Control Unit
CV	Constant Volume
CW	Condenser Water
CWR	Condenser Water Return
CWS	Condenser Water Supply
DBMS	Database Management System
DDC	Direct Digital Control
DHW	Domestic Hot Water
DI	Digital Input
DO	Digital Output
D-to-A	Digital-to-Analog
BAS	Building Automation System
EMT	Electrical Metallic Tubing
EP	Electro-Pneumatic
ETL	Edison Testing Laboratories
GUI	Graphical User Interface
HHD	Hand Held Device
HOA	Hand-Off-Automatic
HVAC	Heating, Ventilating and Air-Conditioning
HTTP	Hyper-Text Transfer Protocol
I/O	Input/output
IEEE	Institute of Electrical and Electronics Engineers
ISO	International Organization for Standardization
LAN	Local Area Network
LANID	LAN Interface Device
MAC	Medium Access Control
MHz	Megahertz
MS/TP	Master-Slave/Token-Passing
NEMA	National Electrical Manufacturers Association
NFPA	National Fire Protection Association
NIST	National Institute of Standards and Technology
ODBC	Open Database Connectivity
OI	Operator Interface
OWS	Operator Workstation
P	Proportional
PC	Personal Computer
PI	Proportional-Integral
PICS	Protocol Implementation Conformance Statement

PID	Proportional-Integral-Derivative
POT	Portable Operators Terminal
PTP	Point-to-Point
RAM	Random Access Memory
SOO	Sequence of Operation
SQL	Standardized Query Language
SSL	Secure Socket Layers
TAB	Test, Adjust, and Balance
TDR	Time Delay Relay
UFT	Underfloor Fan Terminal Box
UL	Underwriters' Laboratories, Inc.
XML	Extensible Markup Language

B. Terms

Term	Definition
Accessible	Locations that can be reached with no more than a ladder to assist access and without having to remove permanent partitions or materials. Examples include inside mechanical rooms, mechanical equipment enclosures, instrument panels, and above suspended ceilings with removable tiles.
BACnet Interoperability Building Blocks	A BIBB defines a small portion of BACnet functionality that is needed to perform a particular task. BIBBs are combined to build the BACnet functional requirements for a device in a specification.
BACnet/BACnet Standard	BACnet communication requirements as defined by the latest version of ASHRAE/ANSI 135 and approved addenda.
Change of Value	An event that occurs when a digital point changes value or an analog value changes by a predefined amount.
Client	A device that is the requestor of services from a server. A client device makes requests of and receives responses from a server device.
Concealed	Embedded in masonry or other construction, installed in furred spaces, within double partitions, above hung ceilings, in trenches, in crawl spaces, or in enclosures.
Continuous Monitoring	A sampling and recording of a variable based on time or change of state (such as trending an analog value, monitoring a binary change of state).
Contract Documents	Specifications, drawings, and other materials provided with request for bids.
Control Systems Server	A computer(s) that maintain(s) the systems configuration and programming database.
Controller	Intelligent stand-alone control device. Controller is a generic reference to BCs, AACs, and ASCs.
Direct Digital Control	Microprocessor-based control including Analog/Digital conversion and program logic.
Building Automation System	The entire integrated management and control system.
Equal	Approximately equal in material types, weight, size, design, quality, and efficiency of specified product.

Term	Definition
Exposed	Not installed underground or concealed.
Furnish	To purchase, procure, acquire and deliver complete with related accessories.
Gateway	Bi-directional protocol translator connecting control systems that use different communication protocols.
Hand Held Device	Manufacturer's microprocessor based portable device for direct connection to a field Controller.
Inaccessible	Locations that do not meet the definition of accessible. Examples include inside furred walls, pipe chases and shafts, or above ceilings without removable tiles.
Indicated, shown or noted	As indicated, shown or noted on drawings or specifications.
Install	To erect, mount and connect complete with related accessories.
Instrumentation	Gauges, thermometers and other devices mounted in ductwork or piping that are not a part of the BAS.
IT LAN	Reference to the facility's Information Technology network, used for normal business-related e-mail and Internet communication.
LAN Interface Device	Device or function used to facilitate communication and sharing of data throughout the BAS.
Local Area Network	Computer or control system communications network limited to local building or county.
Master-Slave/Token Passing	Data link protocol as defined by the BACnet standard.
Motor Controllers	Starters, variable speed drives, and other devices controlling the operation of motors.
Native BACnet Device	A device that uses BACnet for communication. A device may also provide gateway functionality and still be described as a Native BACnet device.
Native BACnet System	A network composed only of Native BACnet Devices without gateways.
Open Database Connectivity	An open standard application-programming interface for accessing a database developed. ODBC compliant systems make it possible to access any data from any application, regardless of which database management system is handling the data.
Open Connectivity	OPC is an interoperability standard developed for industrial applications. OPC compliant systems make it possible to access or exchange data from any application, regardless of which database management system is handling the data.
Operator Interface	A device used by the operator to manage the BAS including OWSs, POTs, and HHDs.

Term	Definition
Operator Workstation	The user's interface with the BAS system. As the BAS network devices are stand-alone, the OWS is not required for communications to occur.
Owner	The Owner or their designated representatives.
Piping	Pipe, tube, fittings, flanges, valves, controls, strainers, hangers, supports, unions, traps, drains, insulation and related items.
Points	All physical I/O points, virtual points, and all application program parameters.
Point-to-Point	Serial communication as defined in the BACnet standard.
Portable Operators Terminal	Laptop PC used both for direct connection to a controller and for remote dial up connection.
Primary Controlling LAN	High speed, peer-to-peer controller LAN connecting BCs and optionally AACs and ASCs.
Protocol Implementation Conformance Statement	A written document that identifies the particular options specified by BACnet that are implemented in a device.
Provide	Furnish, supply, install and connect up complete and ready safe and regular operation of particular work referred to unless specifically noted.
Reviewed, approved, or directed	Reviewed, approved, or directed by or to Owner's Representative.
Router	A device that connects two or more networks at the network layer.
Secondary Controlling LAN	LAN connecting AACs and ASCs.
Server	A device that is a provider of services to a client. A client device makes requests of and receives responses from a server device.
Standardized Query Language	SQL - A standardized means for requesting information from a database.
Supervisory LAN	Ethernet-based LAN connecting Primary Controller LANs with each other and OWSs, CSS, and THS. See System Architecture below.
Supply	Purchase, procure, acquire and deliver complete with related accessories.
Wiring	Raceway, fittings, wire, boxes and related items.
Work	Labor, materials, equipment, apparatus, controls, accessories and other items required for proper and complete installation.

1.06 QUALITY ASSURANCE

A. Materials and Equipment

1. Manufacturer's Qualifications: See 2.01 for approved manufacturers.

B. Installer

1. BAS Contractor's Project Manager Qualifications: Individual shall specialize in and be experienced with direct digital control system installation for not less than 3 years. Project Manager shall have experience with the installation of the proposed direct digital control equipment product line for not less than 2 projects of similar size and complexity. Project Manager must have proof of having successfully completed the most advanced training offered by the manufacturer of the proposed product line.

2. BAS Contractor's Programmer Qualifications: Individual(s) shall specialize in and be experienced with direct digital control system programming for not less than 3 years and with the proposed direct digital control equipment product line for not less than 1.5 years. Programmers must show proof of having successfully completed the most advanced programming training offered by the vendor of the programming application on the proposed product line.

3. BAS Contractor's Lead Installation Technician Qualifications: Individual(s) shall specialize in and be experienced with direct digital control system installation for not less than 3 years and with the proposed direct digital control equipment product line for not less than 1.5 years. Installers must show proof of having successfully completed the installation certification training offered by the vendor of the proposed product line.

4. BAS Contractor's Service Qualifications: The installer must be experienced in control system operation, maintenance and service. BAS Contractor must document a minimum 5-year history of servicing installations of similar size and complexity. Installer must also document at least a 1-year history of servicing the proposed product line.

5. Installer's Response Time and Proximity

    a. Installer must maintain a fully capable service facility within 50 miles of the subject Project. Service facility shall manage the emergency service dispatches and maintain the inventory of spare parts.

    b. Installer must demonstrate the ability to meet the emergency response times listed in Paragraph 1.14B.1.

6. Electrical installation shall be by manufacturer-trained electricians

    a. Exception: Roughing in wiring and conduit and mounting panels may be subcontracted to any licensed electrician.

1.07 SUBMITTALS

A. No work may begin on any segment of this Project until the related submittals have been reviewed for conformity with the design intent and the Contractor has responded to all comments to the satisfaction of the Owner's Representative.

B. Submit drawings and product data as hereinafter specified. Conditions in this Section take precedence over conditions in Division 1 or Section 230501 Basic Mechanical Materials and Methods.

C. Submittal Schedule: Submittal schedule shall be as follows unless otherwise directed by the Owner's Representative:

1. Allow 15 working days for approval, unless Owner's Representative agrees to accelerated schedule.

2. Submittal Package 0 (Qualifications) shall be submitted with bid.

3. Submittal Package 1 (Hardware and Shop Drawings) shall be submitted in accordance with schedule established by the Owner in bid documents.

4. Submittal Package 2 (Programming and Graphics) and shall be submitted no less than 30 days before software is to be installed in field devices.

5. Submittal Package 3 (Pre-Functional Test Forms) shall be submitted no less than 30 days prior to conducting tests.

6. Submittal Package 4 (Pre-Functional Test Report) shall be submitted no less than 14 after conducting tests.

7. Submittal Package 5 (Post-Construction Trend Points List) shall be submitted 14 days prior to the start of the trend collection period.

8. Submittal Package 6 (Functional Test Report) shall be submitted no more than 7 days after conducting tests.

9. Submittal Package 7 (Training Materials) shall be submitted no less than 14 days prior to conducting first training class.

10. Submittal Package 8 (Post-Construction Trend Logs) shall be submitted after demonstration tests are accepted and systems are in full automatic operation.

D. Submission and Resubmission Procedure

1. Optional Pre-Submittals. At Contractor's option, electronic submittals indicated below may be submitted unofficially via email directly to the Engineer for review and comment prior to formal submission. Comments provided by the Engineer are not official and may be changed or additional comments may be provided on the formal submittal. The intent of pre-submittals is to reduce paperwork and review time.

2. Each submittal shall have a unique serial number that includes the associated specification section followed by a number for each sub-part of the submittal for that specification section, such as SUBMITTAL 250000-01.

3. Each resubmittal shall have the original unique serial number plus unique revision number such as SUBMITTAL 250000-01 REVISION 1.

4. Submit one copy of submittal in electronic format specified under each submittal package below. Submissions made in the wrong format will be returned without action.

5. Submittals shall have bookmarks for each subsection (e.g. Materials, Drawings) and for each drawing including drawing number and name.

6. Owner's Representative will return a memo or mark-up of submittal with comments and corrections noted where required.

7. Make corrections

   a. Revise initial submittal to resolve review comments and corrections.

   b. Clearly identify resubmittal by original submittal number and revision number.

c. The cover page of resubmittals shall include a summary of prior comments and how they were resolved in the resubmittal.

d. Indicate any changes that have been made other than those requested.

8. Resubmit revised submittals until no exceptions are taken.

a. The cost of Taylor Engineering's review of submittals after first resubmittal will be borne by Contractor at Taylor Engineering standard billing rates.

9. Once submittals are accepted with no exceptions taken, provide

a. Complete submittal of all accepted drawings and products in a single electronic file.

b. Photocopies or electronic copies for coordination with other trades, if and as required by the General Contractor or Owner's Representative.

E. Submittals Packages

1. Submittal Package 0 (Qualifications)

a. Provide Installer and Key personnel qualifications as specified in Paragraph 1.06B.

b. Format: Word-searchable format per Paragraph 1.10C.3.

2. Submittal Package 1 (Hardware and Shop Drawings)

a. Hardware

1) Organize by specification section and device tags as tagged in these specifications.

2) Do not submit products that are not used even if included in specifications.

3) Include a summary table of contents listing for every submitted device:

a) Tab of submittal file/binder where submittal is located

b) Device tag as tagged in these specifications (such as TS-1A, FM-1)

c) Specification section number (down to the lowest applicable heading number)

d) Whether device is per specifications and a listed product or a substitution

e) Manufacturer

f) Model number

g) Device accuracy (where applicable)

h) Accuracy as installed including wiring and A/D conversion effects (where applicable)

4) Submittal shall include manufacturer's description and technical data, such as performance data and accuracy, product specification sheets, and installation instructions for all control devices and software.

5) When manufacturer's cut-sheets apply to a product series rather than a specific product, the data specifically applicable to the Project shall be highlighted or clearly indicated by other means. Each submitted piece of literature and drawings shall clearly reference the specification or drawing that the submittal is to cover. General catalogs shall not be accepted as cut sheets to fulfill submittal requirements.

6) A BACnet Protocol Implementation Conformance Statement (PICS) for each type of controller and operator interface.

7) Format: Word-searchable format per Paragraph 1.10C.3.

b. Shop Drawings

1) System architecture one-line diagram indicating schematic location of all control units, workstations, LAN interface devices, gateways, etc. Indicate address and type for each control unit. Indicate media, protocol, baud rate, and type of each LAN.

2) Schematic flow diagram of each air and water system showing fans, coils, dampers, valves, pumps, and control devices. The schematics provided on Drawings shall be the basis of the schematics with respect to layout and location of control points.

3) All physical points on the schematic flow diagram shall be indicated with names, descriptors, and point addresses identified as listed in the point summary table.

4) Label each input and output with the appropriate range.

5) Device table (Bill of Materials). With each schematic, provide a table of all materials and equipment including:

a) Device tag as indicated in the schematic and actual field labeling (use tag as indicated in these specifications where applicable and practical)

b) Device tag as indicated in these specifications where applicable and if it differs from schematic device tag

c) Description

d) Proposed manufacturer and model number

e) Range

f) Quantity

6) With each schematic or on separate valve sheet, provide valve and actuator information including pipe size, valve size, C_v, design flow, target pressure drop, actual design pressure drop, manufacturer, model number, close off rating, etc. Indicate normal positions of fail-safe valves and dampers.

7) Indicate all required electrical wiring. Electrical wiring diagrams shall include both ladder logic type diagram for motor starter, control, and safety circuits and detailed digital interface panel point termination diagrams with all wire numbers and terminal block numbers identified. Provide panel termination drawings on separate drawings. Ladder diagrams shall appear on system schematic. Clearly differentiate between portions of wiring that are factory-installed and portions to be field-installed.

8) Details of control panels, including controllers, instruments, and labeling shown in plan or elevation indicating the installed locations.

9) Format

a) Sheets shall be consecutively numbered.

b) Each sheet shall have a title indicating the type of information included and the mechanical/electrical system controlled.

c) Table of Contents listing sheet titles and sheet numbers.

d) Legend and list of abbreviations.

e) Schematics

1. Word searchable pdf format.

2. 21 inch x 15 inch or 17 inch x 11 inch.

c. Do not include sequence of controls on shop drawings or equipment submittals; they are included in Submittal Package 2.

3. Submittal Package 2 (Programming and Graphics)

a. A detailed description of point naming convention conforming to Paragraph 3.13B to be used for all software and hardware points, integrated with existing database convention.

b. A list of all hardware and software points identifying their full text names, device addresses and descriptions.

c. Control Logic Documentation

1) Submit control logic program listings (graphical programming) consistent with specified English-language Sequences of Operation for all control units.

2) Control logic shall be annotated to describe how it accomplishes the sequence of operation. Annotations shall be sufficient to allow an operator to relate each program component (block or line) to corresponding portions of the specified Sequence of Operation.

3) Include a MS Word file of the specified English-language Sequences of Operation of each control sequence updated to reflect any suggested changes made by the Contractor to clarify or improve the sequences. Changes shall be clearly marked. Also merge Guideline 36 sequences, where referenced, verbatim into the file. SOO shall be fully consistent with the graphical programming. (A

MS Word file version of the sequences of controls in Paragraph 3.13 will be provided to the Contractor upon request.)

4) Include control settings, setpoints, throttling ranges, reset schedules, adjustable parameters and limits.

5) Submit one complete set of programming and operating manuals for all digital controllers concurrently with control logic documentation.

d. Graphic screens of all required graphics, provided in final colors.

e. Format

1) Points list: Word-searchable format per Paragraph 1.10C.3.

2) Programming: EC-gfx Program or equal.

3) Control sequences: MS Word

4) Programming and operating manual: Word-searchable format per Paragraph 1.10C.3.

5) Graphics: Graphical electronic format (pdf, png, etc.).

4. Submittal Package 3 (Pre-Functional Test Forms)

a. Provide pre-functional test forms as required by Paragraph 3.15E.2.

b. Format: Word-searchable format per Paragraph 1.10C.3.

5. Submittal Package 4 (Pre-Functional Test Report)

a. Provide Pre-Functional Test Report as required by Paragraph 3.15E.2.

b. Format: Word-searchable format per Paragraph 1.10C.3.

6. Submittal Package 5 (Post-Construction Trend Points List)

a. Provide a list of points being trended along with trend interval or change-of-value per Paragraph 3.15I.2.d.

b. Format: See Paragraph 2.11D.11.h.

7. Submittal Package 6 (Functional Test Report)

a. Provide completed functional test forms as required by Paragraph 3.15G.4.

b. Format: Word-searchable format per Paragraph 1.10C.3.

8. Submittal Package 7 (Training Materials)

a. Provide training materials as required by Paragraph 3.16.

b. Format: Word-searchable format per Paragraph 1.10C.3.

9. Submittal Package 8 (Post-Construction Trend Logs)

    a. Provide trend logs as required by Paragraph 3.15I.

    b. Format: See Paragraph 2.11D.11.h..

1.08 USE OF PREMISES

1.09 REUSE OF EXISTING SYSTEMS AND EQUIPMENT

A. The Controls Contractor is not responsible for the repairs or replacement of existing energy equipment and systems, valves, dampers, or actuators that are designated to be reused. Should the Contractor find existing equipment that requires maintenance, the Owner shall be notified immediately.

A. At the end of phased construction, existing DDC controls shall not be reused.

B. All existing control conduit and wiring may be reused.

1. Where wiring is allowed to be reused, its integrity and suitability to the new application is the responsibility of the Contractor. Wiring shall be properly identified and tested.

2. Unused or redundant wiring and conduit shall be removed.

C. Existing VAV Boxes, controllers, sensors, dampers, and damper actuators shall be replaced.

D. Existing temperature sensors shall be replaced.

B. Existing temperature sensors shall be replaced.

C. Control Panels

1. The Contractor may reuse any existing temperature control panels to locate new equipment.

2. Only the following existing equipment within existing panels may be reused:

    a. Power connection

    b. Convenience outlets

    c. Disconnect switch

    d. DIN rails

3. All unused existing equipment within these panels shall be removed and shall not be reused.

D. Existing motor starters and variable speed drives shall be replaced.

E. Safeties and Fire Alarm Controls

1. See division 26 for Fire Alarm Control scope

F. Existing control valves and actuators shall be fully replaced with new valves and actuators.

G. Fire/Smoke Dampers – see Division 26 drawings.

H. Existing pressure gauges and thermometers on existing mechanical equipment shall remain as-is. Repair or calibration of existing instrumentation is not part of this project.

1.10 COMPLETION REQUIREMENTS

A. Procedure

1. Until the documents required in this Section are submitted and approved, the system will not be considered accepted and final payment to Contractor will not be made.

2. Before requesting acceptance of Work, submit one set of completion documents for review and approval of Owner.

3. After review, furnish quantity of sets indicated below to Owner.

B. Completion Documents

1. Operation and Maintenance (O & M) Manuals. Provide in both paper and electronic format per Paragraph 1.10C.

a. Include the as-built version of all submittals (product data, shop drawings, control logic documentation, hardware manuals, software manuals, installation guides or manuals, maintenance instructions and spare parts lists) in maintenance manual. Submittal data shall be located in tabs along with associated maintenance information.

b. Engineering, Installation, and Maintenance Manual(s) that explain how to design and install new points, panels, and other hardware; preventive maintenance and calibration procedures; how to debug hardware problems; and how to repair or replace hardware.

c. Complete original issue documentation, installation, and maintenance information for all third-party hardware and software provided, including computer equipment and sensors.

d. A list of recommended spare parts with part numbers and suppliers.

e. Operators Manual with procedures for operating the control systems, including logging on/off, alarm handling, producing point reports, trending data, overriding computer control, and changing set points and other variables.

f. Programming Manuals with a description of the programming language, control block descriptions (including algorithms and calculations used), point database creation and modification, program creation and modification, and use of the programming editor.

g. Recommended preventive maintenance procedures for all system components, including a schedule of tasks (inspection, cleaning, calibration, etc.), time between tasks, and task descriptions.

h. A listing and documentation of all custom software for the Project created using the programming language, including the set points, tuning parameters, and point and object database.

i. English language control sequences updated to reflect final programming installed in the BAS at the time of system acceptance.

2. Complete original issue electronic copy for all software provided, including operating systems, programming language, operator workstation software, and graphics software.

3. Complete electronic copy of BAS database, user screens, setpoints and all configuration settings necessary to allow re-installation of system after crash or replacement of server, and resume operations with the BAS in the same configuration as during owner sign-off.

4. Project Record Drawings

   a. As-built versions of the submittal drawings in reproducible paper and electronic format per Paragraph 1.10C.

   b. As-built network architecture drawings showing all BACnet nodes including a description field with specific controller and device identification, description and location information.

5. Commissioning Reports. Completed versions of all Pre-functional, Functional, and Demonstration Commissioning Test reports, calibration logs, etc., per Paragraph 3.15A.9.

6. Copy of inspection certificates provided by the local code authorities.

7. Written guarantee and warranty documents for all equipment and systems, including the start and end date for each.

8. Training materials as required by Paragraph 3.16E.

9. Contact information. Names, addresses, and 24-hour telephone numbers of contractors installing equipment, and the control systems and service representatives of each.

C. Format of Completion Documents

1. Provide the type and quantity of media listed in table below.

2. Project database, programming source files, and all other files required to modify, maintain, or enhance the installed system shall be provided in their source format and compiled format (where applicable).

3. Where electronic copies are specified, comply with the following:

   a. Provide in word-searchable electronic format; acceptable formats are MS Word, Adobe Acrobat (pdf), and HTML; submit other formats for review and approval prior to submission; scanned paper documents not acceptable.

   b. For submittals, provide separate file for each type of equipment.

   c. Control sequences shall be in MS Word.

	Document	Paper (binder or bound)	Electronic	
			Loaded onto Flash Drive	Loaded onto CSS
1.	O&M Manual	–	1	1
2.	Original issue software	–	1 per workstation	1

	Document	Paper (binder or bound)	Electronic	
			Loaded onto Flash Drive	Loaded onto CSS
3.	Project database including all source files	–	1 per workstation	1
4.	Project Record Drawings	2	1	1
5.	Control sequences	–	1	1
6.	Commissioning Reports	–	1	1
7.	Inspection Certificates	–	1	1
8.	Warranty documents	–	1	1
9.	Training materials	1 per trainee	1	1
10.	Contact information	–	1	1

D. Permanent On-site Documentation

1. In each panel, provide the following stored in clear plastic sleeve taped to the back of the panel door:

a. 8.5x11 printout of as-built points list

b. 21 inch x 15 inch or 17 inch x 11 inch set of as-built shop drawings for devices in panel

1.11 BAS DESIGN

A. System Architecture

1. General

a. The system provided shall incorporate hardware resources sufficient to meet the functional requirements specified in this Section. Include all items not specifically itemized in this Section that are necessary to implement, maintain, and operate the system in compliance with the functional intent of this Section.

b. The system shall be configured as a distributed processing network(s) capable of expansion as specified herein.

c. The system will consist of BAS Control Systems Server (CSS) located in the Building Engineer's Office room 309. The CSS shall connect via a high-speed network to BCs and other control devices located throughout the building as well as the Owner's IT LAN.

d. The BAS shall be standalone and not rely on any 3rd party networks, such as the Owner's IT LAN.

e. All control products provided for this Project shall comprise an interoperable Native BACnet System. All control products provided for this Project shall conform to ANSI/ASHRAE Standard 135.

2. BAS Network Architecture

a. Supervisory LAN: The LAN shall be an Ethernet-based, 100 or 1000 Mbps network connecting the server and OWS(s) and to certain gateways as specified herein. Provide this as a dedicated LAN for the control system; the Owner's IT LAN shall not

be used for this purpose. LAN shall be IEEE 802.3 Ethernet with switches and routers that support 100 Mbps minimum throughput. Power-line carrier communication are not acceptable for communications. This network shall be BACnet/IP as defined in the BACnet standard, and shall share a common network number for the Ethernet backbone, as defined in BACnet.

b. Primary Controller LAN (Primary LAN): High-speed, peer-to-peer communicating LAN used to connect BCs, AACs, and certain gateways where specified herein. The Primary LAN communicates exclusively control information. Acceptable technologies include and are limited to:

1) Ethernet (IEEE802.3)

2) ARCNET (IEEE802.4)

c. Secondary Controller LAN (Secondary LAN): Network used to connect ASCs and certain gateways where specified herein. These may be Master Slave/ Token Passing (MS/TP) in addition to those allowed for Primary Controller LANs. Network speed versus the number of controllers on the LAN shall be dictated by the response time and trending requirements.

3. Operator Interfaces and Servers

a. Control Systems Server (CSS). This shall be a server upon which the systems configuration and programming databases are maintained and serves as web server for operator interface. It shall hold the backup files of the information downloaded into the individual controllers and as such support uploading and downloading that information directly to or from the controllers. It shall also act as a control information server to non-control system based programs. It shall allow secure multiple-access to the control information. It shall also store trend data uploaded from controllers.

b. The Operator Interface shall provide for overall system supervision, graphical user interface, management report generation, alarm annunciation, and remote monitoring. The system shall be capable of supporting an unlimited number of clients using a standard Web browser.

c. Remote monitoring and control shall be through use of a web browser through the Owner's IT LAN and via the internet through the Owner's IT LAN.

4. Controllers. The BCs, AACs, and ASCs shall monitor, control, and provide the field interface for all points specified.

5. Gateways

a. See Paragraph 2.03 for a list of gateways and routers.

b. Where gateways are used, critical points shall be hardwired from the BAS to the controlled device, rather than using the gateway, to avoid problems with gateway failures, currently a common problem. Critical points are those that are essential for proper operation and are listed in points list as separate points. Where listed, these points shall be hardwired even when available through gateway.

B. System Performance

1. The communication speed between the controllers, LAN interface devices, and operator interface devices shall be sufficient to ensure fast system response time under any loading condition. This includes when system is collecting trend data for commissioning and for long term monitoring. (See Paragraph 3.15I.) In no case shall delay times between an event, request, or command initiation and its completion be greater than those listed herein, assuming no other simultaneous operator activity. Reconfigure LAN as necessary to accomplish these performance requirements. This does not apply to gateways and their interaction with non-BAS-vendor equipment.

    a. Object Command: The maximum time between an operator command via the operator interface to change an analog or binary point and the subsequent change in the controller shall be less than 5 seconds.

    b. Object Scan: All changes of state and change of analog values will be transmitted over the network such that any data used or displayed at a controller or workstation will have been current within the previous 10 seconds.

    c. Graphics Scan: The maximum time between an operator's selection of a graphic and it completely painting the screen and updating at least 10 points shall be less than 10 seconds.

    d. Alarm Response Time: The maximum time from when an object goes into alarm to when it is annunciated at the workstation or broadcast (where so programmed) shall not exceed 10 seconds for a Level 1 alarm, 20 seconds for alarm levels 2 and 3, and 30 seconds for alarm levels 4 and 5. All workstations on the onsite network must receive alarms within 5 seconds of each other.

    e. Program Execution Frequency: Custom and standard applications shall be capable of running as often as once every 5 seconds. Contractor shall be responsible for selecting execution times consistent with the mechanical process under control.

    f. Control Loop Performance: Programmable controllers shall be able to execute DDC PID control loops at a selectable frequency of at least once per second. The controller shall scan and update the process value and output generated by this calculation at this same frequency.

2. Sensor selection, wiring method, use of transmitters, A-to-D conversion bits, etc. shall be selected and adjusted to provide end-to-end (fluid to display) accuracy at or better than those listed in the following table.

Measured Variable	**Reported Accuracy**
Space drybulb temperature	±1ºF
Ducted Air drybulb temperature	±0.5ºF
Mixed Air drybulb temperature	±1ºF
Outside Air drybulb temperature	±0.5ºF
Chilled Water Temperature	±0.2ºF
Hot Water Temperature	±0.5ºF
Water Flow	±1% of reading
Airflow (terminal)	±10% of reading
Airflow (measuring stations)	±5% of reading
Air Pressure (ducts)	±0.05 inches
Air Pressure (space)	±0.01 inches
Water Pressure	±2% of reading
Electrical power	1% of reading
Carbon Dioxide (CO_2)	±75 ppm

1.12 OWNERSHIP OF PROPRIETARY MATERIAL

A. All project-developed software and documentation shall become the property of the Owner. These include, but are not limited to:

1. Project graphic images

2. Record drawings

3. Project database

4. Project-specific application programming code

5. All documentation

1.13 WARRANTY

A. At the successful completion of the final testing, commissioning, and demonstration phase in accordance with the terms of this specification, if equipment and systems are operating satisfactorily to the Owner and if all completion requirements per Paragraph 1.10B have been fulfilled, the Owner shall certify in writing that the control system has been accepted. The date of acceptance shall be the start of the warranty period.

B. Guarantee all materials, equipment, apparatus and workmanship (including programming) to be free of defective materials and faulty workmanship for the following periods from date of acceptance:

1. BCs, AACs, and ASCs: two years

2. Valve and damper actuators: five years

3. All else: one year

C. Provide new materials, equipment, apparatus and labor to replace that determined by Owner to be defective or faulty.

D. Control system failures during the warranty period shall be adjusted, repaired, or replaced at no additional cost or reduction in service to the Owner. Contractor shall respond to the Owner's request for warranty service within 24 hours during normal business hours.

E. Operator workstation software, project-specific software, graphic software, database software, and firmware updates that resolve known software deficiencies shall be provided at no cost to the Owner during the warranty period.

F. Sequence of operation programming bugs (both due to programming misinterpretations and sequence errors) shall be corrected and any reasonable control sequence changes required to provide proper system operation shall be provided at no additional cost to the Owner during this period.

1.14 WARRANTY MAINTENANCE

A. The Owner reserves the right to make changes to the BAS during the warranty period. Such changes do not constitute a waiver of warranty. The Contractor shall warrant parts and installation work regardless of any such changes made by the Owner, unless the Contractor

provides clear and convincing evidence that a specific problem is the result of such changes to the BAS.

B. At no cost to the Owner, provide maintenance services for software and hardware components during the warranty period as specified below:

1. Emergency Service: Any malfunction, failure, or defect in any hardware component or failure of any control programming that would result in property damage or loss of comfort control shall be corrected and repaired following notification by the Owner to the Contractor.

   a. Response by telephone or via internet connection to the BAS to any request for service shall be provided within two hours of the Owner's initial request for service.

   b. In the event that the malfunction, failure, or defect is not corrected, at least one technician, trained in the system to be serviced, shall be dispatched to the Owner's site within eight hours of the Owner's initial request for such services.

2. Normal Service: Any malfunction, failure, or defect in any hardware component or failure of any control programming that would not result in property damage or loss of comfort control shall be corrected and repaired following notification by the Owner to the Contractor.

   a. Response by telephone to any request for service shall be provided within eight working hours (contractor specified 40 hr. per week normal working period) of the Owner's initial request for service.

   b. In the event that the malfunction, failure, or defect is not, at least one technician, trained in the system to be serviced, shall be dispatched to the Owner's site within three working days of the Owner's initial request for such services, as specified.

3. Owner's Telephonic Request for Service: Contractor shall specify a maximum of three telephone numbers for Owner to call in the event of a need for service. At least one of the lines shall be attended continuously (24/7). Alternatively, pagers/SMS can be used for technicians trained in system to be serviced. One of the three paged/texted technicians shall respond to every call within 15 minutes.

4. Technical Support: Contractor shall provide technical support by telephone throughout the warranty period.

5. Documentation: Record drawings and software documentation shall be updated as required to reflect any and all changes made to the system or programming during the warranty period.

PART 2 PRODUCTS

2.01 PRIMARY BAS MANUFACTURER

A. Primary BAS manufacturers shall meet the following minimum qualifications:

1. The system shall be compatible with the Niagara Framework.

B. The following primary BAS manufacturers are known to meet the above criteria and are the basis of this specification:

1. Alerton

2. Distech Controls

3. Or equal, no known equal

2.02 GENERAL

A. Materials shall be new, the best of their respective kinds without imperfections or blemishes and shall not be damaged in any way.

B. To the extent practical, all equipment of the same type serving the same function shall be identical and from the same manufacturer.

C. All controllers, associated hardware (repeaters, routers, etc.), sensors, and control devices shall be fully operational and maintain specified accuracy at the anticipated ambient conditions of the installed location as follows:

1. Outdoors or in harsh ambient conditions: -20°C to 55°C (-4°F to 130°F), 10% RH to 90% RH noncondensing.

2. Conditioned spaces or mechanical rooms: 0°C to 40°C (32°F to 104°F), 10% RH to 80% RH noncondensing.

2.03 CONTROLLERS

A. General

1. Point information from any controller (including BCs, AACs, and ASCs) and from any gateway shall be capable of being used in a control sequence in any other panel. The use of OWS or CSS to serve as a communications server between control panels and gateways is not acceptable.

2. For all controllers, operating configuration and software shall be retained in the event of a power outage without requiring a download from upper level controllers by one or a combination of the following:

a. Volatile RAM shall have a replaceable battery backup using a lithium battery with a rated service life of 10,000 hours continuous and a rated shelf life of at least 7 years.

b. Volatile RAM shall have a automatically rechargeable battery backup using a lithium battery with a rated service life of 50 hours continuous and a rated shelf life of at least 10 years.

c. EEPROM, EPROM, or NVROM non-volatile memory.

3. Controllers shall allow independent operation regardless of the status of the other controllers or OWS or CSS. BCs, AACs, and ASCs shall perform all specified control sequences independent of operator interface devices and servers, i.e. all programming shall reside in BCs, AACs, and ASCs.

4. Each controller shall continually check the status of its processor and memory circuits. If an abnormal operation is detected, the controller shall.

a. Assume a predetermined failure mode.

b. Generate an alarm notification to the master controller, Operator Workstation, or both.

5. All input points and output points shall be protected such that shorting of the point to itself — to another point, or to ground — will cause no damage to the controller. All input and output points shall be protected from voltage up to 24V of any duration, such that contact with this voltage will cause no damage to the controller.

6. Programmability: All controllers, including BCs, AACs, and ASCs, shall be fully user programmable. Configurable pre-programmed logic shall not be acceptable in any controller. (This is required due to non-standard control sequences at AHUs and VAV terminal units.)

B. Stand-Alone Functionality

1. General: These requirements clarify the requirement for stand-alone functionality relative to packaging I/O devices with a controller. Stand-alone functionality is specified with the controller and for each Application Category specified in Part 3. This item refers to acceptable paradigms for associating the points with the processor.

2. Functional Boundary: Provide controllers so that all points associated with and common to one unit or other complete system or equipment shall reside within a single control unit. The boundaries of a standalone system shall be as dictated in the contract documents. Generally systems specified for the Application Category will dictate the boundary of the standalone control functionality. See related restrictions below. When referring to the controller with respect to standalone functionality, reference is specifically made to the processor. One processor shall execute all the related I/O control logic via one operating system that uses a common programming and configuration tool.

3. The following configurations are considered acceptable with reference to a controller's standalone functionality:

a. Points packaged as integral to the controller such that the point configuration is listed as an essential piece of information for ordering the controller (having a unique ordering number).

b. Controllers with processors and modular back planes that allow plug in point modules as an integral part of the controller.

c. I/O point expander boards, plugged directly into the main controller board to expand the point capacity of the controller.

4. The following configurations are considered unacceptable with reference to a controller's standalone functionality:

a. Multiple controllers enclosed in the same control panel to accomplish the point requirement.

C. Building Controller (BC)

1. General Requirements

a. BCs shall be peer-to-peer devices connected to the Primary Controller LAN.

b. Each BC shall be capable of standalone direct digital operation utilizing its own microprocessor, internal RAM, non-volatile memory, input/output, wiring terminal strips, A/D converters, real-time clock/calendar and voltage transient and surge protection devices, battery backup, regulated power supply, power conditioning equipment, ports for connection of operating interface devices, and control enclosure. Refer to standalone functionality specified above.

c. The BC(s) shall provide fully distributed control independent of the operational status of the OWSs and CSS. All necessary calculations required to achieve control shall be executed within the BC independent of any other device.

d. BCs shall perform overall system coordination, accept control programs, perform automated HVAC functions, control peripheral devices and perform all necessary mathematical and logical functions. BCs shall share information with the entire network of BCs and AACs/ASCs for full global control. Each controller shall permit multi-user operation from multiple workstations and portable operator terminals connected either locally or over the Primary Controller LAN.

e. BC shall contain sufficient memory for all specified global control strategies, user defined reports and trending, communication programs, and central alarming.

f. The BC may provide for point mix flexibility and expandability. This requirement may be met via either a family of expander boards, modular input/output configuration, or a combination thereof. Refer to standalone functionality specified above.

g. All BC point data, algorithms and application software shall be configurable, and all control strategies performed by the BC shall be both operator definable and modifiable, from Operator Interfaces. The point database and all application programs shall be stored in non-volatile or battery backed volatile memory within the BC and shall be able to upload to or download from the OWS or CSS.

h. BC shall provide buffer for holding alarms, messages, trends etc.

i. Each BC shall include self-test diagnostics, which allow the BC to automatically alarm any malfunctions or alarm conditions that exceed desired parameters as determined by programming input.

j. Each BC shall contain software to perform full DDC/PID control loops.

k. Memory

    1) Memory for data trending shall reside in BCs; the Operator Workstation shall not need to be connected for data trending to occur. Memory shall be large enough to record 256 records of each hardware point on the panel and an equal number of software points, each record to include both data value and time of occurrence. See Paragraph 3.15I for trending software requirements.

    2) Provide sufficient internal memory for the specified sequences of operation and trend logging. There shall be a minimum of approximately 25% of available memory free for future programming changes.

    3) Provide an additional BC if needed to comply with this Paragraph.

l. For systems requiring end-of-line resistors those resistors shall be located in the BC.

m. Input-Output Processing

1) Digital Outputs (DO): Outputs shall be rated for a minimum 24 Vac or Vdc, 0.5 amp maximum current. Each shall be configurable as normally open or normally closed. Each DO shall be discrete outputs from the BC's board. Multiplexing to a separate manufacturer's board is unacceptable. Provide suppression to limit transients to acceptable levels.

2) Analog Inputs (AI): AI shall be 0-5 Vdc, 0-10 Vdc, and 0-20 mA; or direct thermistor connection. Provide signal conditioning and zero and span calibration for each input. Each input shall be a discrete input to the BC's board. Multiplexing to a separate manufacturers board is unacceptable. A/D converters shall have a minimum resolution of 12 bits.

3) Digital Inputs (DI): Monitor dry contact closures. Accept pulsed inputs of at least one per second. Source voltage for sensing shall be supplied by the BC and shall be isolated from the main board. Software multiplexing of an AI and resistors is unacceptable.

4) Universal Inputs (UI-AI or DI): To serve as either AI or DI as specified above.

5) Electronic Analog Outputs (AO): Voltage mode: 0-5 Vdc and 0-10 Vdc; Current mode: 4-20 mA. Provide zero and span calibration and circuit protection. Pulse Width Modulated (PWM) analog is not acceptable. D/A converters shall have a minimum resolution of 8 bits.

6) Pulsed Inputs: Capable of counting up to 8 pulses per second with buffer to accumulate pulse count. Pulses shall be counted at all times.

n. A communication port for operator interface through a terminal shall be provided in each BC. It shall be possible to perform all program and database back-up, system monitoring, control functions, and BC diagnostics through this port. Standalone BC panels shall allow temporary use of portable devices without interrupting the normal operation of permanently connected printers, or workstations.

o. Each BC shall be equipped with loop tuning algorithm for precise proportional, integral, derivative (PID) control. Loop tuning tools provided with the Operator Workstation software is acceptable. In any case, tools to support loop tuning must be provided such that P, I, and D gains are automatically calculated.

p. All output points shall have a selectable failure setpoint or mode. The BC shall be capable of maintaining this failure setpoint or mode in the event of a system malfunction, which causes loss of BC control or loss of output signal as long as power is available at the BC. The failure setpoint or mode shall be selectable on a per point basis.

q. Slope intercepts and gain adjustments shall be available on a per-point basis.

r. BC Power Loss

1) Upon a loss of power to any BC, the other units on the primary controlling network shall not in any way be affected.

2) Upon a loss of power, all software, database parameters, and data (except trend data) shall be protected from memory loss per Paragraph 2.03A.2.

3) Upon restoration of power within the specified battery backup period, the BC shall resume full operation without operator intervention. The BC shall automatically reset its clock such that proper operation of any time dependent function is possible without manual reset of the clock. All monitored functions shall be updated.

4) Should the duration of a loss of power exceed the specified battery back-up period or BC panel memory be lost for any reason, the panel shall automatically report, or CSS shall automatically determine, the condition (upon resumption of power) and be capable of receiving a download via the network, and connected computer. In addition, the Owner shall be able to upload the most current versions of all energy management control programs, Direct Digital Control programs, database parameters, and all other data and programs in the memory of each BC to the OWS via the local area network, or via the local RS-232C port to the POT.

s. BC Failure

1) Controller LAN Data Transmission Failure: BC shall continue to operate in stand-alone mode. BC shall store loss of communication alarm along with the time of the event. All control functions shall continue with the global values programmable to either last value or a specified value.

2) BC Hardware Failure: BC shall cease operation and terminate communication with other devices. All outputs shall go to their specified fail position.

t. Each BC shall be equipped with firmware resident or software self-diagnostics for sensors and be capable of assessing an open or shorted sensor circuit and taking an appropriate control action (close valve, damper, etc.).

u. BCs may include LAN communications interface functions for controlling secondary LANs. Refer to Paragraph 2.03C for requirements if this function is packaged with the BC.

v. BCs shall be mounted on equipment, in packaged equipment enclosures, or locking wall mounted in a NEMA enclosure, as specified herein.

2. BACnet Building Controller Requirements

a. The BC(s) shall support all BIBBs defined in the BACnet Building Controller (B-BC) device profile as defined in the BACnet standard.

b. Each BC shall be connected to the BACnet Primary Controller LAN communicating to or from other BCs.

D. Advanced Application Controller (AAC) and Application Specific Controller (ASC)

1. General Requirements

a. AACs and ASCs shall be connected to the Primary or Secondary Controller LAN.

b. AACs and ASCs shall provide intelligent, standalone control of HVAC equipment. Each unit shall have its own internal RAM, non-volatile memory and will continue to operate all local control functions in the event of a loss of communications on the Secondary LAN. Refer to standalone requirements by application specified in Part 3

of this Section. In addition, it shall be able to share information with every other BC and AAC /ASC on the entire network.

c. Each AAC and ASC shall include self-test diagnostics that allow the AAC /ASC to automatically relay to the BC, LAN Interface Device or workstation, any malfunctions or abnormal conditions within the AAC /ASC or alarm conditions of inputs that exceed desired parameters as determined by programming input.

d. AACs and ASCs shall include sufficient memory to perform the specific control functions required for its application and to communicate with other devices.

e. Each AAC and ASC must be capable of stand-alone direct digital operation utilizing its own processor, non-volatile memory, input/output, voltage transient and surge protection devices to perform all specified application sequences.

f. All point data; algorithms and application software within an AAC /ASC shall be modifiable from Operator Interfaces.

g. Memory

1) Memory for data trending is not required for AACs and ASCs. If not provided in controller, memory for trend data shall reside in BCs connected to the same Network.

2) Provide sufficient internal memory for the specified sequences of operation. For AACs, there shall be a minimum of approximately 25% of available memory free for future programming changes. Provide additional AACs or a BC if needed to comply with this requirement.

h. AAC Input-Output Processing. Same as BCs (Paragraph 2.03C.1.m) except A/D converters may be 10 bit.

i. ASC Input-Output Processing

1) Digital Outputs (DO): Outputs shall be rated for a minimum 24 Vac or Vdc, 0.5 amp maximum current. Each shall be configurable as normally open or normally closed. Each output shall have an LED to indicate the operating mode of the output. Each DO shall be discrete outputs from the ASC's board (multiplexing to a separate manufacturer's board is unacceptable). Provide suppression to limit transients to acceptable levels.

2) Analog Inputs (AI): AI shall be 0-5 Vdc, 0-10 Vdc, 0-20 mA, or direct thermistor connection. Provide signal conditioning, and zero and span calibration for each input. Each input shall be a discrete input to the ASC's board (multiplexing to a separate manufacturers board is unacceptable unless specifically indicated otherwise). A/D converters shall have a minimum resolution of 10 bits.

3) Digital Inputs (DI): Monitor dry contact closures. Accept pulsed inputs of at least one per second. Source voltage for sensing shall be supplied by the ASC and shall be isolated from the main board. Software multiplexing of an AI and resistors may only be done in non-critical applications and only with prior approval of the Owner.

4) Universal Inputs (UI-AI or DI): To serve as either AI or DI as specified above.

5) Electronic Analog Outputs (AO): Voltage mode: 0-5 Vdc and 0-10 Vdc; Current mode: 4-20 mA. Provide zero and span calibration and circuit protection. Pulse Width Modulated (PWM) analog is not acceptable. D/A converters shall have a minimum resolution of 8 bits.

2. BACnet AAC(s) and ASC(s) Requirements

a. The AAC(s) and ASC(s) shall support all BIBBs defined in the BACnet Building Controller (B-AAC and B-ASC) device profile as defined in the BACnet standard.

b. AAC(s) and ASC(s) shall communicate over the BACnet Primary Controller LAN or the Secondary LAN.

2.04 COMMUNICATION DEVICES

A. Controller Local Area Network Interface Devices (LANID)

1. The Controller LANID shall be a microprocessor-based communications device which acts as a gateway/router between the Primary LAN, Secondary LAN, an operator interface, or printer. These may be provided within a BC or as a separate device.

2. The LANID shall perform information translation between the Primary LAN and the Secondary LAN, supervise communications on a polling secondary LAN, and shall be applicable to systems in which the same functionality is not provided in the BC. In systems where the LANID is a separate device, it shall contain its own microprocessor, RAM, battery, real-time clock, communication ports, and power supply as specified for a BC in Paragraph 2.03C. Each LANID shall be mounted in a lockable enclosure.

3. Upon loss of power to a LANID, the battery shall provide for minimum 100-hour backup of all programs and data in RAM. The battery shall be sealed and self-charging.

4. The LANID shall be transparent to control functions and shall not be required to control information routing on the Primary LAN.

B. Supervisory LAN Routers

1. The Supervisory Router shall be a microprocessor-based communications device that acts as a router between the Supervisory LAN CSSs or OWS and the Primary LAN.

2. The Supervisory Router shall not perform information translation. Both Primary LAN and the Supervisory LAN shall use BACnet.

3. The Supervisory Router shall contain its own microprocessor, RAM, communication ports, and power supply. Each Supervisory Router shall be mounted in a lockable enclosure.

4. The Supervisory Router shall allow centralized overall system supervision, operator interface, management report generation, alarm annunciation, acquisition of trend data, and communication with control units. It shall allow system operators to perform the following functions from the CSS, OWSs, and POTs.

a. Configure systems.

b. Monitor and supervise control of all points.

c. Change control setpoints.

d. Override input values.

e. Override output values.

f. Enter programmed start/stop time schedules.

g. View and acknowledge alarms and messages.

h. Receive, store and display trend logs and management reports.

i. Upload/Download programs, databases, etc. as specified.

5. Upon loss of power to the Supervisory Router, the battery shall provide for minimum 100-hour backup of all programs and data in RAM. The battery shall be sealed and self-charging.

6. The Supervisory Router shall be transparent to control functions and shall not be required to control information routing on the Primary LAN.

C. BACnet broadcast message routing

1. To allow BACnet broadcast messages to be relayed from remote nodes communicating via the internet and connecting to the Supervisory Router through IP protocol, a BACnet/IP Broadcast Management Device (BBMD) shall be provided which conforms to the BACnet standard for two-hop distribution. Multicast messaging or one-hop distribution requiring configuration of IP routers which are not part of the BAS vendor's scope is not acceptable.

D. BACnet Gateways & Routers

1. Gateways shall be provided to link non-BACnet control products to the BACnet inter-network. All of the functionality described in this Paragraph is to be provided by using the BACnet capabilities. Each Gateway shall have the ability to expand the number of BACnet objects of each type supported by 20% to accommodate future system changes.

2. Each Gateway shall provide values for all points on the non-BACnet side of the Gateway to BACnet devices as if the values were originating from BACnet objects. The Gateway shall also provide a way for BACnet devices to modify (write) all points specified by the Points List using standard BACnet services.

3. Each Gateway shall provide a way to collect and archive or trend (time, value) data pairs.

4. Each Gateway and any devices that the Gateway represents which have time-of-day information shall respond to workstation requests to synchronize the date and time. Each Gateway and any devices that the Gateway represents shall support dynamic device binding and dynamic object binding.

5. All points in the system shall be made network visible through the use of standard BACnet objects or through proprietary BACnet extensions that the workstation also supports. All points shall be writable using standard BACnet services.

6. All devices have a Device Object instance number that is unique throughout the entire inter-network. All BACnet devices shall be configured with a Device Object instance

number that is based on the format specified. This includes all physical devices as well as any logical BACnet devices that are physically represented by Gateways.

7. Upon loss of power to a Gateway, the battery shall provide for minimum 500-hour backup of all programs and data in RAM. The battery shall be sealed and self-charging.

8. UL 916 CE FCC part 15 Subpart B – Class A with surge and transient protection circuitry for power and communications.

E. Gateway and Routers

Equipment/System	Interface			
	Type	Specified Under Division:	Location	Connect to this Network:
Variable Speed Drives	BACnet/MSTP	23	Each VFD	Secondary
Air to Water Heat Pump	BACnet/MSTP	23	Each Heat Pump	Secondary
Lighting Controls	BACnet/IP	26	Electrical Room	Supervisory

2.05 BAS INTERFACE HARDWARE

A. Control System Server (CSS)

1. Hardware

a. Intel Core i7 8 core 4.8 GHz (minimum) Processor

b. 16 GB DDR2 RAM (minimum)

c. 1 TB SATA hard drive with 6 GB/s transfer rate (minimum)

d. One Ethernet 10/100 Mbps internal network card (for connection to Supervisory LAN)

e. One Ethernet 10/100/1000 Mbps (1 Gbps) internal network card (for connection to Owner's IT LAN)

f. 24 inch color, 1920 x 1200 pixel flat panel display.

g. 256 MB VGA/DVI graphics adapter

h. 2-button with scroll optical USB mouse

i. Enhanced USB 101-key keyboard

j. Internal speakers

k. High efficiency power supply; EnergyStar configured

l. One spare serial port and one spare USB port in addition to those needed for specified peripherals

m. 24x7 dedicated technical support service that delivers reduced hold time, direct access to advanced level technicians, and reduced time to resolution, minimum 3 years

n. Tower cabinet

2. Software by PC Supplier (factory installed):

a. Operating system: Microsoft Windows 10 Pro

b. Database: MySQL or MS SQL

c. Browser: Microsoft Internet Explorer, Firefox, or Chrome

d. All software shall be at least the latest version available as of the date of purchase.

B. Operator Workstation (OWS)

1. CSS doubles as OWS

C. Uninterruptible Power Supply (UPS)

1. UPS ES battery backup and surge protection.

2. EMI/RFI filtering to FCC Class B.

3. Surge protection for all outlets.

4. Stepped sine wave output.

5. Wide input voltage range.

6. Automatic battery testing.

7. Continuous battery monitoring.

8. Continuous overload monitoring.

9. Sufficient to power all BAS servers and computers in Engineer's Office at full load for 5 minutes after power failure.

2.06 AIR TUBING

A. Seamless copper tubing, Type L-ACR, ASTM B 88; with cast-bronze solder joint fittings, ANSI B1.18; or wrought-copper solder-joint fittings, ANSI B16.22; except brass compression-type fittings at connections to equipment. Solder shall be 95/5 tin antimony, or other suitable lead free composition solder.

B. Virgin polyethylene non-metallic tubing type FR, ASTM D 2737, and with flame-retardant harness for multiple tubing. Use compression or push-on brass fittings.

2.07 ELECTRIC WIRING AND DEVICES

A. All electrical work shall comply with Division 26.

B. Communication Wiring

1. Provide all communication wiring between Building Controllers, Routers, Gateways, AACs, ASCs and local and remote peripherals (such as operator workstations and printers).

2. Ethernet LAN: Use Fiber or Category 5e or 6 of standard TIA/EIA 68 (10baseT). Network shall be run with no splices and separate from any wiring over 30 volts.

3. ARCnet and MS/TP LAN: Communication wiring shall be individually 100% shielded pairs per manufacturers recommendations for distances installed, with overall PVC cover, Class 2, plenum-rated run with no splices and separate from any wiring over 30 volts. Shield shall be terminated and wiring shall be grounded as recommended by BC manufacturer.

C. Analog Signal Wiring

1. Input and output signal wiring to all field devices, including, but not limited to, all sensors, transducers, transmitters, switches, current or voltage analog outputs, etc. shall be twisted pair, 100% shielded if recommended or required by controller manufacturer, with PVC cover. Gauge shall be as recommended by controller manufacturer.

2.08 CONTROL CABINETS

A. All control cabinets shall be fully enclosed with hinged door.

1. For panels in mechanical rooms and other spaces that are secure and accessible only to BAS/MEP operators, provide quarter-turn slotted latch.

2. For panels located in electrical rooms, IDF rooms, and other spaces that may be accessible by persons other than BAS/MEP operators, provide key-lock latch. A single key shall be common to all panels within each building. Provide 3 keys.

B. Construction

1. Indoor

a. Mechanical or electrical rooms etc.: NEMA 1

b. Air plenums: NEMA 12

2. Outdoor: NEMA 4X with 316 stainless steel

C. Interconnections between internal and face-mounted devices shall be pre-wired with color-coded stranded conductors neatly installed in plastic troughs or tie-wrapped. Terminals for field connections shall be UL Listed for service, individually identified per control-interlock drawings, with adequate clearance for field wiring. All control tubing and wiring shall be run neatly and orderly in open slot wiring duct with cover. Control terminations for field connection shall be individually identified per control Shop Drawings.

D. Provide ON/OFF power switch with over-current protection for control power sources to each local panel.

E. Provide with

1. Framed, plastic-encased point list for all points in cabinet.

2. Nameplates for all devices on face.

2.09 SENSORS AND MISCELLANEOUS FIELD DEVICES

A. The listing of several sensors or devices in this section does not imply that any may be used. Refer to points list in Paragraph 2.12 Points List for device specification. Only where two or more devices are specifically listed in points list (such as “FM-1 or FM-4”) may the Contractor choose among listed products.

B. Control Valves

1. Manufacturers

a. Belimo

b. Siemens

c. Schneider

d. Delta

e. JCI

f. Bray

g. Or equal

2. Butterfly Valves

a. Body: Extended neck epoxy coated cast or ductile iron with full lug pattern, ANSI Class bolt pattern to match specified flanges.

b. Seat: EPDM replaceable, non-collapsible, phenolic backed.

c. Disc: Polished aluminum bronze or stainless steel, pinned or mechanically locked to shaft. Sanded castings are not acceptable.

d. Bearings: Bronze or stainless steel.

e. Shaft: 416 stainless steel supported at three locations with PTFE bushings for positive shaft alignment.

f. Close off rating: Bubble-tight shutoff greater or equal to 125% of pump shut-off head.

g. Manufacturers (In Addition to Paragraph 2.09B.1.)

1) Jamesbury

2) Keystone

3) Dezurik

4) Or equal

3. Two Position Ball Valves

a. Valves shall be specifically designed for two-position duty in control application with guaranteed average leak-free life span over 200,000 full stroke cycles.

b. Industrial quality with nickel plated forged brass body and female NPT threads.

c. Blowout proof stem design, glass-reinforced Teflon thrust seal washer and stuffing box ring with minimum 600 psi rating (1 inch and smaller) or 400 psi rating (larger than 1 inch). The stem packing shall consist of 2 lubricated O-rings designed for on-off service and requiring no maintenance.

d. Valves suitable for water or low-pressure steam shall incorporate an anti-condensation cap thermal break in stem design.

e. No characterization disks

f. Close off rating: Bubble-tight shutoff greater or equal to 125% of pump shut-off head.

g. Ball: Chrome plated brass

h. Stem: Chrome plated brass

4. Modulating Characterized Ball Valves

a. Valves shall be specifically designed for modulating duty in control application with guaranteed average leak-free life span over 200,000 full stroke cycles.

b. Industrial quality with nickel plated forged brass body and female NPT threads.

c. Blowout proof stem design, glass-reinforced Teflon thrust seal washer and stuffing box ring with minimum 600 psi rating (2-way valves) or 400 psi rating (3-way valves). The stem packing shall consist of 2 lubricated O-rings designed for modulating service and requiring no maintenance.

d. Valves suitable for water or low-pressure steam shall incorporate an anti-condensation cap thermal break in stem design.

e. Close off rating: Bubble-tight shutoff greater or equal to 125% of pump shut-off head.

f. Ball: stainless steel

g. Stem: stainless steel

h. Characterizing disk held securely by a keyed ring providing equal percentage characteristic

5. Minimum valve assembly pressure ratings shall meet or exceed inlet pressures listed on equipment schedules at the following temperatures:

a. Chilled water: 60ºF

b. Hot water: 180ºF

6. Valve Selection

a. Valve Characteristic

1) 2-way valves: equal percentage or modified equal percentage.

2) 3-way valves controlling cooling coils and condenser water heat exchangers: linear.

3) 3-way valves controlling heating coils: equal percentage or modified equal percentage.

4) 6-way valves: linear

5) Two-position valves: not applicable. For ball valves used for two-position duty, do not include characterizing disk.

b. Valve Sizing

1) Modulating Water: Size valve to achieve the following full-open pressure drop

a) Minimum pressure drop: equal to half the pressure drop of coil or exchanger.

b) Maximum pressure drop

1. Hot water at coils: 2 psi

c) 3-way valves shall be selected for near minimum pressure drop. 2-way and 6-way valves shall be selected near maximum pressure drop.

d) See HVAC schedules for flow coefficient (C_v).

e) Flow coefficient (C_v) shall not be less than 1.0 (to avoid clogging)

f) Valve size shall match as close as possible the pipe size where C_v is available in that size.

2) Two-position valves: Line size unless otherwise indicated on Drawings.

C. Control Dampers

1. See Section 233300 Duct Accessories

D. Actuators

1. Manufacturers

a. Belimo

b. No equal

2. Warranty: Valve and damper actuators shall carry a manufacturer's 5-year warranty.

3. Electric Actuators

a. Entire actuator shall be UL or CSA approved by a National Recognized Testing Laboratory.

b. Enclosure shall meet NEMA 4X weatherproof requirements for outdoor applications.

c. Dampers. The actuator shall be direct coupled over the shaft, enabling it to be mounted directly to the damper shaft without the need for connecting linkage. The clamp shall be steel of a V-bolt design with associated V-shaped, toothed cradle attaching to the shaft for maximum strength and eliminating slippage via cold weld attachment. Single bolt or set screw type fasteners are not acceptable. Aluminum clamps are unacceptable.

d. Valves. Actuators shall be specifically designed for integral mounting to valves without external couplings.

e. Actuator shall have microprocessor based motor controller providing electronic cut off at full open so that no noise can be generated while holding open. Holding noise level shall be inaudible.

f. Noise from actuator while it is moving shall be inaudible through a tee-bar ceiling.

g. Actuators shall provide protection against actuator burnout using an internal current limiting circuit or digital motor rotation sensing circuit. Circuit shall insure that actuators cannot burn out due to stalled damper or mechanical and electrical paralleling. End switches to deactivate the actuator at the end of rotation or use of magnetic clutches are not acceptable.

h. Modulating Actuators. Actuators shall accept a 0 to 10 VDC or 0 to 20 mA control signal and provide a 2 to 10 VDC or 4 to 20 mA operating range. Actuators shall have positive positioning circuit so that controlled device is at same position for a given signal regardless of operating differential pressure. Actuators that internally use a floating actuator with an analog signal converter are not acceptable.

i. Where indicated on Drawings or Points List, actuators shall include

   1) 2 to 10 VDC position feedback signal

   2) Limit (end) position switches

j. All 24 VAC/DC actuators shall operate on Class 2 wiring and shall not require more than 10 VA for AC. Actuators operating on 120 VAC power shall not require more than 10 VA. Actuators operating on 230 VAC power shall not require more than 11 VA.

k. All modulating actuators shall have an external, built-in switch to allow the reversing of direction of rotation.

l. Actuators shall be provided with a conduit fitting an a minimum three-foot electrical cable and shall be pre-wired to eliminate the necessity of opening the actuator housing to make electrical connections.

m. Where fail-open or fail-closed (fail-safe) position is required by Paragraph 2.09D.5, an internal mechanical, spring return mechanism shall be built into the actuator housing. Electrical capacitor type fail-safe are also acceptable. All fail-safe actuators shall be capable of both clockwise or counterclockwise spring return operation by simply changing the mounting orientation.

n. Actuators shall be capable of being mechanically and electrically paralleled to increase torque where required.

o. All non-spring return actuators shall have an external manual gear release to allow manual positioning of the damper when the actuator is not powered. Spring return actuators with more than 60 inch-pound torque capacity shall have a manual crank for this purpose.

p. Actuators shall be designed for a minimum of 60,000 full cycles at full torque and be UL 873 listed.

q. Actuators shall provide clear visual indication of damper/valve position.

4. Electric Actuators for Large Butterfly Valves

a. Entire actuator shall be UL or CSA approved by a National Recognized Testing Laboratory.

b. The valve actuator shall consist of a capacitor-type reversible electric motor, gear train, limit switches and terminal block, all contained in a die cast aluminum enclosure.

c. Enclosure shall meet NEMA 4X weatherproof requirements for outdoor applications.

d. Output shaft shall be electroless nickel plated to prevent corrosion.

e. Actuator shall have a motor rated for minimum 75% duty cycle. Duty cycle shall be defined as running time divided by installed time at maximum torque.

f. Actuator shall be suitable for operation in ambient temperature ranging from -22°F to +150°F.

g. A pre-wired cable shall bring wiring outside enclosure to avoid necessity of opening cover.

h. Gears shall be hardened alloy steel, permanently lubricated. A self-locking gear assembly or a brake shall be supplied.

i. Actuator shall be equipped with a hand wheel for manual override to permit operation of the valve in the event of electrical power failure or system malfunction. Hand wheel must be permanently attached to the actuator. When in manual operation electrical power to the actuator will be permanently interrupted.

j. The hand wheel will not rotate while the actuator is electrically driven.

k. Actuator shall have heater and thermostat to minimize condensation within the actuator housing.

l. Provide limit (end) position switches where indicated on schematics.

m. Actuators shall provide clear visual indication of valve position.

5. Normal and Fail-Safe Position

a. Except as specified otherwise herein, the normal position (that with zero control signal) and the fail-safe position (that with no power to the actuator) of control devices and actuators shall be as indicated in table below. “Last” means last

position. Actuators with a fail-safe position other than "Last" must have spring or electronic fail-safe capability.

Device	Normal Position	Fail-Safe Position
Outside air damper	CLOSED	LAST
Return air damper	OPEN	LAST
Exhaust/relief air damper	CLOSED	LAST
AHU cooling coil valves	CLOSED	LAST
Equipment isolation valves	OPEN	LAST
Hot water reheat coil valves	CLOSED	LAST
AWHP-1 HW/CHW Changeover valves	Same as fail-safe	See Sheet BAS0.01
VAV box dampers	OPEN	LAST

6. Valve Actuator Selection

    a. Modulating actuators for valves shall have minimum rangeability of 50 to 1.

    b. Water

        1) 2-way, and two-position valves

            a) Tight closing against 125% of system pump shut-off head.

            b) Modulating duty against 90% of system pump shut-off head.

        2) 3-way shall be tight closing against twice the full open differential pressure for which they are sized.

7. Damper Actuator Selection

    a. Actuators shall be direct coupled. For multiple sections, provide one actuator for each section; linking or jack-shafting damper sections shall not be allowed.

    b. Provide sufficient torque as velocity, static, or side seals require per damper manufacturer's recommendations and the following:

        1) Torque shall be a minimum 5 inch-pound per square foot for opposed blade dampers and 7 inch-pound per square foot for parallel blade dampers.

        2) The total damper area operated by an actuator shall not exceed 80% of the manufacturer's maximum area rating.

E. General Field Devices

1. Provide field devices for input and output of digital (binary) and analog signals into controllers (BCs, AACs, ASCs). Provide signal conditioning for all field devices as recommended by field device manufacturers and as required for proper operation in the system.

2. It shall be the Contractor's responsibility to assure that all field devices are compatible with controller hardware and software.

3. Field devices specified herein are generally two-wire type transmitters, with power for the device to be supplied from the respective controller. If the controller provided is not

equipped to provide this power, or is not designed to work with two-wire type transmitters, or if field device is to serve as input to more than one controller, or where the length of wire to the controller will unacceptably affect the accuracy, provide a transmitter and necessary regulated DC power supply, as required.

4. For field devices specified hereinafter that require signal conditioners, signal boosters, signal repeaters, or other devices for proper interface to controllers, furnish and install proper device, including 120V power as required. Such devices shall have accuracy equal to, or better than, the accuracy listed for respective field devices.

5. Accuracy: As used in this Section, accuracy shall include combined effects of nonlinearity, non-repeatability and hysteresis. Sensor accuracy shall be at or better than both that specifically listed for a device and as required by Paragraph 1.11B.2.

F. Temperature Sensors (TS)

1. General

a. Unless otherwise noted, sensors may be platinum RTD, thermistor, or other device that is commonly used for temperature sensing and that meets accuracy, stability, and resolution requirements.

b. When matched with A/D converter of BC, AAC, or ASC, sensor range shall provide a resolution of no worse than 0.3ºF (0.16 °C) (unless noted otherwise herein).

c. Sensors shall drift no more than 0.3ºF and shall not require calibration over a five-year period.

d. Manufacturers

1) Mamac

2) Kele Associates

3) Building Automation Products Inc.

4) Automated Logic Corp.

5) Or equal

2. Duct temperature sensors: Shall consist of sensing element, junction box for wiring connections and gasket to prevent air leakage or vibration noise.

a. TS-1A: Single point (use where not specifically called out to be averaging in points list). Sensor probe shall be 304 stainless steel.

b. TS-1B: Averaging. Sensor length shall be at least 1 linear foot for each 2 square feet of face area up to 25 feet maximum. Sensor probe shall be bendable aluminum.

3. Water Temperature Sensors

a. TS-2A: Well mounted immersion sensor, ¼" stainless steel probe, double encapsulated sensor, with enclosure suitable for location.

b. TS-2B: Same as TS-2A except provide extra precision (XP) temperature sensors to meet accuracy specified Paragraph 1.11B.2.

c. All piping immersion sensors shall be in one-piece machined brass or stainless steel wells that allow removal from operating system, with lagging extension equal to insulation thickness where installed in insulated piping. Wells shall be rated for maximum system operating pressure, temperature and fluid velocity. The well shall penetrate the pipe by the lesser of approximately half the pipe diameter or eight inches. The use of direct immersion or strap-on type sensors is not acceptable.

4. Room Sensors

a. Thermostat tags refer to the following:

Type:	Tag	
Distech model	EC-SmartAir	EC-SmartVue
Display	Blank	LCD
Temperature only	TS-3A	TS-3C
With CO_2	TS-3AC	TS-3CC

1) Display

a) Blank: Blank cover (or LCD display with display configured to be shut off and touchpad or keypad disabled)

b) LCD: LCD display of all sensors, temperature setpoint adjustment buttons, and schedule override button

2) CO2 Sensor

a) 400 to 1250 PPM/ ±30PPM or 3% of reading, whichever is greater.

b) The sensor shall include automatic background calibration (ABC) logic to compensate for the aging of the infrared source and shall not require recalibration for a minimum of 5 years, guaranteed. If sensor is found to be out of calibration, supplier shall recalibrate at no additional cost to the Owner within 5 years of purchase date.

c) Meet Title 24 requirements including calibration interval

3) For room sensors connected to terminal box controllers (such as at VAV boxes) that require calibration: Include a USB port or some other means for connection of POT for terminal box calibration. Alternative means of terminal calibration are acceptable provided they result in no cost to Work performed under Section 230593 Testing, Adjusting, and Balancing.

b. See equipment schedules for thermostat type.

5. TS-4: Outdoor Air Sensor

a. Outdoor air sensors shall have a sun shield, utility box, and watertight gasket to prevent water seepage.

G. Pressure Transmitters (PT)

1. PT-1: Water, General Purpose

a. Fast-response stainless steel sensor

b. Two-wire transmitter, 4-20 mA output with zero and span adjustments

c. Accuracy

1) Overall Accuracy (at constant temp) ±0.5% full scale, includes non-linearity, repeatability, and hysteresis

d. Long Term Stability 0.5% FS per year

e. Pressure Limits

1) Rated pressure: see points list

2) Proof pressure = 3x rated pressure

3) Burst pressure = 5x rated pressure

f. Manufacturers

1) Setra 209

2) Kele & Associates P51 Series

3) Or equal

H. Differential Pressure Transmitters (DPT)

1. DPT-1: Water, General Purpose

a. Fast-response capacitance sensor

b. Two-wire transmitter, 4-20 mA output with zero and span adjustments

c. Accuracy

1) Overall Accuracy (at constant temp) ±0.25% full scale (FS).

2) Non-Linearity, BFSL ±0.22% FS.

3) Hysteresis 0.10% FS.

4) Non-Repeatability 0.05% FS.

d. Long Term Stability 0.5% FS per year

e. Only 316 stainless steel in contact with fluid

f. Pressure Limits

1) 0 to 100 psid range: 250 psig maximum static pressure rating, 250 psig maximum overpressure rating.

2) 100 to 300 psid range: 450 psig maximum static pressure rating, 450 psig maximum overpressure rating.

g. Include brass 5-valve assembly for single sensor devices. See Paragraph 3.12E.8.

h. Manufacturers

1) Setra 209 or 230

2) Modus W30

3) Or equal

2. DPT-2: Not used

3. DPT-3: Air, Duct Pressure

a. General: Loop powered two-wire differential capacitance cell-type transmitter.

b. Output: two wire 4-20 mA output with zero adjustment.

c. Overall Accuracy: ±1% of range (not of maximum range/scale)

d. Switch selectable range:

1) ≥ 0.5 inches water column

2) ≤10 inches water column

3) Select range as specified in points list or, if not listed for specified setpoint to be between 25% and 75% full-scale.

e. Housing: Polymer housing suitable for surface mounting.

f. Static Sensing Element: Pitot-type static pressure sensing tips similar to Dwyer model A-301, Davis Instruments, or equal, with connecting tubing.

g. DPT-3A: Include LCD display of reading.

h. DPT-3B: Same as DPT-3 except with stainless steel pitot-type static pressure sensing tips similar to Dwyer model A-301-SS, or equal.

i. Manufacturers.

1) Setra

2) Modus

3) Dwyer

4) Or equal

4. DPT-4: Air, Low Differential Pressure

a. General: Loop powered, two-wire differential capacitance cell type transmitter.

b. Output: Two-wire 4-20 mA output with zero adjustment.

c. Overall Accuracy

1) General: ±1% FS

2) Underfloor: ±0.5% FS

3) Minimum outdoor air damper DP used for minimum outdoor airflow: ±0.25% FS

d. Range

1) Fixed (non-switch selectable)

2) Minimum Range: 0, -0.1, -0.25, -0.5, or -1.0 inches water column

3) Maximum Range: +0.1, 0.25, 0.5, or 1.0 inches water column

4) Range shall be as specified in points list or, if not listed, selected such that specified setpoint is between 25% and 75% full-scale.

e. Housing: Polymer housing suitable for surface mounting

f. Static Sensing Element

1) Ambient sensor: Dwyer A-306 or 420, BAPI ZPS-ACC-10, or equal

2) Space sensor:

a) Wall plate: Kele RPS-W, BAPI ZPS-ACC-01, Dwyer A-417 or 465 or equal

b) Ceiling or wall probe: BAPI ZPS-ACC06, Dwyer A-419A, Veris AA05 or equal

3) Filter or duct pressure sensor: Dwyer A-301 or equal

4) Plenum pressure sensor: Dwyer A-421 or equal

g. Manufacturers

1) Setra 267

2) Modus

3) Air Monitor

4) Paragon

5) Or equal

5. DPT-5: VAV Velocity Pressure

a. General: Loop powered two-wire differential capacitance cell type transmitter.

b. Output: Two-wire, 4-20 mA output with zero adjustment.

c. Flow transducer (including impact of A-to-D conversion) shall be capable of stably controlling to a setpoint of 0.004 inches differential pressure or lower, shall be capable of sensing 0.002 inches differential pressure or lower, and shall have a ±0.001 inches or lower resolution across the entire scale.

d. Calibration software shall use a minimum of two field measured points, minimum and maximum airflow, with curve fitting airflow interpolation in between.

e. Range: 0 to 1 in.w.c.

f. Housing: Polymer housing suitable for surface mounting.

g. Manufacturer

1) Automated Logic or Distech

2) No equal

I. Differential Pressure Switches (DPS)

1. DPS-1: Water: Diaphragm with adjustable setpoint, 2 psig or adjustable differential, and snap-acting Form C contacts rated for the application. 60 psid minimum pressure differential range. 0ºF to 160ºF operating temperature range.

2. DPS-2: Air: Diaphragm with adjustable setpoint and differential and snap acting form C contacts rated for the application. Automatic reset. Provide manufacturer's recommended static pressure sensing tips and connecting tubing.

J. Current Switches (CS-1)

1. Clamp-on or solid-core

2. Range: as required by application

3. Trip Point: Automatic or adjustable

a. Exception: Fixed setpoint (Veris H-600 or equal) may be used on direct drive constant speed fans that do not have backdraft or motorized shutoff dampers.

4. Switch: Solid state, normally open, 1 to 135 Vac or Vdc, 0.3 Amps. Zero off state leakage

5. Lower Frequency Limit: 6 Hz

6. Trip Indication: LED

7. Approvals: UL, CSA

8. May be combined with relay for start/stop

9. Where used for single-phase devices, provide the CS/CR in a self-contained unit in a housing with override switch. Kele RIBX, Veris H500, or equal

10. Manufacturers

a. Veris Industries H-608/708/808/908

b. Senva C-2320L

c. RE Technologies SCS1150A-LED

d. Or equal

K. Flow Meter (FM)

1. FM-1: Magnetic Flow Tube Flow Meters

a. General Requirements

1) Sensor shall be a magnetic flow meter, which utilizes Faraday's Law to measure volumetric fluid flow through a pipe. The flow meter shall consist of 2 elements, the sensor and the electronics. The sensor shall generate a measuring signal proportional to the flow velocity in the pipe. The electronics shall convert this EMF into a standard current output.

2) Electronic replacement shall not affect meter accuracy (electronic units are not matched with specific sensors).

3) Provide a four-wire, externally powered, magnetic type flow transmitter with adjustable span and zero, integrally mounted to flow tube. Output signal shall be a digital pulse proportional to the flow rate (to provide maximum accuracy and to handle abrupt changes in flow). Standard 4-20 mA or 0-10 Vdc outputs may be used on HVAC applications provided accuracy is as specified.

a) On applications where the output is wired to a BTU meter but flow is required also as a direct input to the DDC system, e.g. for minimum flow control loop, provide a secondary analog output for the DDC system.

4) Flow Tube

a) ANSI class 150 psig steel

b) ANSI flanges

c) Lined with

1. Heating hot water, glycol: PTFE, PFA, or ETFE liner rated for ≤-4°F to ≥212ºF fluid temperature

2. Chilled, condenser, domestic hot and cold water: Polypropylene, Ebonite, PTFE, PFA, or ETFE liner rated for ≤32°F to ≥140ºF fluid temperature

5) Electrode and grounding material

a) 316L Stainless steel or Hastelloy C

b) Electrodes shall be fused to ceramic liner and not require O-rings.

6) Electrical Enclosure: NEMA 4

7) Approvals

a) UL or CSA

b) NSF Drinking Water approval for domestic water applications

8) Performance

a) Accuracy shall be:

1. ±0.4% of reading from 3.3 to 33 ft/s

2. ±0.75% of reading from 1.3 to 3.3 ft/s

3. ±0.0075 ft/s at flow rates less than 1 ft/s

b) Stability: 0.1% of rate over six months.

c) Meter repeatability shall be ± 0.1% of rate at velocities > 3 feet per second.

d) Calibration: The sensor must be factory calibrated on an internationally accredited (such as NAMAS) water flow rig with accuracy better than 0.1%. Calibration shall be NIST traceable.

b. Manufacturers

1) Onicon F-3100 series

2) Siemens/Danfoss Magflo 3100

3) Krohne Optiflux 4000

4) Sparling Tigermag EP FM656

5) Or equal

L. Airflow Measuring Stations (AFMS)

1. General. AFMS provided under this Section shall be licensed to bear the AMCA Certified Rating Seal for Airflow Measuring Stations. Ratings shall be based on tests and procedures performed in accordance with AMCA Publication 611 and comply with requirements of the AMCA Certified Ratings Program.

2. AFMS-4

a. Differential pressure type with uniframe DP sensor

1) Provide quantity of DP sensors per manufacturer’s recommendations

b. Station mounted with expanded metal screen

c. Analog outputs for airflow and temperature

d. Manufacturers

1) Air Monitor

a) Transmitter: OAM-II-2121-1BMMM

b) Airflow Measuring System: OAM-II-AFS-(XX)A-111-013 where “XX” varies with the associated opening dimensions.

2) No equal

M. Electric Control Components

1. Limit Switches (LS): Limit switches shall be UL listed, SPDT or DPDT type, with adjustable trim arm. Limit switches shall be as manufactured by Square D, Allen Bradley, or equal.

2. Control Relays: All control relays shall be UL listed, with contacts rated for the application, and mounted in minimum NEMA-1 enclosure for indoor locations, NEMA-4 for outdoor locations.

a. Control relays for use on electrical systems of 120 volts or less shall have, as a minimum, the following:

1) AC coil pull-in voltage range of +10%, -15% or nominal voltage.

2) Coil sealed volt-amperes (VA) not greater than 4 VA.

3) Silver cadmium Form C (SPDT) contacts in a dustproof enclosure, with 8 or 11 pin type plug.

4) Pilot light indication of power-to-coil and coil retainer clips.

b. Relays used for across-the-line control (start/stop) of 120V motors, 1/4 HP, and 1/3 HP, shall be rated to break minimum 10 Amps inductive load.

c. Relays used for stop/start control shall have low voltage coils (30 VAC or less), and shall be provided with transient and surge suppression devices at the controller interface.

3. General Purpose Power Contactors: NEMA ICS 2, AC general-purpose magnetic contactor. ANSI/NEMA ICS 6, NEMA type 1 enclosure. Manufacturer shall be Square D, Cutler-Hammer, or equal.

4. Control Transformers and Power Supplies

a. Control transformers shall be UL Listed. Furnish Class 2 current-limiting type, or furnish over-current protection in both primary and secondary circuits for Class 2 service per NEC requirements. Mount in minimum NEMA-1 enclosure.

b. Transformer shall be proper size for application. Limit connected loads to 80% of rated capacity.

c. DC power supply output shall match output current and voltage requirements. Unit shall be full-wave rectifier type with output ripple of 5.0 mV maximum peak-to-peak. Regulation shall be 1.0% line and load combined, with 100 microsecond response time for 50% load changes. Unit shall have built-in over-voltage and over-current

protection, and shall be able to withstand a 150% current overload for at least 3 seconds without trip-out or failure.

d. Separate power transformer shall be used for controllers and for actuators and other end devices that use half wave rectification.

e. Unit shall operate between 0°C and 50°C [32°F and 120°F]. EM/RF shall meet FCC Class B and VDE 0871 for Class B, and MIL-STD 810C for shock and vibration.

f. Line voltage units shall be UL Recognized and CSA Approved.

5. Electric Push Button Switch: Switch shall be momentary contact, oil tight, push button, with number of N.O. or N.C. contacts as required. Contacts shall be snap-action type, and rated for minimum 120 Vac operation. Switch shall be 800T type, as manufactured by Allen Bradley, Kele, or equal.

6. Pilot Light: Panel-mounted pilot light shall be NEMA ICS 2 oil tight, transformer type, with screw terminals, push-to-test unit, LED type, rated for 120 VAC. Unit shall be 800T type, as manufactured by Allen-Bradley, Kele, or equal.

7. Potentiometer. Wall box mounted single turn with knob numbered 0 to 10 or 0 to 100. Wall plate cover to match electrical.

8. Electric Selector Switch (SS): Switch shall be maintained contact, NEMA ICS 2, oil-tight selector switch with contact arrangement, as required. Contacts shall be rated for minimum 120 Vac operation. Switch shall be 800T type, as manufactured by Allen-Bradley, Kele, or equal.

2.10 CALIBRATION & TESTING INSTRUMENTATION

A. Provide instrumentation required to verify readings, calibrate sensors, and test the system and equipment performance.

B. All equipment used for testing and calibration shall be NIST/NBS traceable and calibrated within the preceding 6-month period. Certificates of calibration shall be submitted.

C. Test equipment used for testing and calibration of field devices shall be at least twice as accurate as respective field device (for example if field device is ±0.5% accurate, test equipment shall be ±0.25% accurate over same range).

2.11 SOFTWARE

A. General

1. System software shall be based on a server/thin-client architecture, designed around the open standards of web technology. Servers shall be accessed using a web browser over the control system Supervisory LAN, the Owner's IT LAN, and remotely over the Internet (through the Owner's IT LAN).

2. The intent of the thin-client architecture is to provide operators complete access to the BAS via a web browser GUI. No special software other than a web browser (including ActiveX components or fat java clients) shall be required to be installed on OIs used to access the BAS graphics, point displays, trends, and trend configuration. Additional software other than a browser may be used to configure or modify the BAS and programming.

3. The interface software shall be certified by the BACnet Testing Laboratory as an Advanced Operator Workstation Software (B-AWS) under ANSI/ASHRAE Standard 135.

4. Furnish and install all software and programming necessary to provide a complete and functioning system as specified. Include all software and programming not specifically itemized in these specifications that is necessary to implement, maintain, operate, and diagnose the system in compliance with these specifications.

5. Software Components: All software components of the BAS system software shall be installed and completed in accordance with the specification. BAS system components shall include:

    1) Server Software, Database and Web Browser Graphical User Interface

    2) System Configuration Utilities for future modifications to the system

    3) Programming language

    4) Direct digital control software

    5) Application Software

B. Licensing

1. Include licensing and hardware keys for all software packages at all workstations (OWSs and POTs) and servers.

2. Within the limitations of the server, provide licenses for any number of users to have web access to the CSS at any given time.

3. All operator interface, programming environment, networking, database management and any other software used by the Contractor to install the system or needed to operate the system to its full capabilities shall be licensed and provided to the Owner.

4. All operator software, including that for programming and configuration, shall be available on all workstations. Hardware and software keys to provide all rights shall be installed on all workstations.

C. Controller Software

1. BC Software Residency: Each BC shall be capable of control and monitoring of all points physically connected to it. All software including the following shall reside and execute at the BC:

    a. Real-Time Operating System software

    b. Real-Time Clock/Calendar and network time synchronization

    c. BC diagnostic software

    d. LAN Communication software/firmware

    e. Direct Digital Control software

    f. Alarm Processing and Buffering software

g. Data Trending, Reporting, and Buffering software

h. I/O (physical and virtual) database

i. Remote Communication software

2. AAC/ASC Software Residency: Each AAC/ASC shall be capable of control and monitoring of all points physically connected to it. As a minimum, software including the following shall reside and execute at the AAC/ASC. Other software to support other required functions of the AAC/ASC may reside at the BC or LAN interface device (specified in Paragraph 2.04A) with the restrictions and exceptions per application provided in Paragraph 2.03D:

   a. Real-Time Operating System software

   b. AAC/ASC diagnostic software

   c. LAN Communication software

   d. Control software applicable to the unit it serves

   e. I/O (physical and virtual) database to support one mode of operation

3. Standalone Capability: BC shall continue to perform all functions independent of a failure in other BC/AAC/ASC or other communication links to other BCs/AACs/ASCs. Trends and runtime totalization shall be retained in memory. Runtime totalization shall be available on all digital input points that monitor electric motor status. Refer also to Paragraph 2.03 for other aspects of standalone functionality.

4. Operating System: Controllers shall include a real-time operating system resident in ROM or EEPROM. This software shall execute independently from any other device in the system. It shall support all specified functions. It shall provide a command prioritization scheme to allow functional override of control functions. Refer also to Paragraph 2.03 for other aspects of the controller's operating system.

5. Network Communications: Each controller shall include software or firmware that supports the networking of CUs on a common communications trunk that forms the respective LAN. Network support shall include the following:

   a. Building Controller/Primary LAN shall be a high-speed network designed and optimized for control system communication. If a Primary LAN communications trunk is severed, BCs shall reconfigure into two separate LANs and continue operations without interruption or Operator intervention.

   b. Controller communication software shall include error detection, correction, and re-transmission to ensure data integrity.

   c. Operator/System communication software shall facilitate communications between other BCs, all subordinate AACs/ASCs, Gateways and LAN Interface Devices or Operator Workstations. Software shall allow point interrogation, adjustment, addition/deletion, and programming while the controller is on line and functioning without disruption to unaffected points. The software architecture shall allow networked controllers to share selected physical and virtual point information throughout the entire system.

6. Diagnostic Software: Controller software shall include diagnostic software that checks memory and communications and reports any malfunctions.

7. Alarm/Messaging Software: Controller software shall support alarm/message processing and buffering software as specified below.

8. Application Programs: CUs shall support and execute application programs specified herein.

9. Updating/Storing Application Data: Site-specific programming residing in volatile memory shall be uploadable/downloadable from an OWS or CSS using BACnet services connected locally, to the Primary LAN, to the Local Supervisory LAN but all must be available. Initiation of an upload or download shall include all of the following methods; Manually, Scheduled, and Automatically upon detection of a loss or change.

10. Power Loss and Restart: System software shall provide for orderly shutdown upon loss of power. Volatile memory shall be retained. Outputs shall go to programmed fail position, which as a default shall be set to their position in unoccupied mode. Equipment restart shall be automatic upon power restoration and shall include a user definable time delay on each piece of equipment to stagger the restart. Loss of power shall be alarmed at operator interface indicating date and time.

11. Time Synchronization: Operators shall be able to set the time and date in any device on the network that supports time-of-day functionality. The operator shall be able to select to set the time and date for an individual device, devices on a single network or all devices simultaneously. Automatic time synchronization shall be provided using BACnet services.

12. Anti-dithering: In order to improve the life expectancy of modulating electronic actuators, software shall limit the number of re-positions. This can be accomplished by providing anti-dithering software, a small deadband for fully proportioning actuators, and by ensuring that floating actuators do not receive control pulses of excessively short duration.

D. Graphical User Interface Software

1. A web browser installed on each OWS, POT, and server (see Paragraph 2.01A) shall serve as the graphical user interface to the BAS. Communication between the web server GUI and BAS server shall be encrypted using 128-bit encryption technology within Secure Socket Layers. Communication protocol shall be Hyper-Text Transfer Protocol.

2. The GUI shall provide a comprehensive user interface. Using a collection of web pages, it shall be constructed to have a look-and-feel like a single application and provide a complete and intuitive mouse/menu driven operator interface. It shall be possible to navigate through the system using a web browser to accomplish all features specified in this section.

3. The GUI shall (as a minimum) provide a Navigation Pane for navigation, and an Action Pane for display of animated graphics, schedules, alarms/events, live graphic programs, active graphic setpoint controls, configuration menus for operator access, reports, and reporting actions for events.

4. Login: Upon launching the web browser and selecting the appropriate domain name or IP address, the operator shall be presented with a login page that will require a login

name and password. Navigation in the system shall be dependent on the operator's role privileges, and geographic area of responsibility. See Security Access below.

5. Navigation Pane

   a. The Navigation Pane shall comprise a Navigation Tree which defines a geographic hierarchy of the BAS system. Navigation through the GUI shall be accomplished by clicking on appropriate level of a navigation tree (consisting of expandable and collapsible tree control like Microsoft's Explorer program) or by selecting dynamic links to other system graphics. Both the navigation tree and action pane defined below shall be displayed simultaneously enabling the operator to select a specific system or equipment and view the corresponding graphic. The navigation tree shall as a minimum provide the following views:

      1) Geographic View shall display a logical geographic hierarchy of the system including: cities, sites, buildings, building systems, floors, equipment and BACnet objects.

      2) Network View shall display the hierarchy of the actual BACnet IP Intranet network. This can include: Systems, Site, Networks, Routers, Half-Routers, Devices, Equipment and all the BACnet Objects in a device.

      3) Groups View shall display Scheduled Groups and custom reports.

      4) Configuration View shall display all the configuration categories (Operators, Schedule, Event, Reporting and Roles).

   b. Alternative interface structures will also be accepted if they provide similar ease of navigation through the system hierarchy.

6. Action Pane: The Action Pane shall provide several functional views for each HVAC or mechanical/electrical subsystem specified. A functional view shall be accessed by clicking on the corresponding buttons:

   a. Graphics: Using animated png or other graphical format suitable for display in a web browser, graphics shall include aerial building/county views, color building floor-plans, equipment drawings, active graphic setpoint controls, web content, and other valid HTML elements. The data on each graphic page shall automatically refresh at least 6 times per minute.

   b. Properties: Shall include graphic controls and text for the following: Locking or overriding BACnet objects, demand strategies, and any other valid data required for setup. Changes made to the properties pages shall require the operator to depress an accept/cancel button.

   c. Schedules: Shall be used to create, modify, edit and view schedules based on the systems geographical hierarchy and in compliance with Paragraph 2.11D.8.

   d. Events: Shall be used to view alarm event information geographically (using the navigation tree), acknowledge events, sort events by category, actions and verify reporting actions.

   e. Trends: Shall be used to display associated trend and historical data, modify colors, date range, axis and scaling.

f. Logic - Live Graphic Programs: Shall be used to display a real-time graphic of the control algorithm for the mechanical/electrical system selected in the navigation tree.

7. Graphics

a. The GUI shall make extensive use of color in the graphic pane to communicate information related to setpoints and comfort. Animated graphics and active setpoint graphic controls shall be used to enhance usability.

b. Graphics tools used to create Web Browser graphics shall be non-proprietary and provided and installed on each OWS.

c. Graphical display shall be 1280 x 1024 pixels or denser, 256 color minimum.

d. Links

1) Graphics shall include hyperlinks which when selected (clicked on with mouse button) launch applications, initiate other graphics, etc.

2) Screen Penetration: Links shall be provided to allow user to navigate graphics logically without having to navigate back to the home graphic. See additional discussion in Paragraph 3.13E.

3) Information Links

a) On each MEP system and subsystem graphic, provide links to display in a new window the information listed below.

1. English-language as-built control sequence associated with the system. See Paragraph 1.10B.

2. O&M and submittal information for the devices on the graphic. See Paragraph 1.10B. This includes links to electronic O&M and submittal information for mechanical equipment supplied under Section 230501 Basic Mechanical Materials and Methods.

b) The display shall identify the target of the link by file name/address.

c) Information shall be displayed in electronic format that is text searchable.

d) Window shall include software tools so that text, model numbers, or point names may be found. Source documents shall be read-only (not be editable) with this software.

e. Point Override Feature

1) Every real output or virtual point displayed on a graphic shall be capable of being overridden by the user (subject to security level access) by mouse point-and-click from the graphic without having to open another program or view.

2) When the point is selected to be commanded

a) Dialog box opens to allow user to override the point (Operator Mode) or release the point (Automatic Mode). Operator Mode will override automatic control of the point from normal control programs.

b) Dialog box shall have buttons (for digital points) or a text box or slide bar (for analog points) to allow user to set the point's value when in operator mode. These are grayed out when in automatic mode.

c) When dialog box is closed, mode and value are sent to controller.

d) Graphic is updated upon next upload scan of the actual point value.

3) A list of points that are currently in an operator mode shall be available through menu selection.

f. Point override status (if a digital point is overridden by the supervised manual override per Paragraph 2.03C or if a point is in operator mode per Paragraph 2.11D.7.e) shall be clearly displayed on graphics for each point, such as by changing color or flag.

g. The color of symbols representing equipment shall be able to change color or become animated based on status of binary point to graphically represent on/off status.

h. On floor plan displays of spaces, temperature shall be graphically displayed by coloring the zone area in accordance with or similar to the following:

1) Red: space temperature above cooling setpoint by 2ºF (adjustable) or more. This condition can be programmed to generate an alarm.

2) Yellow: space temperature between cooling setpoint and 2ºF (adjustable) above setpoint.

3) Green: space temperature between cooling and heating setpoints and space is in occupied mode.

4) Gray: space temperature between cooling and heating setpoints and space is in unoccupied mode.

5) Light blue: space temperature between heating setpoint and 2ºF (adjustable) below setpoint.

6) Dark blue: space temperature below heating setpoint by 2ºF (adjustable) or more. This condition can be programmed to generate an alarm.

8. Graphics Development Package

a. Graphic development and generation software shall be provided to allow the user to add, modify, or delete system graphic displays.

b. Provide capability to store graphic symbols in a symbol directory and incorporate these symbols into graphics.

c. Provide libraries of pre-engineered screens and symbols depicting standard air handling unit components (such as fans, cooling coils, filters, dampers), mechanical system components (such as, pumps, chillers, cooling towers, boilers), complete mechanical subsystems (such as VAV reheat zone) and electrical symbols.

d. The Graphic Development Package shall use a mouse or similar pointing device to allow the user to perform the following:

1) Define symbols

2) Position items on graphic screens

3) Attach physical or virtual points to a graphic

4) Define background screens

5) Define connecting lines and curves

6) Locate, orient and size descriptive text

7) Define and display colors for all elements

8) Establish correlation between symbols or text and associated system points or other displays.

9) Create hot spots or link triggers to other graphic displays or other functions in the software.

e. A single graphic file shall be used for common control applications (such as VAV boxes) so that any updates to the graphic may be done once and automatically applied to all applications. Displayed points shall be automatically populated based on wild card entry of point name in graphic definition.

9. Time and Schedules

a. Provide a time master that is installed and configured to synchronize the clocks of all BACnet devices supporting time synchronization. Synchronization shall be done using Coordinated Universal Time. All trend sample times shall be able to be synchronized. The frequency of time synchronization message transmission shall be selectable by the operator.

b. System shall automatically change time/date for Daylight Savings Time and leap years.

c. An operator (with password access) shall be able to define a Normal, Holiday or Override schedule for an individual piece of equipment or room, or choose to apply a hierarchical schedule to the entire system, site or floor Zone Group. For example, Independence Day Holiday for every level in the system would be created by clicking at the top of the geographic hierarchy defined in the Navigation Tree. No further operator intervention would be required and every control module in the system with would be automatically downloaded with the Independence Day Holiday.

d. All schedules that affect the system/area/equipment highlighted in the Navigation Tree shall be shown in a summary schedule table and graph.

e. Schedules shall comply with the BACnet standard, (Schedule Object, Calendar Object, Weekly Schedule property and Exception Schedule property) and shall allow events to be scheduled based on

1) Types of schedule shall be Normal, Holiday or Override

2) A specific date

3) A range of dates

4) Any combination of Month of Year (1-12, any), Week of Month (1-5, last, any), Day of Week (M-Sun, Any)

5) Wildcard (example, allow combinations like second Tuesday of every month)

f. Schedule Categories: The system shall allow operators to define and edit scheduling categories (different types of systems or occupancy types). The categories shall include: name, description, icon (to display in the hierarchy tree when icon option is selected) and type of value to be scheduled.

g. Schedule Groups: In addition to hierarchical scheduling, operators shall be able to define functional Schedule Groups, comprised of an arbitrary group of areas/rooms/equipment scattered throughout the facility and site. For example, the operator shall be able to define an individual Tenant Group – who may occupy different areas within a building or buildings. Schedules applied to the Tenant Group shall automatically be downloaded to control modules affecting spaces occupied by the Tenant Group.

h. Partial Day Exceptions: Schedule events shall be able to accommodate a time range specified by the operator (example: board meeting from 6 pm to 9 pm overrides Normal schedule for conference room).

i. Schedule Summary Graph: The schedule summary graph shall clearly show Normal versus Holiday versus Override Schedules, and the net operating schedule that results from all contributing schedules. Note: In case of priority conflict between schedules at the different geographic hierarchy, the schedule for the more detailed geographic level shall apply.

j. Schedule Distribution: For reliability and performance, instead of maintaining a single schedule in a field device that writes over the network to notify other devices when a scheduled event occurs, field devices will only keep their part of the schedule locally. The BAS server software shall determine which nodes a hierarchical schedule applies to and will create/modify the necessary schedule objects in each field device as necessary.

10. Events and Alarms

a. Events and alarms associated with a specific system, area, or equipment selected in the Navigation Tree shall be displayed in the Action Pane by selecting an Events View.

b. Events View: Each event shall display an Event Category (using a different icon for each event category), date/time of occurrence, current status, and event report. An operator shall be able to sort events, edit event templates and categories, acknowledge or force a return to normal in the Events View as specified in this section.

c. Event Categories (Alarm Levels): The operator shall be able to create, edit or delete event categories (alarm level). An icon shall be associated with each Event category, enabling the operator to easily sort through multiple events displayed. Alarm levels (per Guideline 36) shall be initially configured by the Contractor as follows:

1) Level 1: Life Safety Message

2) Level 2: Critical Equipment Message

3) Level 3: Urgent Message

4) Level 4: Normal Message

d. BACnet Event Templates: BACnet Event template shall define different types of alarms and their associated properties. As a minimum, properties shall include a reference name, verbose description, severity of event, acknowledgement requirements, high/low limit and out of range information.

e. Event Areas (Actions): Each Event Categories (Alarm Level) shall be configured to specific Event Reporting Actions. For example, it shall be possible for an operator to assign all HVAC Maintenance events on the 1st floor of a building to email the technician responsible for maintenance. The Navigation Tree shall be used to setup Event Areas in the Graphic Pane.

f. Alarm Configuration. Alarms shall require configuration related to criticality (Critical/Not Critical), operator acknowledgement (Requires Acknowledgement/Does Not Require Acknowledgement), and conditions required for an alarm to clear automatically (Requires Acknowledgement of a Return to Normal/ Does Not Require Acknowledgement of a Return to Normal).

g. Event Reporting Actions: Event Reporting Actions specified shall be automatically launched (under certain conditions) after an event is received by the BAS server software. Operators shall be able to define these Reporting Actions using the Navigation Tree and Graphic Pane through the GUI. Reporting Actions shall be as follows:

1) GUI dialog box: Provide visual and optional audible alarm indication. The alarm dialog box shall always become the top dialog box upon receipt of an alarm irrespective of the foreground application.

2) Print: Alarm/Event information shall be printed to the any network accessible printer.

3) Email: Alarm/Event information shall be via email to a POP3 address on the Owner's intranet or through this intranet to the internet.

4) Text: Alarm/Event information shall be sent to phone via SMS services.

5) File Write: The ASCII File write reporting action shall enable the operator to append operator defined alarm information to any alarm through a text file. The alarm information that is written to the file shall be completely definable by the operator. The operator may enter text or attach other data point information (such as AHU discharge temperature and fan condition upon a high room temperature alarm).

6) Write Property: The write property reporting action updates a property value in a hardware module.

7) Run External Program: The Run External Program reporting action launches specified program in response to an event.

h. Event Time/Date Stamp: All events shall be generated at the BAS control module level and comprise the Time/Date Stamp using the standalone control module time and date.

i. Event Configuration: Operators shall be able to define the type of events generated per BACnet object. A network view of the Navigation Tree shall expose all BACnet objects and their respective Event Configuration. Configuration shall include assignment of event, alarm, type of acknowledgement and notification for return to normal or fault status.

j. Event Summary Counter: The view of events in the Graphic Pane shall provide a numeric counter, indicating how many events are active (in alarm), require acknowledgement, and total number of events in the BAS Server database.

k. Event Auto-Deletion: Events that are acknowledged and closed, shall be auto-deleted from the database and archived to a text file after an operator defined period. The file shall be stored in file on the CSS with no limit to quantity or age of alarms, other than limitations of hard disk. The file can be archived to tape and deleted by operator to clear disk space.

l. Data Format. The system shall allow for external systems to access the event instance data. Event data shall be stored and queried in the database in a relational manner. At a minimum, the fields to be stored in the database are

    1) Event Source

    2) Event Generation Time

    3) Acknowledge Required Flag

    4) Delivery Priority

    5) BACnet Event Type

    6) Event Message Text

    7) BACnet Event Parameter

    8) Classification of Event

    9) Event Acknowledgement Time

    10) Return to Normal Time

    11) Operator Comments

    12) Who Acknowledged the Event

m. Event Simulator: The GUI user shall provide an Event Simulator to test assigned Reporting Actions. The operator shall have the option of using current time or scheduling a specific time to generate the Event. Utilizing the Navigation Tree and drop-down menus in the Graphic Pane, the operator shall be able to select the Event Type, Status, Notification, Priority, Message, and whether acknowledgement is required.

11. Trends

    a. Trending and trend analysis capabilities are considered critical to system performance. The system shall be designed to upload and record large amounts of point data without causing network bottlenecks or affecting proper system operation. Data shall be stored on the CSS. The system as a whole shall be designed to comply with the trending capability test defined in Paragraph 3.15I.

    b. Every point, both real and virtual, shall be available for data trending.

    c. Trending software shall be capable of recording point values and time on a user specified regular time step and on a change-of-value (COV) basis (data is recorded when point changes by a specified amount for analog points or by changes of state for binary points), at the user's option. Sampling intervals shall be as small as one second. Each trended point shall have the ability to be trended at a different sampling interval.

    d. Trend data shall be sampled and stored in control panel memory (see Paragraph 2.03). If historical trending is enabled for the BACnet object, trend data shall be uploaded from control panels to the CSS on a user-defined interval, manual command, or automatically when the trend buffer becomes full. There shall be no limit to the amount of trend data stored at the CSS other than hard disk limitations.

    e. Trends shall conform to the BACnet Trend Log Object specification. Trends shall both be displayed and user configurable through the GUI. Trend logs may comprise analog, digital or calculated points simultaneously. A trend log's properties shall be editable using the Navigation Tree and Graphic Pane.

    f. Viewing Trends

        1) Trend data shall be displayed graphically by the GUI. This shall be a capability internal to the workstation software and not a capability resulting from download of trend data on a third-party spreadsheet program unless such transfer is automatic and transparent to the operation and the third-party software is included with the workstation software package.

        2) The software shall be capable of dynamically graphing the trend logged object data by creating two-axis (x, y) graphs that simultaneously display values relative to time for at least eight objects in different colors, even if objects have been trended at different time intervals. Where trended values are COV, software shall automatically fill the trend samples between COV entries. A graph legend shall identify each variable plotted.

        3) Multiple scales shall be possible, one for each object, with range set automatically by the software but capable of being manually adjusted by the operator.

        4) Trend format, displayed points, etc. shall be capable of being saved as a template for future trend displays.

        5) Trends shall be able to dynamically update at operator-defined intervals, including on a 1 second interval for loop tuning.

        6) It shall be possible to zoom-in on a particular section of a trend for more detailed examination and pan through historical data by simply scrolling the mouse.

7) It shall be possible to pick (or float mouse over) any sample on a trend and have the numerical value displayed.

8) The operator shall have the ability to pan through a historical trend and copy the data viewed to the clipboard using standard Windows keystrokes.

g. Trend Data Storage

1) The database shall allow applications to access the data while the database is running. The database shall not require shutting down in order to provide read-write access to the data. Data shall be able to be read from the database without interrupting the continuous storage of trend data being carried by the BAS using SQL queries.

2) Data shall be stored in an SQL compliant database format and shall be available through the Owner's intranet or internet (with appropriate security clearance) without having to disable BAS access to the database.

3) The database shall not be inherently limited in size, e.g. due to software limitations or lack of a correct license. Database size shall be limited only by the size of the provided storage media (hard drive size).

h. Data export. Trends shall be exportable using one or more of the following methods:

1) Option 1: SQL Query

a) Provide the exact syntax to allow extraction of data from the database in 4-column format as shown in Table 1 below.

b) Provide a windows-compatible ODBC driver for the database along with the installation of the database itself.

TrendName	DateTime	TimeZone	DataValue
B8.Plant.CH3.CHWS.Temp.F	2009-06-16 13:01:02	-0800	43.5
B8.Plant.CH3.CHWS.Temp.F	2009-06-16 13:06:06	-0800	45.2
B8.Plant.CH3.CHWS.Temp.F	2009-06-16 13:11:01	-0800	44.3

Table 1: Example of a database presentation

12. Security Access

a. Security access from the GUI to BAS servers shall require a Login Name and Password.

b. Access to different areas of the BAS shall be defined in terms of roles and geographic area of responsibility.

c. Roles shall reflect the actual roles of different types of operators. Roles shall be defined in terms of View, Edit and Function Privileges.

1) View Privileges: Navigation, Network, and Configuration Trees, Operators, Roles and Privileges, Alarm/Event Template and Reporting Action.

2) Edit Privileges: Setpoint, Tuning and Logic, Manual Override, and Point Assignment Parameters.

3) Function Privileges: Alarm/Event Acknowledgement, Control Module Configuration, Memory Download and Upload, Schedules, Schedule Groups, Manual Commands, Print, and Alarm/Event Maintenance.

d. Roles shall be geographically assigned using a similar expandable/collapsible navigation tree. For example, it shall be possible to assign two HVAC Technicians with similar competencies (and the same operator defined HVAC Role) to different areas of the system.

e. Each operator shall automatically be logged off of the system if no keyboard or mouse activity is detected for an adjustable period of time. This auto logoff time shall be set individually per operator.

f. Provide an audit trail of actions taken by any user, including the user name and time. Store in secure file in database format on the CSS. Provide software to view and print audit trail.

13. Report Software

a. Provide software to create standard and custom reports of point status, alarms, etc. Report format, displayed points, time period (daily, weekly, monthly, or annual), etc. shall be capable of being saved as a template for future reports. Reports shall be time and date stamped and shall contain a report title editable by the user.

b. Reports shall be capable of being sent to a printer or export to Word or ASCII format to a file, and shall be capable of being generated automatically based on date and time of day.

c. Standard reports. Prepare the following standard reports, accessible automatically without requiring definition by user.

1) Tenant or department after-hour usage. System must be capable of monitoring tenant override requests and generating a monthly report showing the daily total time in hours that each tenant has requested after-hours HVAC services.

2) Monthly and annual energy usage and cost. See Utility cost calculation in Paragraph 3.13.

3) Alarm events and status.

4) Points in Hand (Operator Override) via Workstation command (including name of operator who made the command) or via supervised HOA switch at output, including date and time.

E. Control Programming Software

1. Points

a. Provide templates customized for point type, to support input of individual point information using standard BACnet Objects, including long-name field.

b. All real and virtual points shall be accessible to any control panel for use in any control sequences regardless of physical location.

2. Programming Language

a. All controllers must be fully user-programmable using a single programming language for all control devices. Use of canned (preprogrammed, burned-in) software is not acceptable.

b. The control programming language must allow virtually any control sequences to be written. Software shall be capable of the sequences specified in Paragraph 3.13 without exception.

c. All custom programs shall be modifiable from Operator Workstations without having to burn chips or locally access the controller. Software shall allow the user to modify and input control sequence software and to download to panels via the control network.

d. The programming language shall support floating point arithmetic using the following operators and functions: +, -, /, x, square root, and x-to-the-y-power, natural log, log, trigonometric functions (sine, cosine, tangent), absolute value, minimum/maximum value from a list of values, and psychrometric parameters (wetbulb, dewpoint, and enthalpy) from temperature and relative humidity.

e. The programming language shall have predefined variables that represent time of day, day of the week, month of the year, and the date. Other predefined variables shall provide elapsed time in seconds, minutes, hours, and days. These elapsed time variables shall be able to be reset by the language so that interval timing functions can stopped and started within a program.

f. The system must be capable of supporting software (virtual) points to be used in control sequences and monitored just as if they were real digital or analog points.

g. Control programming shall employ the BACnet protocols for Standard Command Priorities.

h. A PID (proportional-integral-derivative) algorithm with adjustable gains and anti-windup shall be included as an integral part (subroutine) of the programming language, not requiring special programming or hardware.

i. The programming language shall be graphical. BASIC-like or other line- or block-type programming languages are not acceptable. With the graphical programming language, a sequence of operations shall be created by drag-and-drop assembling on screen of graphic blocks that represent each of the commands or functions necessary to complete a control sequence. Blocks represent common logical control devices such as relays, switches, high signal selectors, PID loops, optimum start, etc. Blocks are then interconnected on screen using graphic “wires,” each forming a logical connection. Once assembled, each logical grouping of graphic blocks and their interconnecting wires then forms a graphic function block which may be used to control any piece of equipment with a similar point configuration and sequence of operation.

j. The graphic programming software shall support a live mode, where all input/output data, calculated data, and setpoints shall be displayed in a real-time mode. For each piece of HVAC equipment, the entire graphic program shall be displayed through the

GUI. The operator must have the ability to scroll through the entire live graphic program as necessary.

3. Debugging Software

   a. Provide a search capability that will search all control sequences for a given point name to determine all sequences that use or control the point.

   b. The control programs shall be capable of being tested on-line or off-line (prior to installation in field panels). The program and results of programming tests shall be displayed graphically using graphical programming language with parameter values displayed in appropriate locations. Simulation capabilities shall include step-by-step, accelerated time, and operator defined simulation criteria like outside weather, demand, and communication status.

F. Miscellaneous Software

1. Provide a context-sensitive, on-line help system to assist the operator in operating and editing the system. On-line help shall be available for all applications and shall provide relevant data for the application or object that help is being called from.

2. Provide software for viewing (but not editing) electronic versions of as-built shop drawings of

   a. Mechanical, electrical, and plumbing systems in Adobe pdf format

3. Automatic Demand Response (ADR) Control Software

   a. Provide certified OpenADR 2.0a or OpenADR 2.0b Virtual End Node (VEN) software, as specified under Clause 11, Conformance, in the applicable OpenADR 2.02 Specification.

   b. The software shall allow OpenADR communication from PG&E's Demand Response Automation Server through the Owner's LAN to the CSS, communicating at least the minimum points shown in Paragraph 2.12C.3.

2.12 CONTROL POINTS

A. Table Column Definitions

1. Point description

2. Type (number in point schedule after each type refers to tag on schematics)

   a. AO: analog output

   b. AI: analog input

   c. DO: digital or binary output

   d. DI: digital or binary input

3. Device description

   a. See Paragraph 2.09 for device definition.

4. Trend Logging

   a. Commissioning: Where listed, point is to be trended at the basis listed for commissioning and performance verification purposes.

   b. Continuous: Where listed, point is to be trended at the basis listed continuously, initiated after system acceptance, for the purpose of future diagnostics.

   c. Trend Basis

      1) Where range of engineering units is listed, trend on a change of value (COV) basis (in other words record time stamp and value when point value changes by engineering unit listed).

      2) Where time interval is listed, trend on a time basis (in other words record time stamp and value at interval listed). All points relating to a specific piece of equipment shall be trended at the same initiation time of day so data can be compared in text format.

5. Calibration

   a. F = factory calibration only is required (no field calibration)

   b. HH = field calibrate with handheld device. See Paragraph 3.15E.6.a.2)

B. Note that points lists below are for each system of like kind. Refer to drawings for quantity of each.

C. Points mapped through gateways and network interfaces

1. Variable speed drives

Description	Type	Device	Trend Logging		Calibration
			Commissioning	Continuous	
Fault reset	DO	Through network	COV	COV	–
On/off status	DI	Through network	COV	COV	–
Fault (critical alarm)	DI	Through network	COV	COV	–
Minor alarm	DI	Through network	COV	COV	–
Fault text	AI	Through network (convert code to plain English text)	COV	COV	–
Alarm text	AI	Through network (convert code to plain English text)	COV	COV	–
Keypad in hand/auto	DI	Through network	COV	COV	–
Minimum frequency setpoint	AO	Through network	±5%	±5%	–
Maximum frequency setpoint	AO	Through network	±5%	±5%	–
Acceleration rate	AO	Through network	±5%	±5%	–
Deceleration rate	AO	Through network	±5%	±5%	–
Actual frequency	AI	Through network	1 min	15 min	–
DC bus voltage	AI	Through network	±10%	±10%	F
AC output voltage	AI	Through network	±10%	±10%	F
Current	AI	Through network	15 min	60 min	F

Description	Type	Device	Trend Logging		Calibration
			Commissioning	Continuous	
VFD temperature	AI	Through network	60 min	60 min	F
Power, kW	AI	Through network	1 min	15 min	F
Energy, MWh	AI	Through network	15 min	60 min	–

2. Air to Water Heat Pumps: Not all points available with all manufacturers. Include points listed from each refrigerant circuit.

Description	Type	Device	Trend Logging		Calibration
			Commissioning	Continuous	
Evap. outlet temperature	AI	Through network	10 min.	10 min.	F
Evap. inlet temperature	AI	Through network	10 min.	10 min.	F
Common Evap. outlet temperature	AI	Through network	10 min.	10 min.	F
Common Evap. inlet temperature	AI	Through network	10 min.	10 min.	F
Recovery outlet temperature	AI	Through network	10 min.	10 min.	F
Recovery inlet temperature	AI	Through network	10 min.	10 min.	F
External air temperature	AI	Through network	10 min.	10 min.	F
Refrigerant gas temperature	AI	Through network	10 min.	10 min.	F
Refrigerant liquid temperature	AI	Through network	10 min.	10 min.	F
System dead zone	AO	Through network	10 min.	10 min.	F
Recovery dead zone	AO	Through network	10 min.	10 min.	
Defrost current Delta LP	AI	Through network	10 min.	10 min.	F
Auto. Differential HP only	AO	Through network	10 min.	10 min.	
Auto. Differential chiller only	AO	Through network	10 min.	10 min.	
Current system setpoint	AI	Through network	10 min.	10 min.	
Total recovery set-point	AO	Through network	10 min.	10 min.	
Total recovery differential	AO	Through network	10 min.	10 min.	
System summer differential	AO	Through network	10 min.	10 min.	
System winter differential	AO	Through network	10 min.	10 min.	
Setpoint summer	AO	Through network	10 min.	10 min.	
Setpoint winter	AO	Through network	10 min.	10 min.	
System On/Off Mode	AO	Through network	10 min.	10 min.	
Recovery On/Off Mode	AO	Through network	10 min.	10 min.	
Summer winter selection	AO	Through network	10 min.	10 min.	
Mode duration minimum time	AO	Through network	10 min.	10 min.	
System active power	AI	Through network	10 min.	10 min.	F
Recovery active power	AI	Through network	10 min.	10 min.	F
Unit state	AI	Through network	10 min.	10 min.	
Total power request	AI	Through network	10 min.	10 min.	
Fan speed	AI	Through network	10 min.	10 min.	
Total power request	AI	Through network	10 min.	10 min.	

Description	Type	Device	Trend Logging		Calibration
			Commissioning	Continuous	
defrost State	AI	Through network	10 min.	10 min.	
Unit On/Off	DI	Through network	COV	COV	
Summer/Winter request	DO	Through network	COV	COV	
Reset alarms	DO	Through network	COV	COV	
System On/Off	DO	Through network	COV	COV	
Recovery On/Off	DO	Through network	COV	COV	
Evaporative pump status	DI	Through network	COV	COV	
Recovery pump status	DI	Through network	COV	COV	
Compressor status	DI	Through network	COV	COV	
Fan status	DI	Through network	COV	COV	
Reversing valve	DI	Through network	COV	COV	
Defrost valve	DI	Through network	COV	COV	
All alarms	DI	Through network	COV	COV	

3. Automated Demand Response

Description	Type	Device	Trend Logging		Calibration
			Commissioning	Continuous	
Demand Response Level	AI	Level 1, 2, or 3 from OpenADR Virtual End Node	±1	±1	–
Minutes until next occurrence of Demand Level 1	AI	From OpenADR Virtual End Node	±1 min	±1 min	–
Minutes until next occurrence of Demand Level 2	AI	From OpenADR Virtual End Node	±1 min	±1 min	–
Minutes until next occurrence of Demand Level 3	AI	From OpenADR Virtual End Node	±1 min	±1 min	–

4. Lighting Controls

a. Global

Description	Type	Device	Trend Logging		Calibration
			Commissioning	Continuous	
Demand Shed 1	DO	Through network	COV	COV	–
Demand Shed 2	DO	Through network	COV	COV	–
Demand Shed 3	DO	Through network	COV	COV	–

b. For each lighting zone

Description	Type	Device	Trend Logging		Calibration
			Commissioning	Continuous	
Light Zone State Enable	DO	Through network	COV	COV	–
Occupancy Sensor State	DI	Through network	COV	COV	–

D. Hardwired Points

1. VAV Box with reheat

Description	Type	Device	Trend Logging		Calibration
			Commissioning	Continuous	
VAV Box Damper Position	AO	Modulating actuator	1 min	15 min	–
HW valve signal	AO	2-way valve (occasional 3-way valve – see equipment schedule)	1 min.	15 min	
Local Override	DI	TS-3x – where applicable (see Paragraph 2.09F).	COV	COV	–
Supply Airflow	AI	DPT-5 connected to box manufacturer supplied flow cross	1 min	15 min	HH (see §230593)
Supply air temperature	AI	TS-1A	1 min	15 min	F
Zone Temperature Setpoint Adjustment	AI	TS-3x – where applicable (see Paragraph 2.09F).	15 min	60 min	F
Zone Temperature	AI	TS-3x (see Paragraph 2.09F)	1 min	15 min	F
Zone CO_2 Concentration	AI	TS-3x (see Paragraph 2.09F)	5 min	15 min	F

2. Fan-powered VAV Box (Parallel or Series) with reheat and variable volume fan

Description	Type	Device	Trend Logging		Calibration
			Commissioning	Continuous	
Start Fan	DO	Dry contact to ECM or auxiliary relay (coordinate with final equipment submittal)	COV	COV	–
VAV Box Damper Position	AO	Modulating actuator	1 min	15 min	–
Fan speed	AO	0-10Vdc to ECM	1 min	15 min	–
HW valve signal	AO	2-way valve (occasional 3-way valve – see equipment schedule)	1 min.	15 min	
Local Override	DI	TS-3x – where applicable (see Paragraph 2.09F).	COV	COV	–
Supply fan status or speed feedback	DI or AI	Feedback from ECM or CT-1 (coordinate with final equipment submittal)	1 min	15 min	–
Supply Airflow	AI	DPT-5 connected to box manufacturer supplied flow cross	1 min	15 min	HH (see §230593)
Supply air temperature	AI	TS-1A	1 min	15 min	F
Zone Temperature Setpoint Adjustment	AI	TS-3x – where applicable (see Paragraph 2.09F).	15 min	60 min	F
Zone Temperature	AI	TS-3x (see Paragraph 2.09F)	1 min	15 min	F
Zone CO_2 Concentration	AI	TS-3x (see Paragraph 2.09F)	5 min	15 min	F
Level 2 Plenum Air Temperature (for series fan powered box FPS-1105 only)	AI	TS-1A	1 min	15 min	F

3. VAV Air Handling Unit and Relief Fan

Description	Type	Device	Trend Logging		Calibration
			Commissioning	Continuous	
Relief Fan Start/Stop	DO	Connect to VFD Run	COV	COV	–
Supply fan high static alarm reset	DO	Dry contact to 120V or 24V control circuit –see control schematics for details	COV	COV	–
Supply Fan Start/Stop	DO	Connect to VFD Run	COV	COV	–
Outdoor Air Damper	AO	Modulating actuator	1 min	15 min	–
Relief Fan Speed	AO	Connect to VFD speed	1 min	15 min	–
Return Air Damper	AO	Modulating actuator	1 min	15 min	–
Supply Fan Speed	AO	Connect to VFD speed	1 min	15 min	–
OA Airflow	AI	AFMS-4	1 min	15 min	F
Mixed Air Temperature	AI	TS-1B across filter bank	1 min	15 min	F
Filter Pressure Drop	AI	DPT-3A, 0 to 1 inch	–	60 min	F
Return Air Temperature	AI	TS-1A	1 min	15 min	F
Supply Air Temperature	AI	TS-1A	1 min	15 min	HH
AHU Outdoor Air Temperature	AI	TS-1A in AHU OA intake	1 min	15 min	F
Building Outdoor Air Temperature	AI	TS-4A on penthouse west wall. See sheet M2.04	1 min	15 min	F
Duct Static Pressure	AI	DPT-3A, 0 to 2 inches	1 min	15 min	F
Building Pressure,	AI	DPT-4, ±0.25 inches with ceiling probe sensor on L1 north	1 min	15 min	F

4. Air-to-Water Heat Pump Plant

Description	Type	Device	Trend Logging		Calibration
			Commissioning	Continuous	
AWHP-1 on/off	DO	Connect to 2-pipe heat pump enable contact on panel	COV	COV	–
AWHP-1 mode	DO	Connect to 2-pipe heat pump heat/cool mode contact on panel	COV	COV	–
AWHR-2 cooling on/off	DO	Connect to 4-pipe heat pump enable contact on panel	COV	COV	–
AWHR-2 heating on/off	DO	Connect to 4-pipe heat pump enable contact on panel	COV	COV	–
Start HWP-1	DO	Connect to motor starter	COV	COV	–
HWP-1 Status	AI	Connect to motor starter	COV	COV	
AWHP-1 changeover valves	DO	2-position 2-way valves, line size, spring return	COV	COV	–
AWHP-2 changeover valves	DO	2-position 2-way valves, line size, spring return	COV	COV	–
Secondary HWST	AI	TS-2A			
Secondary HWRT	AI	TS-2A			
CHWST	AI	TS-2A			
CHWRT	AI	TS-2A			
Secondary HW flow	AI	FM-1	5 min	15 min	F

Description	Type	Device	Trend Logging		Calibration
			Commissioning	Continuous	
HW system gauge pressure	AI	PT-1, 0 to 60 psi (located near expansion tank)	15 min	1 hr	F
CHW system gauge pressure	AI	PT-1, 0 to 60 psi (located near expansion tank)	15 min	1 hr	F

5. Single Speed Fans

Description	Type	Device	Trend Logging		Calibration
			Commissioning	Continuous	
Fan Start/Stop	DO	Dry contact to 120V starter control circuit	COV	COV	–
Fan Status	DI	CS-1 OR CT-1	COV	COV	See 3.12F

PART 3 EXECUTION

3.01 INSTALLATION - GENERAL

A. Install systems and materials in accordance with manufacturer's instructions, roughing-in drawings and details indicated on Drawings.

B. Coordinate Work and Work schedule with other trades prior to construction.

C. Examine areas and conditions under which control systems are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.02 DELIVERY, STORAGE, AND HANDLING

A. Provide factory-shipping cartons for each piece of equipment and control device. Maintain cartons during shipping, storage and handling as required to prevent equipment damage, and to eliminate dirt and moisture from equipment.

B. Store equipment and materials inside and protect from weather.

3.03 IDENTIFICATION

A. General

1. Manufacturers' nameplates and UL or CSA labels to be visible and legible after equipment is installed.

2. Identifiers shall match record documents.

3. All plug-in components shall be labeled such that removal of the component does not remove the label.

B. Wiring and Tubing

1. All wiring and cabling, including that within factory-fabricated panels, shall be labeled at each end within 2 inches of termination with the BAS address or termination number.

2. Permanently label or code each point of field terminal strips to show the instrument or item served.

3. All pneumatic tubing shall be labeled at each end within 2 inches of termination with a descriptive identifier.

C. Equipment and Devices

1. Valve and damper actuators: None required.

2. Sensors: Provide 1 inch x 3 inches x 1/8 inches black micarta or lamacoid labels with engraved white lettering, ¼ inches high. Indicate sensor identifier and function (for example “CHWS Temp”).

3. Panels

a. Provide 2 inches x 5 inches 1/8 inches black micarta or lamacoid labels with engraved white lettering, ½ inches high. Indicate panel identifier and service.

b. Provide permanent tag indicating the electrical panel and circuit number from which panel is powered.

4. Identify room sensors relating to terminal box or valves with indelible marker on sensor hidden by cover.

3.04 CUTTING, CORING, PATCHING AND PAINTING

A. Provide canning for openings in concrete walls and floors and other structural elements prior to their construction.

B. Penetrations through rated walls or floors shall be filled with a listed material to provide a code compliant fire-stop.

C. All damage to and openings in ductwork, piping insulation, and other materials and equipment resulting from Work in this Section shall be properly sealed, repaired, or re-insulated by experienced mechanics of the trade involved. Repair insulation to maintain integrity of insulation and vapor barrier jacket. Use hydraulic insulating cement to fill voids and finish with material matching or compatible with adjacent jacket material.

D. At the completion of Work, all equipment furnished under this Section shall be checked for paint damage, and any factory-finished paint that has been damaged shall be repaired and repainted to original finish.

3.05 CLEANING

A. Clean up all debris resulting from its activities daily. Remove all cartons, containers, crates, and other debris generated by Work in this Section as soon as their contents have been removed. Waste shall be collected and legally disposed of.

B. Materials stored on-site shall be protected from weather and stored in an orderly manner, neatly stacked, or piled in the designated area assigned by the Owner’s Representative.

C. At the completion of work in any area, clean all work and equipment of dust, dirt, and debris.

D. Use only cleaning materials recommended by the manufacturer of the surfaces to be cleaned and on surfaces recommended by the cleaning material manufacturer.

3.06 CONTROLLERS

A. General

1. Install systems and materials in accordance with manufacturer's instructions, specifications roughing-in drawings and details indicated on Drawings.

2. Regardless of application category listed below, each Control Unit shall be capable of performing the specified sequence of operation for the associated equipment. Except as listed below, all physical point data and calculated values required to accomplish the sequence of operation shall reside within the associated CU. Listed below are point data and calculated values that shall be allowed to be obtained from other CUs via LAN.

a. Global points such as outdoor air temperature

b. Requests, such as heat/cool requests, used to request operation or for setpoint reset from zones to systems and systems to plants

c. Modes, such as system modes, used to change operating logic from plants to systems and systems to zones

3. Where associated control functions involve functions from different categories identified below, the requirements for the most restrictive category shall be met.

B. Controller Application Categories

1. Controllers shall comply with the application table below (X under controller type indicates acceptable controller type).

Application Category	**Examples**	**Acceptable Controller**		
		ASC	**AAC**	**BC**
0	Monitoring of variables that are not used in a control loop, sequence logic, or safety, such as status of sump pumps or associated float switches, temperatures in monitored electrical rooms.	X	X	X
1	Constant speed exhaust fans and pumps	X	X	X
2	Fan Coil Units	X		
3	Terminal Units (such as VAV Boxes)	X		
4	Air Handling Units		X (note 1)	X
5	Heat Pump CHW and HW Plant		X (note 1)	X

Notes:
1. Controller may be used only if all control functions and physical I/O associated with a given unit resides in one AAC

2. ASC Installation

    a. ASCs that control equipment located above accessible ceilings shall be mounted on the equipment in an accessible enclosure and shall be rated for plenum use if ceiling attic is used as a return air plenum.

    b. ASCs that control equipment mounted in a mechanical room may either be mounted in or on the equipment, or on the wall of the mechanical room at an adjacent, accessible location.

    c. ASCs that control equipment mounted outside or in occupied spaces shall either be located in the unit or in a proximate mechanical/utility space.

3. AAC and BC Installation

    a. AACs/BCs shall be located in temperature control cabinets constructed per Paragraph 2.08.

3.07 COMMUNICATION DEVICES

A. General

1. Install systems and materials in accordance with manufacturer's instructions, roughing-in drawings and details indicated on Drawings.

2. Provide all interface devices and software to provide an integrated system.

B. LANID and LAN Routers

1. Provide as required

2. Connect networks to both sides of device

3. Thoroughly test to ensure proper operation

4. Interruptions or fault at any point on any Primary Controller LAN shall not interrupt communications between other nodes on the network. If a LAN is severed, two separate networks shall be formed and communications within each network shall continue uninterrupted. The system shall automatically monitor the operation of all network devices and annunciate any device that goes off-line because it is failing to communicate.

C. Gateways and Routers to Equipment Controllers

1. See Paragraph 2.03 for network connection of gateways and routers.

2. Wire to networks on both sides of device.

3. Map across all monitoring and control points listed in Paragraph 2.12C.

4. Thoroughly test each point to ensure that mapping is accurate.

5. Initiate trends of points as indication in Paragraph 2.12C.

D. External Communications

1. Provide an Ethernet second port on the CSS to which the Owner can connect their Owner IT LAN (intranet), by others. Contractor shall coordinate with the Owner's Representative to establish an IP address and communications parameters to assure proper operation. This connection shall also provide access to Internet through Owner's firewall to Internet Services Provider procured by Owner.

E. VIRTUAL BAS SERVER

1. Provide controls using the County of San Mateo Virtual server via the County's IT LAN.

2. Provide virtual server licensing required per section 2.11B.

3. Coordinate with the County's IT provider for additional information and requirements.

3.08 BAS INTERFACE HARDWARE

A. Provide one Control System Server (CSS) in the building manager's office an electrical room 309.

B. Install all hardware and software and configure all devices in accordance with manufacturer's instructions.

C. Provide all licenses, keys, etc. and all documentation and any information required to install, configure, operate, diagnose and maintain the system.

D. Connections

1. CSS

a. Connect to Supervisory LAN

b. Connect to Owner's IT LAN.

E. Backup

1. After completion and acceptance of installation, create a backup of all CSSs and server database and configuration files for permanent record of initial installation on a flash drive. Make three copies, two for Owner and one for Contractor to retain for his records off-site.

2. All other backup configuration shall be by the Owner.

F. Anti-virus and firewall software and installation shall be by the Owner.

3.09 CONTROL AIR TUBING

A. Sensor air tubing shall be sized by the Contractor.

B. All control air piping shall be concealed except in equipment rooms or unfinished areas.

C. Installation methods and materials

1. Concealed and Inaccessible: Use copper tubing or FR plastic in metal raceway. Exception: Room thermostat drops in stud walls in areas with lay-in ceiling may be FR plastic tubing.

2. Concealed and Accessible tubing (including ceiling return air plenums) shall be copper tubing or FR plastic tubing, subject to the following limitations

    a. FR tubing shall be enclosed in metal raceway when required by local code.

    b. Quantity of FR tubing per cubic foot of plenum space shall not exceed manufacturer's published data for Class 1 installation.

3. Exposed to view or damage: Use hard-drawn copper or FR plastic in metal raceway.

    a. Where copper tubing is used, a section 12 inches or less of FR plastic tubing is acceptable at final connection to control device.

D. Mechanically attach tubing to supporting surfaces. Sleeve through concrete surfaces in minimum 1 inch sleeves, extended 6 inches above floors and 1 inch below bottom surface of slabs.

E. Pneumatic tubing shall not be run in raceway containing electrical wiring.

F. Where FR tubing exits the end of raceway or junction box, provide a snap-in nylon bushing. Where pneumatic tubing exits control panels, provide bulkhead fittings. Where copper tubing exits junction boxes or panels, provide bulkhead fittings.

G. All tubing shall be number coded on each end and at each junction for easy identification.

H. All control air piping shall be installed in a neat and workmanlike manner parallel to building lines with adequate support.

I. Piping above suspended ceilings shall be supported from or anchored to structural members or other piping or duct supports. Tubing shall not be supported by or anchored to electrical raceways or ceiling support systems.

J. Brass-barbed fittings shall be used at copper-to-FR tubing junctions. Plastic slipped-over copper tubing is not acceptable.

K. Number-code or color-code tubing, except local individual room control tubing, for future identification and servicing of control system. Code shall be as indicated on approved installation drawings.

3.10 CONTROL POWER

A. Power wiring and wiring connections required for Work in this Section shall be provided under this Section unless specifically indicated on Division 26 Drawings or Specifications. See Paragraph 1.01B.

B. Extend power to all BAS devices, including 120V power to panels, from an acceptable power panel.

1. See Division 26 Electrical Drawings for power locations pre-allocated for BAS system.

2. Where no power source is indicated on drawings, for bid purposes only, assume a dedicated circuit is available within an average of 20 feet of panel location. If this is not the case, request additional cost prior to submission of shop drawings or no additional costs will be reimbursed.

3. Coordinate with Division 26 during shop drawing development for final connection location.

C. General requirements for obtaining power include the following:

1. Electrical service to controls panels and control devices shall be provided by isolated circuits, with no other loads attached to the circuit, clearly marked at its source. The location of the breaker shall be clearly identified in each panel served by it.

2. Obtain power from a source that feeds the equipment being controlled such that both the control component and the equipment are powered from the same panel. Where equipment is powered from a 460V source, obtain power from the electrically most proximate 120V source fed from a common origin.

3. Where control equipment is located inside a new equipment enclosure, coordinate with the equipment manufacturer and feed the control with the same source as the equipment. If the equipment's control transformer is large enough and of the correct voltage to supply the controls, it may be used. If the equipment's control transformer is not large enough or not of the correct voltage to supply the controls, provide separate transformer(s).

4. Where a controller controls multiple systems on varying levels of power reliability (normal, emergency, or interruptible), the controller shall be powered by the highest level of reliability served.

D. Unless transformers are provided with equipment as specified in related Division 23 and 26 equipment Sections, Contractor shall provide transformers for all low voltage control devices including non-powered terminal units such as cooling-only VAV boxes and VAV boxes with hot water reheat. Transformer(s) shall be located in control panels in readily accessible locations such as Electrical Rooms.

E. Power line filtering. Provide transient voltage and surge suppression for all workstations and BCs either internally or as an external component.

3.11 CONTROL AND COMMUNICATION WIRING

A. Control and Signal Wiring

1. Comply with Division 26.

2. Line Voltage Wiring

a. All line-voltage wiring shall meet NEC Class 1 requirements.

b. All Class 1 wiring shall be installed in UL Listed approved raceway per NEC requirements and shall be installed by a licensed electrician.

c. Class 1 wiring shall not be installed in raceway containing pneumatic tubing.

3. Low Voltage Wiring

a. All low-voltage wiring shall meet NEC Class 2 requirements. (Low-voltage power circuits shall be sub-fused when required to meet Class 2 current-limit.)

b. Class 2 wiring shall be installed in UL Listed approved raceway as follows:

1) Where located in unconcealed or inaccessible locations, such as:

   a) Equipment rooms

   b) Exposed to weather

   c) Exposed to occupant view

   d) Inaccessible locations such as concealed shafts and above inaccessible ceilings

2) Class 2 wiring shall not be installed in raceway containing Class 1 wiring.

c. Class 2 wiring need not be installed in raceway as follows:

   1) Where located in concealed and easily accessible locations, such as:

      a) Inside mechanical equipment enclosures and control panels

      b) Above suspended accessible ceilings (e.g. lay-in and spline)

      c) Above suspended drywall ceilings within reach of access panels throughout

      d) In shafts within reach of access panels throughout

      e) Nonrated wall cavities

   2) Wiring shall be UL Listed for the intended application. For example, cables used in floor or ceiling plenums used for air transport shall be UL Listed specifically for that purpose.

   3) Wiring shall be supported from or anchored to structural members neatly tied at 10 foot intervals and at least 1 foot above ceiling tiles and light fixtures. Support or anchoring from straps or rods that support ductwork or piping is also acceptable. Cables shall not be supported by or anchored to ductwork, electrical raceways, piping, or ceilings.

   4) Install wiring in sleeves where it passes through walls and floors. Maintain fire rating at all penetrations.

d. Boxes and panels containing high-voltage wiring and equipment shall not be used for low-voltage wiring except for the purpose of interfacing the two (for example relays and transformers).

4. All wire-to-device connections shall be made at a terminal block or terminal strip. All wire-to-wire connections shall be at a terminal block.

5. All field wiring shall be properly labeled at each end, with self-laminating typed labels indicating device address, for easy reference to the identification schematic. All power wiring shall be neatly labeled to indicate service, voltage, and breaker source.

6. Use coded conductors throughout with different colored conductors.

7. All wiring within enclosures shall be neatly bundled and anchored to permit access and prevent restriction to devices and terminals.

8. Maximum allowable voltage for control wiring shall be 120 V. If only higher voltages are available, the Contractor shall provide step-down transformers.

9. All wiring shall be installed as continuous lengths, with no splices permitted between termination points.

10. Size of raceway and size and type of wire shall be the responsibility of the Contractor, in keeping with the manufacturer's recommendation and NEC requirements.

11. Include one pull string in each raceway 1 inch or larger.

12. Control and status relays are to be located in designated enclosures only. These enclosures include packaged equipment control panel enclosures unless they also contain Class 1 starters.

13. Conceal all raceways, except within mechanical, electrical, or service rooms. Install raceway to maintain a minimum clearance of 6 inches from high-temperature equipment (for example steam pipes or flues).

14. Secure raceways with raceway clamps fastened to the structure and spaced according to code requirements. Raceways and pull boxes may not be hung on flexible duct strap or tie rods. Raceways may not be run on or attached to ductwork.

15. Install insulated bushings on all raceway ends and openings to enclosures. Seal top end of all vertical raceways.

16. Terminate all control or interlock wiring.

17. Maintain updated as-built wiring diagrams with terminations identified at the jobsite.

18. Flexible metal raceways and liquid-tight, flexible metal raceways shall not exceed 3 feet in length and shall be supported at each end. Flexible metal raceway less than ½ inches electrical trade size shall not be used. In areas exposed to moisture liquid-tight, flexible metal raceways shall be used.

19. Raceway must be rigidly installed, adequately supported, properly reamed at both ends, and left clean and free of obstructions. Raceway sections shall be joined with couplings per code. Terminations must be made with fittings at boxes and ends not terminating in boxes shall have bushings installed.

20. Wire digital outputs to either the normally-closed or normally-open contacts of binary output depending on desired action in case of system failure. Unless otherwise indicated herein, wire to the NO contact except the following shall be wired to the NC contact

21. Hardwire Interlocks

    a. The devices referenced in this Section are hardwire interlocked to ensure equipment shutdown occurs even if control systems are down. Do not use software (alone) for these interlocks.

    b. Hardwire device NC contact to air handler fan starter upstream of HOA switch, or to VFD enable contact.

c. Where multiple fans (or BAS DI) are controlled off of one device and the device does not have sufficient contacts, provide a relay at the device to provide the required number of contacts.

d. Provide for the following devices where indicated on Drawings or in Sequences of Operation:

1) Duct smoke detector

2) High discharge static pressure

3) Low mixing plenum pressure

22. Shielded cable shield shall be grounded only at one end. Signal wiring shield shall be grounded at controller end only unless otherwise recommended by the controller manufacturer.

B. Communication Wiring

1. Adhere to the requirements of Paragraph 3.11A in addition to this Paragraph.

2. Communication and signal wiring may be run without conduit in concealed, accessible locations as permitted by Paragraph 3.11A only if noise immunity is ensured. Contractor is fully responsible for noise immunity and rewire in conduit if electrical or RF noise affects performance.

3. All cabling shall be installed in a neat and workmanlike manner. Follow all manufacturers' installation recommendations for all communication cabling.

4. Do not install communication wiring in raceway and enclosures containing Class 1 or other Class 2 wiring.

5. Maximum pulling, tension, and bend radius for cable installation as specified by the cable manufacturer shall not be exceeded during installation.

6. Verify the integrity of the entire network following the cable installation. Use appropriate test measures for each particular cable.

7. All runs of communication wiring shall be unspliced length when that length is commercially available.

8. All communication wiring shall be labeled to indicate origination and destination data.

9. Grounding of coaxial cable shall be in accordance with NEC regulations Article on Communications Circuits, Cable and Protector Grounding.

10. Power-line carrier signal communication or transmission is not acceptable.

3.12 SENSORS AND MISCELLANEOUS FIELD DEVICES

A. Install sensors in accordance with the manufacturer's recommendations.

B. Mount sensors rigidly and adequately for the environment within which the sensor operates.

C. Sensors used as controlled points in control loops shall be hardwired to the controller to which the controlled device is wired and in which the control loop shall reside.

D. Temperature Sensors

1. Room temperature sensors and thermostats shall be installed with back plate firmly secured to the wall framing or drywall anchors.

   a. For sensors mounted in exterior walls or columns, use a back plate insulated with foam and seal all junction box openings with mastic sealant.

   b. For sensors on exposed columns, use Wiremold or equal enclosures that are the smallest required to enclose wiring (e.g. Wiremold 400 BAC or equal) and Wiremold or equal junction boxes that are the narrowest required to enclose the temperature sensor and wiring connections (e.g. Wiremold 2348S/51 or equal). Color or raceway and boxes shall be per the architect; submit for approval prior to installation.

2. All wires attached to sensors shall be air sealed in their raceways or in the wall to stop air transmitted from other areas affecting sensor readings.

3. Averaging sensors shall be installed in a serpentine manner vertically across duct. Each bend shall be supported with a capillary clip. Where located in front of filters (such as mixed air sensors), access for filter removal shall be maintained.

4. Temperature sensors downstream of coils shall be located as far from the coil fins as possible, 6 inches minimum. Temperature sensors upstream of coils shall be a minimum of 6 inches away from the coil fins. No part of the sensor or its support elements or conduit shall be in contact with the coil, coil framing or coil support elements. Discharge temperature sensors on VAV boxes shall be mounted as far from the coil as possible but upstream of the first diffuser with the probe located as near as possible to the center of the duct both vertically and horizontally.

5. All pipe-mounted temperature sensors shall be installed in wells. For small piping, well shall be installed in an elbow into pipe length. Install the sensor in the well with a thermal-conducting grease or mastic. Use a closed-cell insulation patch that is integrated into the pipe insulation system to isolate the top of the well from ambient conditions but allow easy access to the sensor. Install a test plug adjacent to all wells for testing and calibration.

6. Unless otherwise noted on Drawings or Points List, temperature sensors/thermostats, humidity sensors/humidistats, CO_2 sensors, and other room wall mounted sensors shall be installed at same centerline elevation as adjacent electrical switches, 4 feet above the finished floor where there are no adjacent electrical switches, and within ADA limitations.

7. Unless otherwise noted on Drawings or Points List, install outdoor air temperature sensors on north wall where they will not be influenced by building exhaust, exfiltration, or solar insolation. Do not install near intake or exhaust air louvers.

E. Differential Pressure Sensors

1. Supply Duct Static Pressure

   a. Mount transmitter in temperature control panel near or in BAS panel to which it is wired.

b. Low pressure port of the pressure sensor

1) Pipe to either

a) Building pressure (high) signal of the building static pressure transmitter.

b) Open to a conditioned space inside the building

c) Open to the BAS panel in which the DPT is mounted provided the panel is inside the building envelope and not in an air plenum.

c. High-pressure port of the pressure sensor

1) Pipe to the duct using a static pressure tip located as indicated on Drawings; if no location is indicated, locate at end of duct riser or main as far out in the system as possible but upstream of all smoke and fire dampers.

2) Install pressure tips securely fastened with tip facing upstream in accordance with manufacturer's installation instructions.

2. Building Static Pressure

a. Mount transmitter in temperature control panel near or in BAS panel to which it is wired.

b. Low pressure port of the pressure sensor

1) Pipe to the ambient static pressure probe located on the outside and at high point of the building through a high-volume accumulator or otherwise protected from wind fluctuations.

c. High-pressure port of the pressure sensor

1) Pipe to either

a) Behind a BAS temperature sensor cover in an interior zone (provided sensor has openings to allow ambient air to freely flow through it)

b) Wall plate sensor or wall/ceiling probe sensor as scheduled

2) Do not locate near elevators, exterior doors, atria, or (for ceiling sensor applications) near diffusers.

3. Filter Differential Pressure

a. Install static-pressure tips upstream and downstream of filters with tips oriented in direction of flow. If there is a Magnehelic gauge installed by the AHU manufacturer, it may be removed and discarded with its pressure tips used for the DPT provided the DPT has an LCD so it can double as a visual gauge.

b. Mount transmitter on outside of filter housing or filter plenum in an accessible position with LCD display clearly visible. This sensor is used in lieu of an analog gauge and thus must be readily viewable.

4. Minimum Outdoor Air Damper Differential Pressure

a. Install plenum static-pressure sensors upstream and downstream of minimum outdoor air damper in a location where air velocity is minimal.

b. Mount transmitter on inside or outside of economizer plenum (whichever is most accessible while out of weather) in an accessible position with LCD display clearly visible.

5. High/Low Static Pressure Safeties

a. High static

1) Install DPS-2 on side of supply air duct in accessible location.

2) High port shall be open to supply air duct downstream of fan.

3) Reference low port pressure shall be that at DP location.

b. Low static

1) Install DPS-2 inside or outside of mixed air plenum whichever is most accessible.

2) Low port shall be open to mixed air plenum.

3) Reference high port pressure shall be pressure on other side of mixed air plenum with the highest pressure, e.g. ambient pressure for systems with relief fans or non-powered relief, or relief air plenum for systems with return fans.

6. All pressure transducers, other than those controlling VAV boxes, shall be located where accessible for service without use of ladders or special equipment. If required, locate in field device panels and pipe to the equipment monitored or ductwork.

7. The piping to the pressure ports on all pressure transducers (both air and water) shall contain a capped test port located adjacent to the transducer.

8. Piping differential pressure transducers shall have one of the following:

a. Five valve manifold, brass, two valves to allow removal of sensor without disrupting the hydronic system, an equalizing valve to allow the sensor to be zeroed and to prevent sensor from experiencing full static (as opposed to differential) where, and two valves used as air vents that also can be used as test plugs for calibration.

b. For sensors using two separate sensors, install test plugs on each connection for calibration and also used as vents.

F. Current Switches and Current Transformers for Motor Status Monitoring

1. For CTs, create a software binary point for fan status triggered at a setpoint determined below and ~10% deadband.

2. Adjust the setpoint so that it is below minimum operating current and above motor no load current. For fans with motorized discharge dampers, adjust so that fan indicates off if damper is closed while fan is running. For pumps, adjust so that pump indicates off if valve is closed while pump is running.

G. Airflow Measuring Stations: Install per manufacturer's recommendations for unobstructed straight length of duct both upstream and downstream of sensor, except those installations specifically designed for installation in fan inlet. For installations in fan inlets, provide on both inlets of double inlet fans and provide inlet cone adapter as recommended by AFMS manufacturer.

H. Fluid Flow Meters: Install per manufacturer's recommendations for unobstructed straight length of pipe both upstream and downstream of sensor. Commission per the manufacturer's startup and commissioning recommendations. Complete all manufacturer's startup documentation and include this in prefunctional commissioning report.

I. Actuators

1. Type: All actuators shall be electric.

2. Mount and link control damper actuators per manufacturer's instructions.

3. Dampers

a. To compress seals when spring-return actuators are used on normally closed dampers, power actuator to approximately 5° open position, manually close the damper, and then tighten the linkage, or follow manufacturer's instructions to achieve same effect.

b. Check operation of damper-actuator combination to confirm that actuator modulates damper smoothly throughout stroke to both open and closed positions.

c. Provide all mounting hardware and linkages for actuator installation.

4. Control Valves: Install so that actuators, wiring, and tubing connections are accessible for maintenance. Where possible, mount the valve so that the position indicator is visible from the floor or other readily accessible location. However, do not install valves with stem below horizontal or down. The preferred location for the valve and actuator is on lowest point in the valve train assembly for ease of access and inspection. If this is on the coil supply piping, the control valve may be located there even if schematics (and standard practice) show valves located on the coil return piping. This comment applies to both 2−way valves and 3-way valves (which would become diverting valves rather than mixing valves in this location).

3.13 SOFTWARE INSTALLATION

A. System Configuration

1. Thoroughly and completely configure BAS system software, supplemental software, network software etc. on OWS, POTs, and servers.

B. Point Structuring and Naming

1. The intent of this Paragraph is to require a consistent means of naming points across the BAS. The following requirement establishes a standard for naming points and addressing Buildings, Networks, Devices, Instances, etc.

2. Point Summary Table

a. The term “Point” includes all physical I/O points, virtual points, and all application program parameters.

b. With each schematic, provide a Point Summary Table listing

1) Building number and abbreviation

2) System type

3) Equipment type

4) Point suffix

5) Full point name (see Point Naming Convention Paragraph)

6) Point description

7) Ethernet backbone network number

8) Network number

9) Device ID

10) Device MAC address

11) Object ID (object type, instance number)

12) Engineering units

13) Device make and model number; include range of device if model number does not so identify.

14) Device physical location description; include floor and column line intersection to one decimal place (for example line 6.2 and line A.3).

c. Point Summary Table shall be provided in both hard copy and in a relational database electronic format (ODBC-compliant).

d. Coordinate with the Owner’s representative and compile and submit a proposed Point Summary Table for review prior to any object programming or Project startup.

e. The Point Summary Table shall be kept current throughout the duration of the Project by the Contractor as the Master List of all points for the Project. Project closeout documents shall include an up-to-date accurate Point Summary Table. The Contractor shall deliver to the Owner the final Point Summary Table prior to final acceptance of the system. The Point Summary Table shall be used as a reference and guide during the commissioning process.

3. Point Naming Convention

a. All point names shall adhere to the format as established below, unless otherwise agreed to by the Owner. New categories and descriptors may be created with approval of the Owner.

b. Format:

1) Building.Category.System.EquipmentTag.Component.Property.

2) Example: 001.HVAC.Heatplant.B-1.HWS.Temperature

Building	Category	System	Equipment Tag	Component	Property	Typical units
Building number	ELCT	Lighting Plug Generator Misc	(from equipment schedules)	SWITCH PHOTO CB CWS CWR HWS HWR CHWS CHWR OA SA RA EA FLUID	Command Status Light Power Voltage Current ValvePos DamperPos Temperature Humidity Pressure Flow Energy Speed Signal	On/off On/off Footcandles Watts Volts Amps %open %open °F %RH Psig, "H_2O Cfm, gpm Btu %, Hz %
	HVAC	Airhandling Exhaust Plant Misc				
	PLMB	Domwater Misc				
	MISC	Weather				

4. Device Addressing Convention

   a. BACnet network numbers and Device Object IDs shall be unique throughout the network.

   b. All assignment of network numbers and Device Object IDs shall be coordinated with the Owner to ensure there are no duplicate BACnet device instance numbers.

   c. Each Network number shall be unique throughout all facilities and shall be assigned in the following manner: VVVNN, where: VVV = 0-999 for BACnet Vendor ID, NN = 00 - 99 for building network.

   d. Each Device Object Identifier property shall be unique throughout the system and shall be assigned in the following manner: VVVNNDD , where: VVV = number 0 to 999 for BACnet Vendor ID , NN = 00 - 99 for building network, DD = 01-99 for device address on a network.

   e. Coordinate with the Owner or a designated representative to ensure that no duplicate Device Object IDs occur.

   f. Alternative Device ID schemes or cross-project Device ID duplication if allowed shall be approved before Project commencement by the Owner.

5. I/O Point Physical Description

   a. Each point associated with a hardware device shall have its BACnet long-name point description field filled out with:

      1) The device manufacturer and model number. Include range of device if model number does not so identify.

      2) For space sensors, include room number in which sensor is located.

C. Point Parameters

1. Provide the following minimum programming for each analog input

   a. Name

   b. Address

   c. Scanning frequency or COV threshold

   d. Engineering units

   e. Offset calibration and scaling factor for engineering units

   f. High and low value reporting limits (reasonableness values), which shall prevent control logic from using shorted or open circuit values.

   g. Default value to be used when the actual measured value is not reporting. This is required only for points that are transferred across the primary or secondary controlling networks and used in control programs residing in control units other than the one in which the point resides. Events causing the default value to be used shall include failure of the control unit in which the point resides or failure of any network over which the point value is transferred.

2. Provide the following minimum programming for each analog output

   a. Name

   b. Address

   c. Engineering units

   d. Offset calibration and scaling factor for engineering units

   e. Output Range

   f. Default value to be used when the normal controlling value is not reporting.

3. Provide the following minimum programming for each digital input

   a. Name

   b. Address

   c. Engineering units (on/off, open/closed, freeze/normal, etc.)

   d. Debounce time delay

   e. Message and alarm reporting as specified

   f. Reporting of each change of state, and memory storage of the time of the last change of state

   g. Totalization of on-time (for all motorized equipment status points), and accumulated number of off-to-on transitions.

4. Provide the following minimum programming for each digital output

    a. Name

    b. Address

    c. Output updating frequency

    d. Engineering units (on/off, open/closed, freeze/normal, etc.)

    e. Direct or Reverse action selection

    f. Minimum on-time

    g. Minimum off-time

    h. Status association with a DI and failure alarming (as applicable)

    i. Reporting of each change of state, and memory storage of the time of the last change of state.

    j. Totalization of on-time (for all motorized equipment status points), and accumulated number of off-to-on transitions.

    k. Default value to be used when the normal controlling value is not reporting.

D. Site-Specific Application Programming

1. All site specific application programming shall be written in a manner that will ensure programming quality and uniformity. Contractor shall ensure:

    a. Programs are developed by one programmer, or a small group of programmers with rigid programming standards, to ensure a uniform style.

    b. Programs for like functions are identical, to reduce debugging time and to ease maintainability.

    c. Programs are thoroughly debugged before they are installed in the field.

2. Massage and tune application programming for a fully functioning system. It is the Contractor's responsibility to request clarification on sequences of operation that require such clarification.

3. All site-specific programming shall be fully documented and submitted for review and approval

    a. Prior to downloading into the panel (see Submittal Package 2, Paragraph 1.07.)

    b. At the completion of functional performance testing, and

    c. At the end of the warranty period (see Warranty Maintenance, Paragraph 1.14).

4. All programming, graphics and data files must be maintained in a logical system of directories with self-explanatory file names. All files developed for the Project will be the

property of the Owner and shall remain on the workstations/servers at the completion of the Project.

E. Graphic Screens

1. All site specific graphics shall be developed in a manner that will ensure graphic display quality and uniformity among the various systems.

2. Schematics of MEP systems

   a. Schematics shall be 2-D or 3-D and shall be based substantially on the schematics provided on Drawings.

   b. All relevant I/O points and setpoints being controlled or monitored for each piece of equipment shall be displayed with the appropriate engineering units. Include appropriate engineering units for each displayed point value. Verbose names (English language descriptors) shall be included for each point on all graphics; this may be accomplished by the use of a pop-up window accessed by selecting the displayed point with the mouse.

   c. Animation or equipment graphic color changes shall be used to indicate on/off status of mechanical components.

   d. Indicate all adjustable setpoints and setpoint high and low limits (for automatically reset setpoints), on the applicable system schematic graphic or, if space does not allow, on a supplemental linked-setpoint screen.

3. Displays shall show all points relevant to the operation of the system, including setpoints.

4. The current value and point name of every I/O point and setpoint shall be shown on at least one graphic and in its appropriate physical location relative to building and mechanical systems.

5. Show weather conditions (local building outside air temperature and humidity) in the upper left hand corner of every graphic.

6. CAD Files: The contract document drawings will be made available to the Contractor in AutoCAD format upon request for use in developing backgrounds for specified graphic screens, such as floor plans and schematics. However the Owner does not guarantee the suitability of these drawings for the Contractor's purpose.

7. Provide graphics for the following as a minimum

   a. Building homepage: Background shall be a building footprint, approximately to scale, oriented as shown on the architectural Drawings. Include links to each floor and mechanical room/area, and to summary graphics described below.

   b. Each occupied floor plan, to scale

      1) HVAC: Floor plan graphics shall show heating and cooling zones throughout the buildings in a range of colors, which provide a visual display of temperature relative to their respective setpoints. The colors shall be updated dynamically as a zone's actual comfort condition changes. In each zone, provide links to associated terminal equipment.

2) If multiple floor plans are necessary to show all areas, provide a graphic building key plan. Use elevation views or plan views as necessary to graphically indicate the location of all of the larger scale floor plans. Link graphic building key plan to larger scale partial floor plans. Provide links from each larger scale graphic floor plan screen to the building key plan and to each of the other graphic floor plan screens.

3) On the floor plan showing the library located on the level 1 east side, include a dropdown menu for the owner to adjust the method zone temperature feedback for the level 1 library terminal units VR-1111, VR-1112, FPP-1110, and FPP-1113. Include the following zone temperature feedback options:

a) Use the average of the VR-1111, VR-1112, FPP-1110, and FPP-1113 zone temperature readings

b) Use the maximum of the VR-1111, VR-1112, FPP-1110, and FPP-1113 zone temperature readings

c) Use the minimum of the VR-1111, VR-1112, FPP-1110, and FPP-1113 zone temperature readings

d) Use each terminal unit's separate thermostat

e) Use VR-1111's thermostat

f) Use VR-1112's thermostat

g) Use FPP-1110's thermostat

h) Use FPP-1113's thermostat

c. Each equipment floor/area plan: To scale, with links to graphics of all BAS controlled/monitored equipment.

d. Each air handler: Provide link to associated HW and CHW plants where applicable.

e. Each trim & respond reset: Next to the display of the setpoint that is being reset, include a link to page showing all trim & respond points (see Guideline 36) plus the current number of requests, current setpoint, and status indicator point with values "trimming," "responding," or "holding." Include a graph of the setpoint trend for the last 24 hours. Trim & respond points shall be adjustable from the graphic except for the associated device.

f. Each zone terminal

1) See Figure 2: VAV Reheat Zone

2) Include a non-editable graphic (picture) showing the design airflow setpoints from the design drawings adjacent to the editable airflows setpoints. The intent is that the original setpoints be retained over time despite "temporary" adjustments that may be made over the years.

g. Air handling unit: operating mode; on/off status; supply air temperature; supply air temperature setpoint; fan speed; duct static pressure; duct static pressure setpoint; outdoor air and return air damper position; coil valve positions; etc. (all key operating

variables); Cooling CHWST Reset current requests, cumulative %-request-hours, and request Importance Multiplier; cumulative %-request-hours

h. Central plant equipment including chilled water system, hot water system, etc.: The flow path shall change on the diagram (by changing piping line color or width) to show which piping has active flow into each boiler, chiller, tower, etc. as valve positions change.

i. Summary graphics: Provide a single text-based page (or as few as possible) for each of the following summary screens showing key variables listed in columns for all listed equipment. Include hyperlinks to each zone imbedded in the zone tag:

1) Zone Groups

a) Separate zone terminal summary for each Zone Group.

b) See FIGURE 1: ZONE GROUP SUMMARY

j. For all equipment with runtime alarms specified, show on graphic adjacent to equipment the current runtime, alarm setpoint (adjustable), alarm light, date of last runtime counter reset, and alarm reset/acknowledge button which resets the runtime counter.

k. For all controlled points used in control loops, show the setpoint adjacent to the current value of the controlled point.

l. All other BAS controlled/monitored equipment.

m. On all system graphics, include a “note” block that allows users to enter comments relevant to system operation.

n. All equipment shall be identified on the graphic screen by the unit tag as scheduled on the drawings.

F. Alarm Configuration

1. Program alarms and alarm levels per Sequence of Operations.

2. Each programmed alarm shall appear on the alarm log screen and shall be resettable or acknowledged from those screens. Equipment failure alarms shall be displayed on the graphic system schematic screen for the system that the alarm is associated with (for example, fan alarm shall be shown on graphic air handling system schematic screen). For all graphic screens, display values that are in a Level 1 or 2 condition in a red color, Level 3 and higher alarm condition in a blue color, and normal (no alarm) condition in a neutral color (black or white).

3. For initial setup, Contractor shall configure alarms as follows:

	Level 1	**Level 2**	**Level 3**	**Level 4**
Criticality	Critical	Not Critical	Not Critical	Not Critical
Acknowledgement	Required	Required	Not Required	Not Required
Acknowledgement of Return to Normal	Not Required	Not Required	Not Required	Not Required
Email to building engineer(s)	Y	Y	Y	N
SMS text to building engineer(s)	Y	Y	N	N

	Level 1	Level 2	Level 3	Level 4
Pop-up dialog box on OWS	Y	Y	N	N
Remove from alarm log	After Acknowledged	After Acknowledged	After 2 weeks	After 2 weeks

3.14 SEQUENCES OF OPERATION

A. See Section 259000 Building Automation Sequences of Operation.

3.15 SYSTEM COMMISSIONING

A. Sequencing. The following list outlines the general sequence of events for submittals and commissioning:

1. Submit Submittal Package 0 (Qualifications) and receive approval.
2. Submit Submittal Package 1 (Hardware and Shop Drawings) and receive approval.
3. Initiate installation of BAS hardware, devices and wiring.
4. Develop point database and application software.
5. Simulate sequencing and debug programming off-line to the extent practical.
6. Submit Submittal Package 2 (Programming and Graphics) and receive approval.
7. Complete installation of BAS hardware, devices and wiring.
8. Install point database and application software in field panels.
9. Submit Submittal Package 3 (Pre-Functional Test Forms) and receive approval.
10. Perform BAS Pre-functional Tests (start up, calibration and tuning) and submit completed forms as Submittal Package 4 (Pre-Functional Test Report) for approval.
11. Receive BAS Pre-functional Test Report approval and approval to schedule Functional Tests.
12. Field test application programs prior to functional testing.
13. Submit Package 5 (Post-Construction Trend Points List) in format specified for review and approval.
14. Receive approval of successful Trend Log configuration, or reconfigure as required.
15. Prepare and initiate commissioning Trend Logs.
16. Perform and record functional tests and submit Submittal Package 6 (Functional Test Report) for approval.
17. Assist in TAB tests and determining setpoints as specified in Section 230593 Testing, Adjusting and Balancing.
18. Assist in Title 24 Acceptance Testing as specified in Section 230800 Mechanical System Commissioning.

19. Submit Package 7 (Training Materials) and receive approval.

20. Receive BAS Functional Test Report approval and approval to schedule Demonstration Tests.

21. Perform Demonstration Tests to Commissioning Provider and Owner's Representatives and submit Demonstration Test Report.

22. Receive acceptance of Demonstration Tests.

23. Train Owner personnel on BAS operation and maintenance.

24. Substantial Completion

25. Submit Package 8 (Post-Construction Trend Logs) in format specified for review and approval.

26. Receive approval of successful Trend Log tests, or retest as required.

27. Complete all items in Completion Requirements per Paragraph 1.10B.

28. Provide administration level password access to the Owner.

29. Final Acceptance

30. Begin Warranty Period.

31. Prepare and initiate continuous Trend Logs per Paragraph 2.12A.4.

32. Update all software as specified.

33. End of Warranty Period

B. This project shall be performed in 3 construction phases as shown on the floor plans. The building shall be fully commissioned upon completion of each construction phase.

C. Assist Commissioning Provider/Coordinator as specified in Section 019100 Commissioning, including attending commissioning meetings.

D. Coordinate with Work specified in Section 230800 Mechanical Commissioning and Division 26 Electrical Commissioning.

E. Pre-functional tests

1. General

   a. Inspect the installation of all devices. Review the manufacturer's installation instructions and validate that the device is installed in accordance with them.

   b. Verify proper electrical voltages and amperages, and verify that all circuits are free from faults.

   c. Verify integrity/safety of all electrical connections.

   d. Verify that shielded cables are grounded only at one end.

e. Verify that all sensor locations are as indicated on drawings and are away from causes of erratic operation.

2. Test Documentation

a. Prepare forms to document the proper startup of the BAS components.

b. All equipment shall be included on test forms including but not limited to

1) Wiring: End-to-end checkout of all wiring at terminations. Power to all controllers and actuators. Confirmation of emergency power where specified.

2) Digital Outputs: Proper installation, normal position, response to command at CU

3) Digital Inputs: Proper installation, device test, response at CU

4) Analog Outputs: Proper installation of devices, verification of maximum and minimum stroke.

5) Analog Inputs: Proper installation of sensors, calibration

6) Panels: Confirmation of location, power source (electrical circuit used), confirmation of emergency power where specified.

7) Alarms and Safeties: Verification of alarm routing to all specified devices and correct hierarchy. Example: confirm alarm routing to cell phones, email, servers, remote workstations. Confirm that appropriate alarm levels are routed to appropriate devices.

8) Loop Tuning: Document setting of P/I parameters for all loops, chosen setpoints, time delays, loop execution speed.

9) Network Traffic: Document speed of screen generation, alarm and signal propagation in system with all required commissioning trends active.

c. Each form shall have a header or footer where the technician performing the test can indicate his/her name and the date of the test.

d. Submit blank forms for approval in Submittal Package 3.

e. Complete work, document results on forms, and submit for approval as Submittal Package 4 (Pre-Functional Test Report).

3. Digital Outputs

a. Verify that all digital output devices (relays, solenoid valves, two-position actuators and control valves, magnetic starters, etc.) operate properly and that the normal positions are correct.

4. Digital Inputs

a. Adjust setpoints, where applicable.

1) For current switches used as status on fans, adjust current setpoint so that fan status is OFF when fan discharge damper (if present) is fully closed and when belt is broken (temporarily remove belt).

2) For current switches used as status on pumps, adjust current setpoint so that pump status is OFF when pump is dead-headed (temporarily close discharge valve).

3) For differential pressure sensors on pumps and fans, set so that status is on when pump operating with all valves open (out on its curve).

5. Analog Outputs

a. Verify start and span are correct and control action is correct.

b. Check all control valves and automatic dampers to ensure proper action and closure. Make any necessary adjustments to valve stem and damper blade travel.

c. Check all normal positions of fail-safe actuators.

d. For outputs to reset other manufacturer's devices (for example, chiller setpoint) and for feedback from them, calibrate ranges to establish proper parameters.

6. Analog Input Calibration

a. Sensors shall be calibrated as specified on the points list. Calibration methods shall be one of the following:

1) Factory: Calibration by factory, to standard factory specifications. Field calibration is not required.

2) Handheld: Field calibrate using a handheld device with accuracy meeting the requirements of Paragraph 2.10.

b. The calibrating parameters in software (such as slope and intercept) shall be adjusted as required. A calibration log shall be kept and initialed by the technician indicating date and time, sensor and hand-held readings, and calibration constant adjustments and included in the Pre-functional Test Report.

c. Inaccurate sensors must be replaced if calibration is not possible.

7. Alarms and Interlocks

a. A log shall be kept and initialed by the technician indicating date and time, alarm/interlock description, action taken to initiate the alarm/interlock, and resulting action, and included in the Pre-functional Test Report.

b. Check each alarm separately by including an appropriate signal at a value that will trip the alarm.

c. Coordinate with Division 26 to test fire and life safety systems alarm contacts.

d. Interlocks shall be tripped using field contacts to check the logic, as well as to ensure that the fail-safe condition for all actuators is in the proper direction.

e. Interlock actions shall be tested by simulating alarm conditions to check the initiating value of the variable and interlock action.

8. Variable Frequency Drive Minimum Speed

a. Minimum speed for VFD-driven fans and pumps shall be determined in accordance with this Paragraph. Tests shall be done for each piece of equipment, except that for multiple pieces of identical equipment used for identical applications, only one piece of equipment need be tested with results applied to all. Note that for fans and pumps, there is no minimum speed required for motor cooling. Power drops with cube of speed, causing motor losses to be minimal at low speeds.

b. This work shall be done only after fan/pump system is fully installed and operational.

c. Determine minimum speed setpoint as follows:

1) Start the fan or pump.

2) Manually set speed to 6 Hz (10%) unless otherwise indicated in control sequences. For cooling towers with gear boxes, use 20% or whatever minimum speed is recommended by tower manufacturer.

3) Observe fan/pump in field to ensure it is visibly rotating.

a) If not, gradually increase speed until it is.

4) The speed at this point shall be the minimum speed setpoint for this piece of equipment.

5) Record minimum speeds in log and store in software point as indicated in Guideline 36.

9. Tuning

a. Tune all control loops to obtain the fastest stable response without hunting, offset or overshoot. Record tuning parameters and response test results for each control loop in the Pre-functional Test Report. Except from a startup, maximum allowable variance from set point for controlled variables under normal load fluctuations shall be as follows. Within 3 minutes of any upset (for which the system has the capability to respond) in the control loop, tolerances shall be maintained (exceptions noted)

Controlled Variable	Control Accuracy
Duct Pressure	±0.1 inches w.g.
Building and relief plenum	±0.01 inches w.g.
Airflow and water flow	±10%
Space Temperature	±1.5ºF
Chilled Water Temperature	±1ºF
Hot Water Temperature	±3ºF
Duct Temperature	±2ºF
Water Differential Pressure	±1.5 psi
Others	±2 times reported accuracy

10. Interface and Control Panels

a. Ensure devices are properly installed with adequate clearance for maintenance and with clear labels in accordance with the Record Drawings.

b. Ensure that terminations are safe, secure and labeled in accordance with the Record Drawings.

c. Check power supplies for proper voltage ranges and loading.

d. Ensure that wiring and tubing are run in a neat and workman-like manner, either bound or enclosed in trough.

e. Check for adequate signal strength on communication networks.

f. Check for standalone performance of controllers by disconnecting the controller from the LAN. Verify the event is annunciated at Operator Interfaces. Verify that the controlling LAN reconfigures as specified in the event of a LAN disconnection.

g. Ensure that buffered or volatile information is held through power outage.

h. With all system and communications operating normally, sample and record update and annunciation times for critical alarms fed from the panel to the Operator Interface.

i. Check for adequate grounding of all BAS panels and devices.

11. Operator Interfaces

a. Verify that all elements on the graphics are functional and are properly bound to physical devices or virtual points, and that hot links or page jumps are functional and logical.

b. Verify that the alarm logging, paging, emailing etc. are functional and per requirements.

F. Testing, Adjusting, and Balancing (TAB) Coordination

1. Coordinate with Work performed under Section 230593 Testing, Adjusting, and Balancing. Some balancing procedures require the BAS to be operational and require Contractor time and assistance.

2. Calibration Software

a. Software shall be provided free of charge on at least a temporary basis to allow calibration of terminal box airflow controls and other Work specified under Section 230593 Testing, Adjusting, and Balancing.

b. Software shall be provided for installation on POT(s) provided by Others or Contractor shall loan a POT or handheld device with software installed for the duration of Work specified under Section 230593 Testing, Adjusting, and Balancing.

c. Provide sufficient training to those performing Work specified under Section 230593 Testing, Adjusting, and Balancing to allow them to use the software for balancing and airflow calibration purposes. Contractor shall include a single training session for this purpose.

3. Setpoint Determination

    a. Perform pre-functional tests described in Paragraph 3.15E before assisting in setpoint determination.

    b. Coordinate with Work performed under Section 230593 Testing, Adjusting, and Balancing to determine fan and pump differential pressure setpoints, outdoor air damper minimum positions and DP setpoints, etc. as indicated in Section 230593 Testing, Adjusting and Balancing.

G. Functional Tests

1. Test schedule shall be coordinated with the Commissioning Provider, Commissioning Coordinator, and Owner's Representative.

2. Functional tests may be witnessed by Owner's Representative at the Owner's option.

3. All approved Functional Tests shall be conducted by the Contractor with results confirmed and signed by the Contractor's start-up technician.

    a. Seasonal Impacts: It shall be assumed that not all tests will be possible due to weather conditions. Those that are not possible shall be deferred until the next season, performed during the warranty period.

4. Test documentation

    a. Owner's Representatives will prepare functional testing forms after Submittal Package 2 has been reviewed and approved. Tests will be designed to test all sequences in a formal manner with simulations and expected outcomes.

    b. Review tests and recommend changes that will improve ease of testing or avoid possible system damage, etc. and provide to Owner's Representative.

    c. Complete work, document results on forms, and submit for approval as Submittal Package 6 Functional Test Report. Tutorials for using the functional test Excel workbook can be found here.

H. Demonstration Test

1. Demonstration tests consist of a small representative sample of functional tests and systems randomly selected by the Commissioning Provider. Tests will be designed to occur over no longer than 2working days.

2. Schedule the demonstration with the Commissioning Provider and Owner's Representative at least 1 week in advance. Demonstration shall not be scheduled until the Functional Test Report has been approved.

3. The Contractor shall supply all personnel and equipment for the demonstration, including, but not limited to, instruments, ladders, etc. Contractor-supplied personnel shall be those who conducted the Functional tests or who are otherwise competent with and knowledgeable of all project-specific hardware, software, and the HVAC systems.

4. The system will be demonstrated following procedures that are the same or similar to those used in the Pre-Functional and Functional Tests. The Commissioning Provider will supply the test forms at the site at the start of the tests.

5. Demonstration tests may be witnessed by Owner's Representative at the Owner's option.

6. Contractor shall conduct tests as directed by and in the presence of the Commissioning Provider and complete test forms. Commissioning Provider will document the test results as the Demonstration Test Report after tests are complete.

7. Demonstration Tests shall be successfully completed and approved prior to Substantial Completion.

I. Trend Log Tests

1. Trends shall be fully configured to record and store data to the server for the points and at the interval listed in Paragraph 2.11 as follows:

   a. Commissioning: Configure trends prior to functional testing phase. Retain configuration until post-construction commissioning trend review has been completed successfully and accepted by the Owner's representative. Trends shall be deactivated after acceptance.

   b. Continuous: After system acceptance, configure trends for the purpose of long term future diagnostics. Configure trends to overwrite the oldest trends at the longest interval possible without filling the server hard disk beyond 80%.

2. Post-Construction Trend Test

   a. Trend logging shall not commence until Demonstration Tests are successfully completed.

   b. Hardware Points. Contractor shall configure points to trend as indicated in the Commissioning Trend column listed in Paragraph 2.11 points.

   c. Software Points. Include the following in trends of systems and zones whose hardware points are being trended as called for above. Time interval shall be the same as associated hardware point.

      1) All setpoints and limits that are automatically reset, such as supply air temperature and fan static pressure setpoints, plus the points that are driving the reset, such as zone level cooling and static pressure requests

      2) All setpoints that are adjustable by occupants

      3) Outputs of all control loops, other than those driving a single AO point that is already being trended

      4) System mode points (e.g. Warm-up, Occupied, etc.)

      5) Global overrides such as demand shed signals

      6) Calculated performance monitoring points, such as chiller efficiency

   d. Submit for review and approval by the Commissioning Provider a table of points to be trended along with trend intervals or change-of-value a minimum of 14 days prior to trend collection period, as Submittal Package 5.

e. Trends shall be uploaded to the CSS in data format specified in Paragraph 2.11C.1.g.

f. Trend logs of all points indicated above shall be collected for a 3week Trend Period.

g. At the completion of the Trend Period, data shall be reviewed by the Contractor to ensure that the system is operating properly. If so, data shall be submitted to the Owner in an electronic format agreed to by the Owner and Contractor (such as flash drive or via direct access to the CSS via the internet) as Submittal Package 8.

h. Data will be analyzed by the Commissioning Provider.

i. The system shall be accepted only if the trend review indicates proper system operation without malfunction, without alarm caused by control action or device failure, and with smooth and stable control of systems and equipment in conformance with these specifications. If any but very minor glitches are indicated in the trends, steps f to h above shall be repeated for the same Trend Period until there is a complete Trend Period of error free operation.

j. After successfully completing the Post-Construction Trend Tests, the Contractor shall configure all points to trend as indicated in the Continuous Trend column listed in Paragraph 2.11 points list.

J. Remedial Work

1. Repair or replace defective Work, as directed by Owner's Representative in writing, at no additional cost to the Owner.

2. Restore or replace damaged Work due to tests as directed by Owner's Representative in writing, at no additional cost to the Owner.

3. Restore or replace damaged Work of others, due to tests, as directed by Owner's Representative in writing, at no additional cost to the Owner.

4. Remedial Work identified by site reviews, review of submittals, demonstration test, trend reviews, etc. shall be performed to the satisfaction of the Owner's Representative, at no additional cost to the Owner.

5. Contractor shall compensate Owner's Representatives and Commissioning Provider on a time and material basis at standard billing rates for any additional time required to witness additional demonstration tests or to review additional BAS trends beyond the initial tests, at no additional cost to the Owner.

3.16 TRAINING

A. Coordinate schedule and materials with Commissioning Provider.

B. Interim Training

1. Provide minimal training so the operating staff can respond to occupant needs and other operating requirements during start-up and commissioning phase.

C. Formal Training

1. Provide training sessions for personnel indicated in Paragraph 3.16G.

2. Submit training materials as Submittal Package 7.

3. Interim training shall be conducted at the end of phase 1 and at the end of phase 3

4. Formal Training shall be conducted at the end of phase 3 after all commissioning is complete and systems are fully operational.

5. Off-site Primary System Training

    a. Training on basic BAS functions as listed in Paragraph 3.16C.5 shall be given off-site by the primary manufacturer's training staff, either at the factory or at a permanent training facility. Training by Contractor staff is not acceptable.

    b. The appropriate level of training shall be provided for each of the persons listed in Paragraph 3.16G.

    c. The length of each training period will depend on the complexity of the system and the audience, described below. Minimum training shall be 8 hours per trainee, but period shall be longer if required to complete the training tasks described below.

    d. Expenses for transportation to and from the training facility, hotel, and meals shall be provided by the Owner and excluded from the BAS bid. Cost for books, manuals and any other type of training equipment or material shall be included in the BAS bid.

6. On-Site Training

    a. Include on-site training to assist personnel in becoming familiar with site-specific issues, systems, control sequences, etc.

        1) 6 hours for Phase 1

        2) 6 hours for Phase 2

        3) 20 hours for Phase 3

    b. Owner shall be permitted to videotape training sessions.

    c. Training may be in non-contiguous days at the request of the Owner.

7. During the warranty period, provide unlimited telephone support for all trained operators.

D. Operators are divided into three categories and shall receive training including but not limited to the tasks listed.

1. Day-to-day Operators shall be trained to

    a. Proficiently operate the system

    b. Understand control system architecture and configuration

    c. Understand BAS system components

    d. Understand system operation and control sequences

    e. Operate the workstation and peripherals

f. Log on and off the system

g. Access graphics, point reports, and logs

h. Adjust and change system set points, time schedules, and holiday schedules

i. Recognize malfunctions of the system by observation of the printed copy and graphical visual signals

j. Understand and acknowledge alarms

k. Understand system drawings, and Operation and Maintenance manual

l. Understand the Project layout and location of control components

m. Print point and predefined reports

2. Advanced Operators shall be trained to do all items for Day-to-Day operators plus

a. Make and change graphics on the workstation

b. Create, delete, and modify alarms, including annunciation and routing

c. Create, delete, and modify point trend logs, and graph or print these both on an ad-hoc basis and at user-definable time intervals

d. Create, delete, and modify reports

e. Add, remove, and modify system's physical points

f. Create, modify, and delete programming

g. Add control panels

h. Add Operator Workstations

i. Create, delete, and modify system displays — both graphical and otherwise

j. Perform BAS system field checkout procedures

k. Perform BAS controller unit operation and maintenance procedures

l. Perform workstation and peripheral operation and maintenance procedures

m. Perform BAS system diagnostic procedures

n. Configure hardware including PC boards, switches, communication, and I/O points

o. Maintain, calibrate, troubleshoot, diagnose, and repair hardware

p. Adjust, calibrate, and replace system components

q. Maintain software and prepare backups

3. System Managers/Administrators shall be trained to do all items for Day-to-Day operators plus

    a. Maintain software and prepare backups

    b. Create and print custom reports, including tenant billing summaries

    c. Interface with project-specific, third-party operator software

    d. Add new users and understand password security procedures

E. Training materials shall include step-by-step instructions (including illustrations, screen captures, etc.) for how to perform all task identified in Paragraph 3.16C.5 such that a new Operator, who has not attended the training in person and has minimal familiarity with this BAS system, can easily follow the instructions and successfully perform all of the identified tasks. One copy of training material shall be provided per student. An electronic copy of the materials shall be stored on the OWS.

F. The instructor(s) shall be factory-trained instructors experienced in presenting this material.

G. The type and number of personnel and location for training shall include

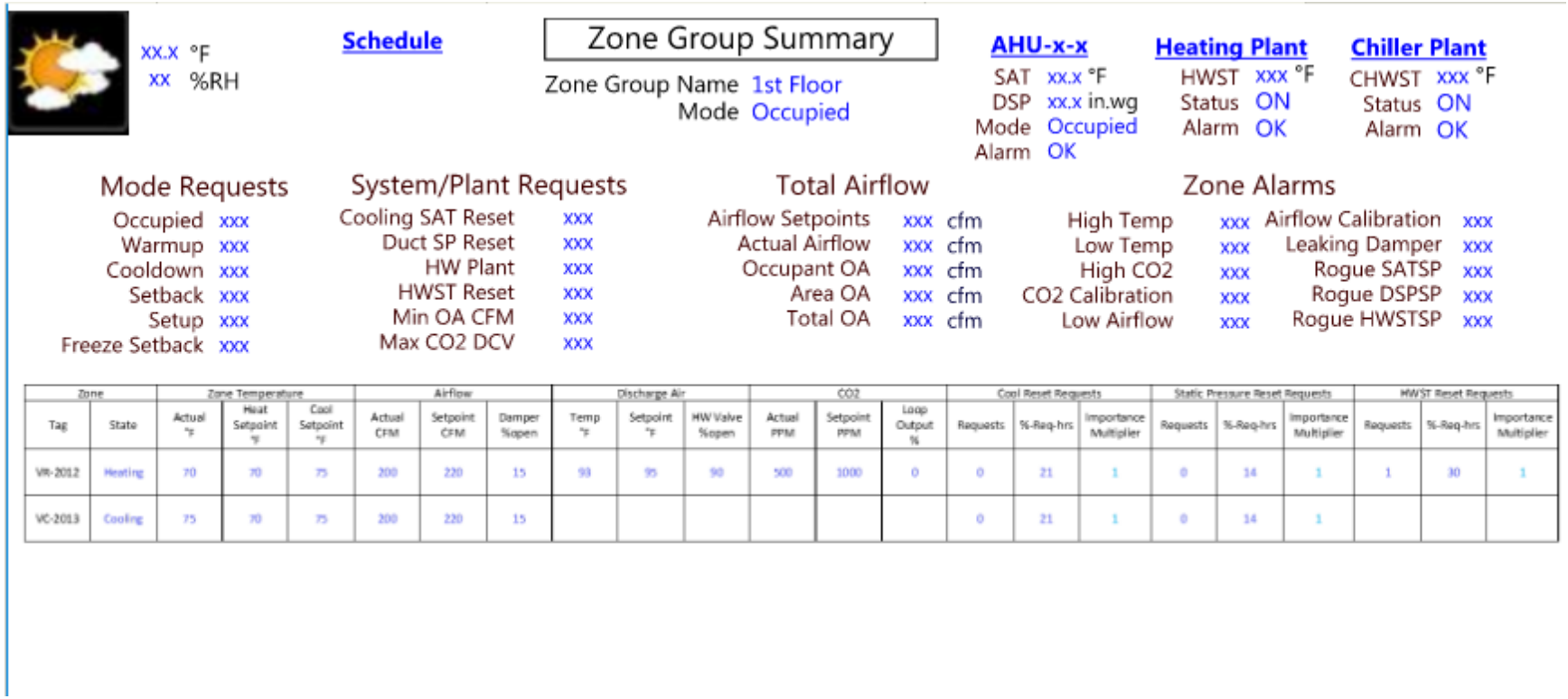
1. Day-to-day Operator: 4

2. Advanced Operator: 3

3. System Managers/Administrators: 2

END OF SECTION 250000

FIGURE 1: ZONE GROUP SUMMARY



xx.x °F
xx %RH

Schedule

Zone Group Summary

Zone Group Name 1st Floor
Mode Occupied

AHU-x-x
SAT xx.x °F
DSP xx.x in.wg
Mode Occupied
Alarm OK

Heating Plant
HWST xxx °F
Status ON
Alarm OK

Chiller Plant
CHWST xxx °F
Status ON
Alarm OK

Mode Requests

Occupied	xxx
Warmup	xxx
Cooldown	xxx
Setback	xxx
Setup	xxx
Freeze Setback	xxx

System/Plant Requests

Cooling SAT Reset	xxx
Duct SP Reset	xxx
HW Plant	xxx
HWST Reset	xxx
Min OA CFM	xxx
Max CO2 DCV	xxx

Total Airflow

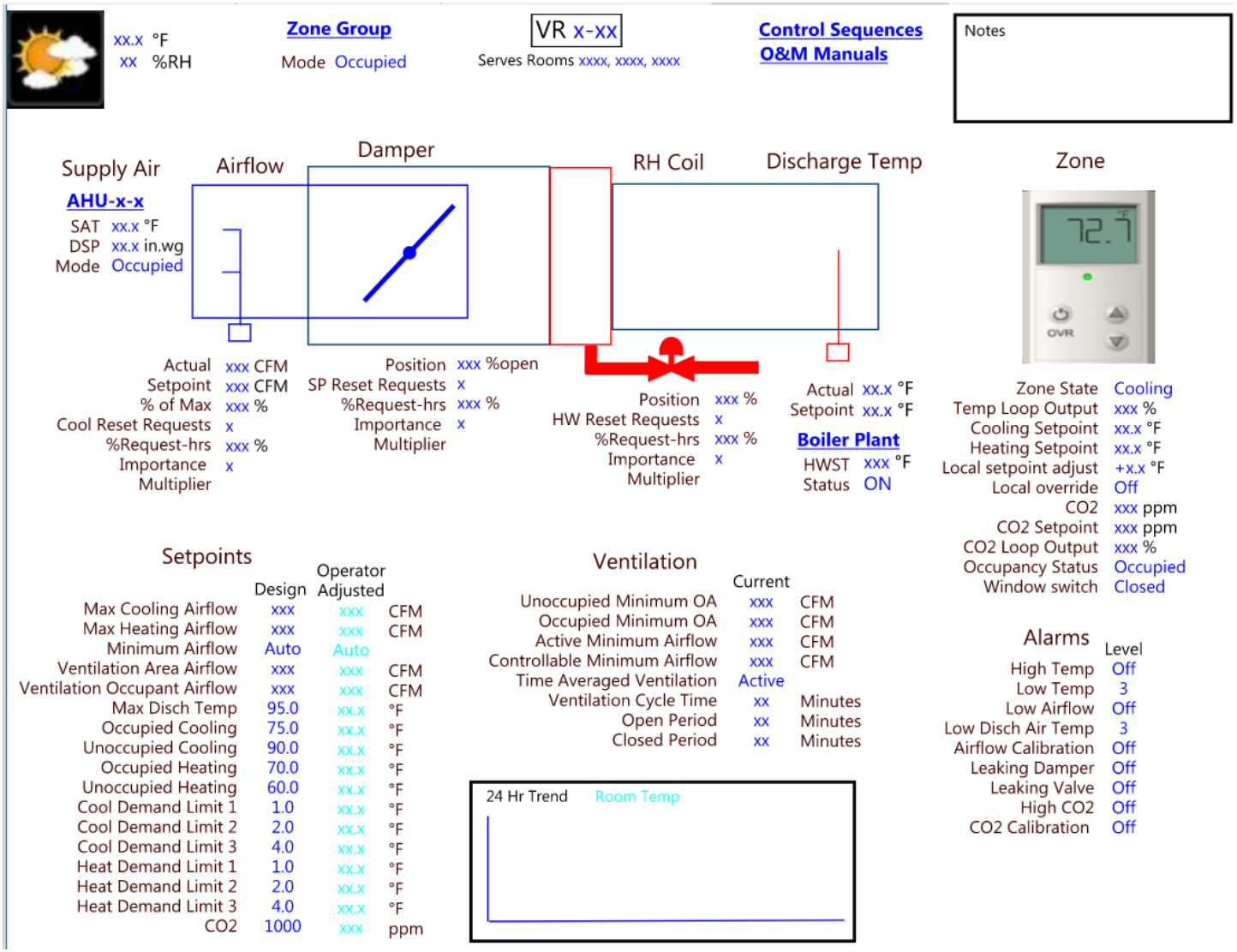
Airflow Setpoints	xxx	cfm
Actual Airflow	xxx	cfm
Occupant OA	xxx	cfm
Area OA	xxx	cfm
Total OA	xxx	cfm

Zone Alarms

High Temp	xxx	Airflow Calibration	xxx
Low Temp	xxx	Leaking Damper	xxx
High CO2	xxx	Rogue SATSP	xxx
CO2 Calibration	xxx	Rogue DSPSP	xxx
Low Airflow	xxx	Rogue HWSTSP	xxx

Zone		Zone Temperature			Airflow			Discharge Air			CO2			Cool Reset Requests			Static Pressure Reset Requests			HWST Reset Requests		
Tag	State	Actual °F	Heat Setpoint °F	Cool Setpoint °F	Actual CFM	Setpoint CFM	Damper %open	Temp °F	Setpoint °F	HW Valve %open	Actual PPM	Setpoint PPM	Loop Output %	Requests	%-Req-hrs	Importance Multiplier	Requests	%-Req-hrs	Importance Multiplier	Requests	%-Req-hrs	Importance Multiplier
VR-2012	Heating	70	70	75	200	220	15	93	95	90	500	1000	0	0	21	1	0	14	1	1	30	1
VC-2013	Cooling	75	70	75	200	220	15							0	21	1	0	14	1			

FIGURE 2: VAV REHEAT ZONE



VAV COOLING-ONLY ZONE

xx.x °F
xx %RH

Zone Group
Mode Occupied

VC x-xx
Serves Rooms xxxx, xxxx, xxxx

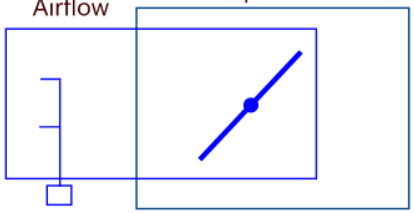
Control Sequences
O&M Manuals

Notes

Supply Air
AHU-x-x
SAT xx.x °F
DSP xx.x in.wg
Mode Occupied

Airflow

Damper



Actual	xxx CFM	Position	xxx %open
Setpoint	xxx CFM	SP Reset Requests	x
% of Max	xxx %	%Request-hrs	xxx %
Cool Reset Requests	x	Importance Multiplier	x
%Request-hrs	xxx %		
Importance Multiplier	x		

Zone

Zone State	Cooling
Temp Loop Output	xxx %
Cooling Setpoint	xx.x °F
Heating Setpoint	xx.x °F
Local setpoint adjust	+x.x °F
Local override	Off
CO2	xxx ppm
CO2 Setpoint	xxx ppm
CO2 Loop Output	xxx %
Occupancy Status	Occupied
Window switch	Closed

Setpoints

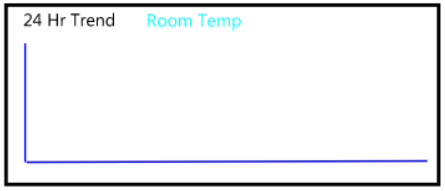
	Design	Operator Adjusted	
Max Cooling Airflow	xxx	xxx	CFM
Minimum Airflow	Auto	Auto	
Ventilation Area Airflow	xxx	xxx	CFM
Ventilation Occupant Airflow	xxx	xx.x	CFM
Occupied Cooling	75.0	xx.x	°F
Unoccupied Cooling	90.0	xx.x	°F
Occupied Heating	70.0	xx.x	°F
Unoccupied Heating	60.0	xx.x	°F
Cool Demand Limit 1	1.0	xx.x	°F
Cool Demand Limit 2	2.0	xx.x	°F
Cool Demand Limit 3	4.0	xx.x	°F
Heat Demand Limit 1	1.0	xx.x	°F
Heat Demand Limit 2	2.0	xx.x	°F
Heat Demand Limit 3	4.0	xx.x	°F
CO2	1000	xxx	ppm

Ventilation

	Current	
Unoccupied Minimum OA	xxx	CFM
Occupied Minimum OA	xxx	CFM
Active Minimum Airflow	xxx	CFM
Controllable Minimum Airflow	xxx	CFM
Time Averaged Ventilation	Active	
Ventilation Cycle Time	xx	Minutes
Open Period	xx	Minutes
Closed Period	xx	Minutes

Alarms

	Level
Low Airflow	Off
Airflow Calibration	Off
Leaking Damper	Off
High CO2	Off
CO2 Calibration	Off



SPECIFICATION 259000
BUILDING AUTOMATION SEQUENCES OF OPERATION

PART 1 GENERAL

1.01 SUMMARY

A. Program and commission the Building Automation System (BAS) to execute the Sequences of Operation specified herein.

B. See Section 250000 Building Automation Systems for general requirements.

C. Sequences herein reference ASHRAE Guideline 36, which refers to the latest 2021 version plus published addenda, possibly followed by exceptions or additions where indicated. Guideline 36 sequences are not repeated herein for brevity and to make exceptions/revisions very clear. However, the final as-built sequences of operation shall include all installed sequences verbatim from Guideline 36; see Section 250000 Building Automation Systems.

PART 2 PRODUCTS

2.01 NOT USED

PART 3 EXECUTION

3.01 GENERAL

A. Fully comply with ASHRAE Guideline 36 Section 5.1 General.

B. Contractor shall review sequences prior to programming and suggest modifications where required to achieve the design intent. Contractor may also suggest modifications to improve performance and stability or to simplify or reorganize logic in a manner that provides equal or better performance. Proposed changes in sequences shall be included as a part of Submittal Package 2.

C. Include costs for minor program modifications if required to provide proper performance of the system.

D. Minimum speed setpoints for all VFD-driven equipment shall be determined in accordance with Section 250000 Building Automation Systems.

E. Equipment Staging and Rotation

1. Fully comply with ASHRAE Guideline 36 Addendum r.

F. Occupancy Status

1. Occupancy status of all spaces shall be via the Lighting Control BACnet interface.

2. Where a zone serves more than one room, “unoccupied” (or “unpopulated” per Guideline 36 terminology) means all rooms are unoccupied and “occupied” (populated) means any room is occupied.

3. In case of the network connection with the Lighting Controls is lost:

G. VAV Box Controllable Minimum

1. This section is used to determine the lowest possible VAV box airflow setpoint (other than zero) allowed by the controls (*Vm*) used in VAV box control sequences. The minimums shall be stored as software points that may be adjusted by the user but need not be adjustable via the graphical user interface.

2. Option 1: If the VAV box controller can control to 0.004" per Section 250000 Building Automation Systems, the minimum setpoint *Vm* shall be determined from the table below if the VAV box manufacturer is listed:

Inlet	Titus	Krueger	Price	MetalAire High Gain	ETI
4	15	15	20	15	15
6	30	35	30	30	30
8	55	60	55	50	55
10	90	90	95	85	90
12	120	130	135	110	130
14	190	175	195	155	180
16	245	230	260	210	235
24x16	455	445	490	N/A	415

3. Option 2: The minimum setpoint *Vm* shall be determined per Guideline 36.

H. Pandemic Mode

1. Provide a software switch on the Home Page graphic for Pandemic Mode on/off. The switch shall include a timer that can be manually set by the operator for a period of up to 60 weeks, after which the Mode shall be shut off.

2. When the Pandemic Mode timer is on:

a. All CO2 DCV setpoints shall be set to 800 ppm.

b. Occupancy sensors used for Occupied Standby logic shall be not reset zone ventilation rates; with respect to ventilation, the zone shall be considered "populated".

c. All Zone Group time schedules shall indicate Occupied Mode one hour prior to the scheduled time. This earlier time shall be reflected in optimum start logic.

I. Wildfire Mode

1. Provide a software switch on the Home Page graphic for Wildfire Mode on/off. The switch shall include a timer that can be manually set by the operator for a period of up to 4 weeks, after which the Mode shall be shut off.

2. When the Wildfire Mode timer is on:

a. Disable all economizers (lock High Limit to off).

3.02 ELECTRICITY DEMAND LIMITING

A. Demand Response

1. On home page, provide three software switches: Demand Limit Level 1 to 3.

a. These switches shall have AUTO, ON, and OFF positions. AUTO position shall set the Demand Limit Level's status to enabled or disabled based on an OpenADR 2.0 signal from the utility (see Section 250000 Building Automation Systems); ON shall manually enable the Demand Limit Level; and OFF shall disable and lockout the Demand Limit Level.

b. The Highest Demand Limit Level signal currently enabled, either via an ON or AUTO command, shall be given priority.

c. These signals are used at the zone level (see Zone Control sequences) to adjust setpoints to reduce demand.

2. Include Demand Shed commands to the lighting control system via BACnet interface for each Demand Level. The response to each Demand Shed command shall be programmed into the lighting control system under Division 26.

3. When any Demand Limit Level is on, generate a Level 4 alarm.

B. Owner-Initiated Electricity Demand Limiting

1. Demand Levels: Demand time periods shall be set up as per utility rate schedule. For each On/Off/Partial-Peak period, three demand kW thresholds can be defined and mapped to the Demand Limit Levels, 1 to 3. When the measured demand exceeds a threshold, and the software switch described above for the associated Demand Limit Level is set to AUTO, the Demand Limit Level shall be enabled; when demand is more than 10% (adjustable) below the limit for a minimum of 15 minutes, or the time is no longer within the On/Off/Partial-Peak window, the Demand Limit Level command shall be disabled.

3.03 ZONES

A. Fully comply with ASHRAE Guideline 36 Section 5.2 Generic Ventilation Zones.

1. Use Title 24 for ventilation logic.

a. Add the following to 5.2.1.4.2

1) c. If no value or if "AUTO" is entered in VAV box schedules for Occupied Minimum Airflow Setpoint (Vmin), Vmin shall be set equal Zone-Abs-OA-min

2. Fully implement Time Averaged Ventilation (TAV) 5.2.2 and use it when VAV minimum, Vmin*, is below the lowest allowed by the controls (*Vm*).

B. Fully comply with ASHRAE Guideline 36 Section 5.3 Generic Thermal Zones.

1. Default setpoints:

Zone type	Occupied		Unoccupied	
	Heat	Cool	Heat	Cool
VAV exterior	70ºF	75ºF	60ºF	90ºF
VAV interior	70ºF	73ºF	60ºF	90ºF
Electrical and mechanical	60ºF	85ºF	60ºF	85ºF

3.04 ZONE GROUPS

A. Fully comply with ASHRAE Guideline 36 Section 5.4 Zone Groups.

B. The outside air temperature used for warm-up mode Section 5.4.6.2 shall be the output of the building outside air temperature sensor.

C. Unless otherwise specified by Owner, the following Zone Groups shall be created:

Zone Group Name	Terminal Unit Tags	Default Schedule
Level 1	VR-1101 to VR-1117	WD: 6am to 8pm SAT: 8am to 5pm SUN: off HOL: off
Level 2	VR-1201 to FPP-1229	WD: 6am to 6pm SAT: off SUN: off HOL: off
Level 3	VR-1301 to VR-1332	WD: 6am to 6pm SAT: off SUN: off HOL: off

3.05 VAV REHEAT BOXES

A. Fully comply with ASHRAE Guideline 36 Section 5.6. except as otherwise noted below.

B. Parameters

1. Design Information (see VAV Box schedule):

a. Vcool-max, zone maximum cooling airflow setpoint

b. Vmin, zone occupied minimum airflow setpoint (optional; If Vmin airflow setpoint is not entered in schedules, Vmin will be dynamically calculated using Paragraph 3.03A.1.a.)

c. Vheat-max, zone maximum heating airflow setpoint

d. Vocc-min, zone minimum outdoor airflow for occupants, per Title 24 prescribed airflow-per-occupant requirements

e. Varea-min, zone minimum outdoor airflow for building area, per Title 24 prescribed airflow-per-area requirements

f. If occupied standby is allowed by Title 24

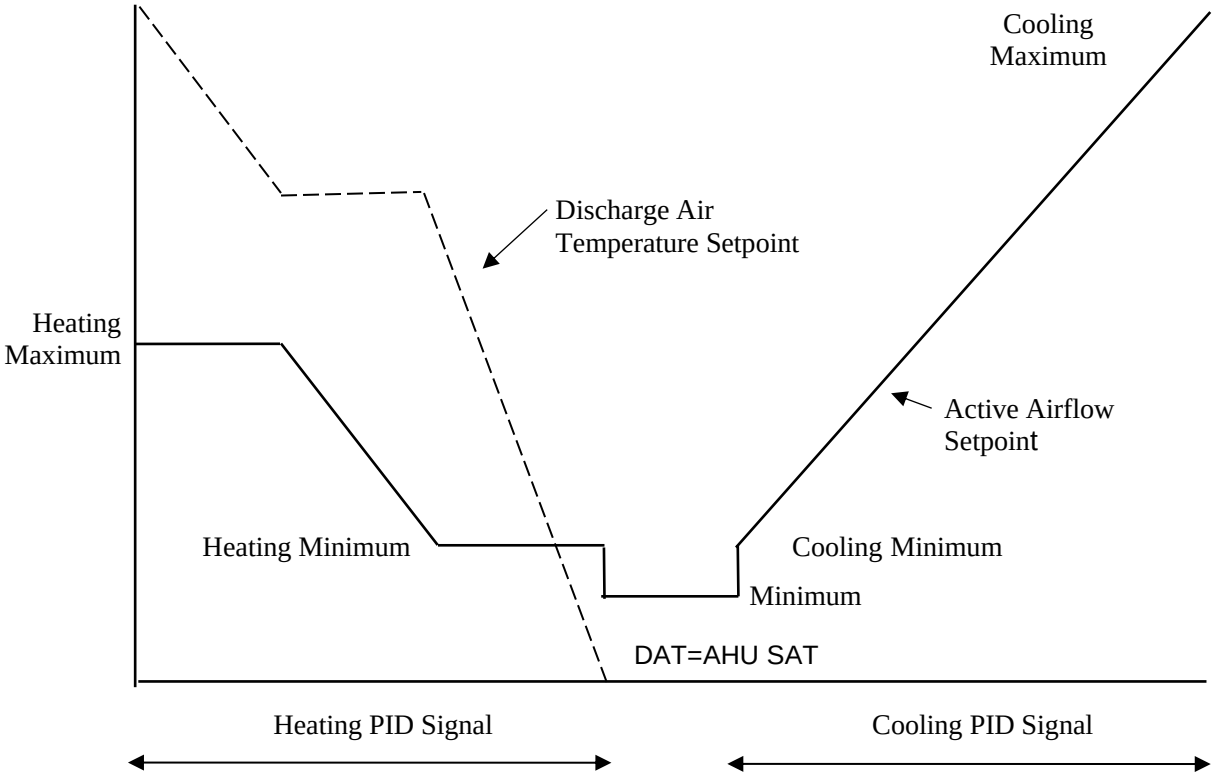
2. Set the following:

a. Zone maximum discharge air temperature above heating setpoint (MaxΔT) = 25°F

b. The heating minimum airflow setpoint (Vheat-min) = 0

C. Add or modify the following sections:

1. Replace Figure 5.6.5 with the following:



2. Replace 5.6.5.3 item a. and b. with the following and renumber the subsections accordingly:

a. From 0 to 33%, the Heating Loop output shall reset the discharge air temperature DAT from the current AHU SAT setpoint to a setpoint equal to MaxΔT above space temperature setpoint. The airflow setpoint shall be the Heating Minimum.
b. From 33% to 66%, if the DAT is greater than the room temperature plus 5ºF, the Heating Loop output shall reset the zone airflow setpoint from the Heating Minimum to the Heating Maximum endpoint.
c. From 66% to 100%, the Heating Loop output shall reset the DAT setpoint to 115°F.

3.06 PARALLEL FAN-POWERED TERMINAL UNIT, VARIABLE VOLUME FAN

A. Fully comply with ASHRAE Guideline 36 Section 5.8 unless otherwise noted.

B. Parameters

1. Design Information (see VAV Box schedule):

a. Vcool-max, zone maximum cooling airflow setpoint

b. Vmin, zone occupied minimum airflow setpoint (optional; If Vmin airflow setpoint is not entered in schedules, Vmin will be dynamically calculated using Paragraph 3.03A.1.a.)

c. Pfan-htgmax, parallel fan maximum heating airflow setpoint

d. Vocc-min, zone minimum outdoor airflow for occupants, per Title 24 prescribed airflow-per-occupant requirements

e. Varea-min, zone minimum outdoor airflow for building area, per Title 24 prescribed airflow-per-area requirements

f. If occupied standby is allowed by Title 24

2. Set the following:

a. Zone maximum discharge air temperature above heating setpoint (MaxΔT) = 25°F

3. Replace Low-Discharge Air Temperature Alarms sections 5.8.6.2a and 5.8.6.2b with the following:

a. If heating hot-water plant is proven ON, and the DAT is 15°F less than the design leaving air temperature (LAT) shown on the HVAC schedules, generate a Level 3 alarm.

3.07 AIR HANDLING UNIT SYSTEM MODES:

A. Fully comply with ASHRAE Guideline 36 Section 5.15 unless otherwise noted.

3.08 MULTIPLE ZONE VAV AIR HANDLING UNIT

A. Fully comply with ASHRAE Guideline 36 Section 5.16 unless otherwise noted.

B. Parameters

1. Design Information:

a. Air Handling Unit is configured as follows

1) No heating coil

2) No CHW control valve

3) One common damper and airflow measuring station for outdoor air

4) One relief fan

b. Temperature Setpoints

1) Min_ClgSAT, lowest cooling supply air temperature setpoint: 55°F.

2) Max_ClgSAT, highest cooling supply air temperature setpoint: 65°F.

3) OAT_Min, the lower value of the OAT reset range: 50°F.

4) OAT_Max, the higher value of the OAT reset range: 70°F.

c. Ventilation Setpoints

1) AbsMinOA: the design outdoor airflow rate when all zones with CO2 sensors or occupancy sensors are unpopulated: per AHU schedule

2) DesMinOA: the design minimum outdoor airflow with areas served by the system are occupied at their design population: per AHU schedule

d. Economizer High Limit: Paragraph 3.1.4.3.2 (California Title 24 economizer high limit requirements)

1) California Climate Zone: 3

2) High limit option: Fixed Dry Bulb + Differential Dry Bulb

3) The outdoor air temperature sensor located in the AHU outdoor air plenum shall be used for AHU operation.

2. TAB Information

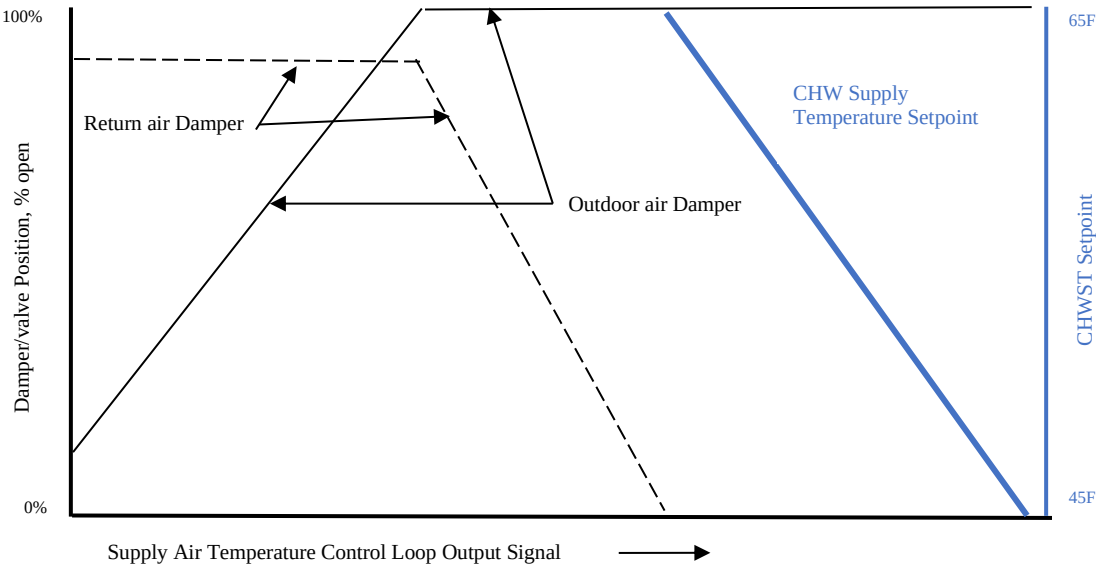
a. Duct design maximum static pressure, Max_DSP to be determined by Section 230593 Testing, Adjusting and Balancing.

b. Minimum Fan Speed: Per Section 250000 Building Automation Systems.

C. Use the following options/revisions:

1. Supply Air Temperature Control: Per Section 5.16.2.3 as modified as follows:

a. Modify figure 5.16.2.3-1 SAT Loop Mapping with the following:



2. Minimum outdoor air setpoint and control: Per Section 5.15.3.2 to comply with Title 24

3. Minimum Outdoor Air Control: Option per AHU design with a single common outdoor air damper air per Section 5.16.6.1; see schedules and control schematics.

4. Relief Fan Control. Section 5.16.9 modified as follows:

   a. There is only one relief fan. Fan staging per Section 5.16.9.7 is not applicable

   b. Relief fans or VFD Fan groups shall be lead/lag controlled per Paragraph 3.01E.

5. Replace Plant Requests Section 5.16.16 with the following:

   a. If the SAT control loop is greater than 95% (adjustable) send 1 Chiller Plant Request

   b. If the SAT control loop is less than 60% (adjustable) send 0 Chiller Plant Requests

3.09 2-PIPE AND 4-PIPE AIR-COOLED CHILLED WATER PLANT

A. Cooling Parameters:

1. Temperature Setpoints

   a. CHWSTmin, the lowest chilled water supply temperature setpoint = 45°F

   b. CH-LOT, the outdoor air lockout temperature below which the chiller plant is prevented from operating = 60°F (adjustable).

2. Cooling Capacity

   a. QCdesign, design plant capacity in tons = 120 tons

   b. QCchiller, design capacity in tons for each chiller:

1) Q1 = 60 tons

2) Q2 = 60 tons

3) Design primary loop flow in gpm:

a) AWHP-1 CHWF = 110 (adjusted during TAB)

b) AWHR-2 CHWF =110 (adjusted during TAB)

c) CHWFdesign = 220 (adjusted during TAB)

3. Minimum Cycling Load

a. MinUnloadTons, the load below which the chiller will begin cycling

1) MinUnloadTons1 = 15 tons

2) MinUnloadTons2 = 15 tons

B. Heating Parameters

1. Temperature Setpoints

a. HWSTmax, the highest hot water supply temperature setpoint = 120°F

b. HW-LOT, the outdoor air lockout temperature above which the hot water plant is prevented from operating = 75°F (adjustable)

2. Capacity

a. QHdesign, design plant capacity = 1100 KBtu/h

b. QHstage, design capacity in KBtu/h for each heat pump

1) Q1 = 550 KBtu/h

2) Q2 = 550 KBtu/h

c. Design primary loop flow

1) AWHP-1 HWF = 110 GPM (adjusted during TAB)

2) AWHR-2 HWF =110 GPM (adjusted during TAB)

3) HWFdesign = 220 GPM (adjusted during TAB)

3. Minimum Cycling Load

a. MinUnloadKBH, the load below which the chiller will begin cycling

1) MinUnloadKBH1 = 140 KBtu/h

2) MinUnloadKBH2 = 140 KBtu/h

4. HW Pump DP setpoint

    a. HW-DPmax = as determine under 230593 Testing, Adjusting and Balancing.

C. Cooling Plant Enable/Disable

1. The Cooling Plant shall include an enabling schedule that allows operators to lock out the plant during off-hours, e.g. to allow off-hour operation of HVAC systems except the chiller plant. The default schedule shall be 24/7 (adjustable).

2. Enable the Cooling Plant in the lowest stage when the plant has been disabled for at least 15 minutes and:

    a. Number of Chiller Plant Requests > I (I= Ignores = 0, adjustable), and

    b. AHU OAT>CH-LOT, and

    c. The cooling plant enable schedule is active.

3. Disable the Cooling Plant when it has been enabled for at least 15 minutes and:

    a. Number of Chiller Plant Requests ≤ I for 3 minutes, or

    b. AHU OAT<CH-LOT – 1°F, or

    c. The cooling plant enable schedule is inactive.

D. Heating Plant Enable/Disable

1. The Heating Plant shall include an enabling schedule that allows operators to lock out the plant during off-hours, e.g. to allow off-hour operation of HVAC systems except the heating plant. The default schedule shall be 24/7 (adjustable).

2. Enable the Heating Plant in the lowest stage when the plant has been disabled for at least 15 minutes and:

    a. Number of Heating Hot-Water Plant Requests > I (I = Ignores shall default to 0, adjustable), and

    b. OAT<HW-LOT, and

    c. The heating plant enable schedule is active.

3. Disable the Heating Plant when it has been enabled for at least 15 minutes and:

    a. Number of Heating Hot-Water Plant Requests ≤ I for 3 minutes, or

    b. OAT>HW-LOT – 1°F, or

    c. The heating enable schedule is inactive.

E. Lead/Lag Alternation

1. If the Heating Plant and Cooling Plant are both enabled, the 4-pipe heat recovery air-to-water heat pump (AWHR-2) shall operate in Stage 1 for both Plants. Else AWHR-2 shall operate in Stage 2 and the 2-pipe air-to-water heat pump (AWHP-1) shall operate in Stages 1.

2. If AWHR-2 is disabled and the heating and cooling plant are both enabled.

    a. If the AHU outdoor air temperature is less than 65°F (adjustable), command AWHP-1 to heating mode.

    b. Otherwise, command AWHP-1 to cooling mode.

3. 2-pipe AWHP-1

    a. If AWHP-1 is commanded on in a desired heating/cooling mode:

        1) Open changeover valves for desired cooling/heating mode.

        2) Enable AWHP-1

    b. If AWHP-1 is commanded off:

        1) Disable AWHP-1 and wait 3 minutes or as required for internal shutdown cycle to time out (determine empirically).

        2) Close all four changeover valves.

F. Cooling Plant

1. Staging

    a. Chillers are staged in part based on required capacity, $Q_{required}$, relative to nominal capacity of a given stage, Q_{stage}. This ratio is the operative part load ratio, *OPLR.*

    b. All chillers are assumed to have integral primary pumps controlled by chiller controller.

    c. $Q_{required}$ is calculated based on chilled water return temperature (*CHWRT*), active chilled water supply temperature setpoint ($CHWST_{SP}$), and measured flow through the associated circuit flow meter (*GPM*), as shown in the equation below. $Q_{required}$ used in logic shall be a 5-minute rolling average of instantaneous values sampled at a minimum of every 30 seconds.

$$Q_{required} = \frac{CHWGPM \quad (CHWRT - CHWST_{SP})}{24} \; [tons]$$

$$Where\ CHWGPM = \begin{cases} AWHP - 1\ CHWF\ when\ only\ \text{AWHP} - 1\ is\ runnning \\ AWHR - 2\ CHWF\ when\ only\ AWHR - 2\ is\ running \\ CHWFDesign\ when\ both\ heat\ pumps\ are\ running \end{cases}$$

    d. When a stage up or stage down transition is initiated, hold $Q_{required}$ fixed at its last value until the longer of the successful completion of the stage change (e.g. lag chiller proven on) and 15 minutes.

e. Q_{stage} is calculated as the sum of the design capacities of the chillers in a given stage.

f. *OPLR* shall be calculated as follows:

$$OPLR_{stage} = \frac{Q_{required}[tons]}{Q_{stage}[tons]}$$

g. Staging part load ratio, *SPLR,* shall be 90%:

h. Staging shall be executed per the table below subject to the following requirements.

1) Each stage shall have a minimum runtime of 15 minutes.

2) Timers shall reset to zero at the completion of every stage change.

3) Stage up and down conditionals may depend on *OPLR* calculated relative to the current stage, next lower stage, or next higher stage. This is denoted with stage subscripts on OPLR in the table below. E.g. $OPLR_1$ means *OPLR* calculated using Stage 1 nominal capacity.

Chiller Stage	Chillers on	Stage up to next stage if	Stage down to lower stage if:
1	Lead	For 15 minutes current stage *OPLR* greater than *SPLR*	
2	Lead + Lag1		For 30 minutes next available lower stage *OPLR* less than $SPLR_{DN}$.

2. Chilled water supply temperature setpoint is reset by the air handling unit supply air temperature control sequence. See paragraph 3.08C.1.

G. Heating Plant

1. Staging

a. Heat pumps are staged in part based on required capacity, $Q_{required}$, relative to nominal capacity of a given stage, Q_{stage}. This ratio is the operative part load ratio, *OPLR.*

b. All heat pumps are assumed to have integral primary pumps controlled by heat pump controller.

c. $Q_{required}$ is calculated based on hot water return temperature (*HWRT*), active hot water supply temperature setpoint ($HWST_{SP}$), and measured flow through the secondary loop (*GPM*), as shown in the equation below. $Q_{required}$ used in logic shall be a 5-minute rolling average of instantaneous values sampled at a minimum of every 30 seconds.

$$Q_{required} = 0.5 * GPM \quad (HWRT - HWST_{SP})\ [KBH]$$

d. When a stage up or stage down transition is initiated, hold $Q_{required}$ fixed at its last value until the longer of the successful completion of the stage change (e.g. lag heat pump proven on) and 15 minutes.

e. Q_{stage} is calculated as the sum of the design capacities of the heat pumps in a given stage.

f. *OPLR* shall be calculated as follows:

$$OPLR_{stage} = \frac{Q_{required}[MBH]}{Q_{stage}[MBH]}$$

g. Staging part load ratio, *SPLR,* shall be 90%:

h. The primary hot water flow is per the following formula:

$$Primary\ HW\ Flow = \begin{cases} AWHP - 1\ HWF\ when\ only\ \text{AWHP} - 1\ is\ runnning \\ AWHR - 2\ HWF\ when\ only\ AWHR - 2\ is\ running \\ HWFDesign\ when\ both\ heat\ pumps\ are\ running \end{cases}$$

i. Staging shall be executed per the table below subject to the following requirements.

1) Each stage shall have a minimum runtime of 15 minutes.

2) Timers shall reset to zero at the completion of every stage change.

Stage up and down conditionals may depend on *OPLR* calculated relative to the current stage, next lower stage, or next higher stage. This is denoted with stage subscripts on OPLR in the table below. E.g. $OPLR_1$ means *OPLR* calculated using Stage 1 nominal capacity.

Heat pump Stage	**Heat pumps on**	**Stage up to next stage if either:**		**Stage down to lower stage if:**
1	Lead	**Efficiency Condition:** for 15 minutes current stage *OPLR* greater than *SPLR*	**Failsafe Condition:** for 15 minutes secondary HW flow > the primary HW flow	
2	Lead + Lag1			for 30 minutes next available lower stage *OPLR* less than $SPLR_{DN}$ and the next available lower stage failsafe condition is not true.

2. HW Supply Temperature shall be reset using Trim & Respond logic (see Guideline 36) with the following parameters:

Variable	Value
Device	Hot Water Plant
SP_0	$120^{O}F$
SP_{min}	$80^{O}F$
SP_{max}	$120^{O}F$
T_d	15 minutes

T	5 minutes
I	2
R	Heating HWST Reset Requests
SP_{trim}	-2^{O}F
SP_{res}	+3^{O}F
$SP_{res-max}$	+7^{O}F

a. HWST Plant Reset loop shall be enabled when the plant is enabled and disabled when the plant is disabled.

b. When a plant stage change is initiated, HW Plant Reset logic shall be disabled and value fixed at its last value for the longer of 15 minutes and the time it takes for the plant to successfully stage.

3. Secondary Hot Water Pump

a. Run HW pump when Heating Plant is enabled and shut off otherwise.

H. Alarms

1. Maintenance interval alarm when pump has operated for more than 1500 hours: Level 4. Reset interval counter when alarm is acknowledged.

2. Maintenance interval alarm when heat pump/chiller has operated for more than 1000 hours: Level 4. Reset interval counter when alarm is acknowledged.

3. Heat pump/chiller alarm: level 2

4. High chiller leaving chilled water temperature (more than 10°F above setpoint) for more than 15 minutes when chiller has been enabled in cooling mode for longer than 15 minutes: Level 3

5. Low heat pump leaving hot water temperature (more than 10°F below setpoint) for more than 15 minutes when heat pump has been enabled in heating mode for longer than 15 minutes: Level 3

6. Pump alarm is indicated by the status input being different from the output command after a period of 15 seconds after a change in output status.

a. Commanded on, status off: Level 2

b. Commanded off, status on: Level 4

7. CHW System low gauge pressure

a. if CHW system gauge pressure falls 1 psig below the scheduled expansion tank pre-charge pressure for 5 minutes, (indicating need to fill): Level 3.

b. if CHW system gauge pressure falls below 0.9 times the scheduled expansion tank pre-charge pressure for 1 minute, (indicating possible leak): Level 2.

8. HW System low gauge pressure

    a. if HW system gauge pressure falls 1 psig below the scheduled expansion tank pre-charge pressure for 5 minutes, (indicating need to fill): Level 3.

    b. if HW system gauge pressure falls below 0.9 times the scheduled expansion tank pre-charge pressure for 1 minute, (indicating possible leak): Level 2.

3.10 TOILET EXHAUST FANS

A. Exhaust fans shall operate when any of the associated system supply fans is proven on and any associated Zone Group is in the occupied mode.

B. Alarms

1. Generate a Level 4 maintenance alarm when fan has operated for more than 3000 hours. Reset interval counter when alarm is acknowledged.

2. Fan alarm is indicated by the status input being different from the output command for 15 seconds.

    a. Commanded on, status off: Level 2. Do not evaluate alarm until the device has been commanded on for 15 seconds.

    b. Commanded off, status on: Level 4. Do not evaluate the alarm until the device has been commanded off for 60 seconds.

3.11 MISCELLANEOUS ALARMS

A. Points in Hand (Operator Override) via Workstation command (including name of operator who made the command) or via supervised HOA switch at output: Level 4

B. Equipment alarm (for equipment with alarm contacts such as VFDs, AC units): Level 2

C. Failure or disconnection of a sensor as indicated by signal widely out of range: Level 2.

D. Panel or LAN failure: Level 2

E. Loss of communication with any device via Gateway (e.g. VFD) for more than 30 seconds: Level 2 (alarm shall indicate which specific device is not responding).

END OF SECTION 259000

SECTION 260010

BASIC ELECTRICAL REQUIREMENTS

PART 1 - GENERAL

1.01 SUMMARY

A. Table of Contents, Division 26 - Electrical:

SECTION NO.	SECTION TITLE
260010	BASIC ELECTRICAL REQUIREMENTS
260090	ELECTRICAL DEMOLITION
260519	BUILDING WIRE AND CABLE
260526	GROUNDING AND BONDING
260529	ELECTRICAL HANGERS AND SUPPORTS
260531	CONDUIT
260533	BOXES
260553	ELECTRICAL IDENTIFICATION
260942	DIGITAL LIGHTING CONTROL
262416	PANELBOARDS
262716	CABINETS AND ENCLOSURES
262726	WIRING DEVICES
262816	OVERCURRENT PROTECTIVE DEVICES
262819	DISCONNECT SWITCHES
265000	LIGHTING
266113	FIRE ALARM SYSTEM

B. Work included: This Section includes general administrative and procedural requirements for Division 26. The following administrative and procedural requirements are included in this Section to supplement the requirements specified in Division 01.

1. Quality assurance.
2. Definition of terms.
3. Submittals.
4. Coordination.
5. Record documents.
6. Operation and maintenance manuals.
7. Rough-in.
8. Electrical installation.
9. Cutting, patching, painting, and sealing.
10. Field quality control.
11. Cleaning.
12. Project closeout.
13. Interface/Responsibility Matrix.

C. Related Work: Consult all other Sections, determine the extent and character of related Work, and properly coordinate Work specified herein with that specified elsewhere to produce a complete and operable installation.

1. General and supplementary conditions: Drawings and general provisions of Contract and Division 01 of the Specifications, apply to all Division 26 Sections.
2. Earthwork: Include trenching, backfilling, boring and soil compaction as required for the installation of underground conduit, in-grade pull boxes, vaults, lighting pole foundations, etc. Refer to Division 31, Earthwork.
3. Selective demolition: Nondestructive removal of materials and equipment for reuse or salvage as indicated. Also dismantling electrical materials and equipment made obsolete by these installations. Refer to Division 02, Selective Demolition.
4. Concrete work: Include forming, steel bar reinforcing, cast-in- place concrete, finishing and grouting as required for underground conduit encasement, light pole foundations, pull box slabs, vaults, housekeeping pads, etc. Refer to Division 03, Concrete.
5. Miscellaneous metal work: Include fittings, brackets, backing, supports, rods, welding and pipe as required for support and bracing of raceways, luminaires, panelboards, distribution boards, switchboards, motor control centers, etc. Refer to Division 05, Miscellaneous Metals.
6. Miscellaneous lumber and framing work: Include wood grounds, nailers, blocking, fasteners and anchorage for support of electrical materials and equipment. Refer to Division 06, Rough Carpentry.
7. Moisture protection and smoke barrier penetrations: Include membrane clamps, sheet metal flashing, counter flashing, caulking and sealant as required for waterproofing of conduit penetrations and sealing penetrations in or through fire walls, floors, ceiling slabs and foundation walls. All penetrations through vapor barriers at slabs on grade shall be taped and made vapor tight. Refer to Division 07, Thermal and Moisture Protection.
8. Access panels and doors: Required in walls, ceilings, and floors to provide access to electrical devices and equipment. Refer to Division 08, Access Doors also, Division 05, Metals.
9. Painting: Include surface preparation, priming and finish coating as required for electrical cabinets, exposed conduit, pull and junction boxes, etc. where indicated as field painted in this Division. Refer to Division 09, Painting.
10. Luminaire supports: Provide slack support wire for luminaires installed in acoustical tile or lay-in suspended ceilings. Refer to Division 09, Acoustical Treatment.

D. Work furnished and installed under another Division requiring connections under this Division includes but is not limited to:

1. Electric motors.
2. Package mechanical equipment: fans, fan coil units, pumps, boilers, compressors, etc.

3. Flow switches and valve monitors for sprinkler system.
4. Elevator controllers.
5. Temperature control panel(s). (Line voltage only)
6. Electric door locks.
7. Door hold-open/release devices.
8. Variable frequency drive units.
9. Chiller starters.

E. Items furnished under another Division, but installed and connected under this Division includes but is not limited to:

1. Electric fire sprinkler water flow bells.

1.02 QUALITY ASSURANCE

A. Reference to Codes, Standards, Specifications and recommendations of technical societies, trade organizations and governmental agencies shall mean that latest edition of such publications adopted and published prior to submittal of the bid. Such codes or standards shall be considered a part of this Specification as though fully repeated herein.

B. When codes, standards, regulations, etc. allow Work of lesser quality or extent than is specified under this Division, nothing in said codes shall be construed or inferred authority for reducing the quality, requirements, or extent of the Contract Documents. The Contract Documents address the minimum requirements for construction.

C. Work shall be performed in accordance with all applicable requirements of the latest edition of all governing codes, rules and regulations including but not limited to the following minimum standards, whether statutory or not:

1. California Electric Code (CEC).
2. California Building Code (CBC).
3. California Fire Code (CFC).
4. California Mechanical Code (CMC).

D. Standards: Equipment and materials specified under this Division shall conform to the following standards where applicable:

ACI	American Concrete Institute
ANSI	American National Standards Institute
ASTM	American Society for Testing Materials
CBM	Certified Ballast Manufacturers
ETL	Electrical Testing Laboratories
FS	Federal Specification
IEEE	Institute of Electrical and Electronics Engineers, Inc.
IPCEA	Insulated Power Cable Engineer Association
NEMA	National Electrical Manufacturer's Association
UL	Underwriters' Laboratories

E. Independent Testing Agency qualifications:

1. Testing Agency shall be an independent testing organization that will function as an unbiased authority, professionally independent of Manufacturer, Supplier and Contractor, furnishing and installing equipment or system evaluated by Testing Agency.
2. Testing Agency shall be regularly engaged in the testing of electrical equipment, devices, installations, and systems.
3. Testing Agency shall meet Federal Occupational Safety and Health Administration (OSHA) requirements for accreditation of independent testing laboratories, Title 9, Part 1907.
4. On-site technical personnel shall be currently certified by the International Electrical Testing Association in electrical power distribution system testing.
5. Testing Agency shall use technicians who are regularly employed by the firm for testing services.
6. Contractor shall submit proof of above Testing Agency qualifications with bid documentation upon request.

F. All base material shall be ASTM and/or ANSI standards.

G. All electrical apparatus furnished under this Section shall conform to NEMA standards and the CEC and bear the UL label where such label is applicable.

H. Certify that each welder performing Work has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone re-certification.

1.03 DEFINITION OF TERMS

A. The following list of terms as used in the Division 26 documents shall be defined as follows:

1. "Provide": Shall mean furnish, install, and connect unless otherwise indicated.
2. "Furnish": Shall mean purchase and deliver to Project site.
3. "Install": Shall mean to physically install the items in-place.
4. "Connect": Shall mean make final electrical connections for a complete operating piece of equipment.
5. "As directed": Shall be as directed by the Owner or their authorized Representative.
6. "Utility Companies": Shall mean the company providing electrical, telephone or cable television services to the Project.

1.04 SUBMITTALS

A. Format: Furnish submittal data in electronic format for each Specification Section with a table of contents listing materials by Section and paragraph number.

B. Submittals shall consist of detailed Shop Drawings, Specifications, block wiring diagrams, "catalog cuts" and data sheets containing physical and dimensional information, performance data, electrical characteristics, materials used in fabrication and material finish. Clearly indicate by arrows or brackets precisely what is being

submitted on and those optional accessories which are included and those which are excluded. Furnish quantities of each submittal as noted in Division 01.

C. Each submittal shall be labeled with the Specification Section Number and shall be accompanied by a cover letter or shall bear a stamp stating that the submittal has been thoroughly reviewed by the Contractor and is in full compliance with the requirements of the Contract Documents or provide a Specification Section line-by-line compliance response statement with detailed exception/ deviation response statements for all applicable provisions for the applicable Specification Section. Any Specification Section lines without a detailed exception/ deviation response statement shall be treated as the Contractor or Vendor is submitting in full compliance with the applicable Specification Section requirements. Cover letters shall list in full the items and data submitted. Failure to comply with this requirement shall constitute grounds for rejection of data.

D. The Contractor shall submit detailed Drawings of all electrical equipment rooms and closets if the proposed installation layout differs from the construction documents. Physical size of electrical equipment indicated on the Drawings shall match those of the electrical equipment that is being submitted for review, i.e.: switchboards, panelboards, transformers, control panels, etc. Minimum scale: 1/4" = 1'- 0". Revised electrical equipment layouts must be approved prior to release of order for equipment and prior to installation.

E. As part of the equipment and fixture submittals, the Contractor shall provide anchorage calculations for floor and wall mounted electrical equipment and fixtures, distribution conduits and raceways, in conformance with the 2019 California Building Code (CBC) and ASCE 7-10. Use the Occupancy Category, Ground Accelerations, Site Class, Seismic Design Category, and Seismic Importance Factor as noted in the structural drawings. For components required for Life Safety or containing hazardous materials use Ip=1.5. Structural Calculations shall be prepared, stamped, and signed by a California Registered Structural Engineer. Specify proof loads for drilled-in anchors, if used.

F. The Manufacturer shall recommend the method of anchoring the equipment to the mounting surface and shall provide the Contractor with the assembly dimensions, weights, and approximate centers of gravity.

G. Review of submittals is for general conformance to design concept and general compliance with the Specification Sections. Submittal Review Comments do not imply waiver of Specifications Section requirements unless specifically noted.

H. All resubmittals shall include a cover letter that lists the action taken and revisions made to each Drawing and equipment data sheet in response to Submittal Review Comments. Resubmittal packages will not be reviewed unless accompanied by this cover letter. Failure to include this cover letter will constitute rejection of the resubmittal package.

I. Shop Drawings for the following systems must be prepared via a computer aided drafting (CAD) system for submission by the Contractor. The Engineer can provide CAD files of the electrical Contract Documents to the Contractor.

   1. Fire alarm system, Section 266113.

J. Independent Testing Agency report:

1. Testing Agency shall provide 3 copies of the complete testing report.
2. Test report shall include the following:
    a. Summary of Project.
    b. Description of equipment.
    c. Equipment used to conduct the test.
        1) Type.
        2) Manufacturer.
        3) Model number.
        4) Serial number.
        5) Date of last calibration.
        6) Documentation of calibration leading to NIST standards.
    d. Description of test.
    e. Test results, as compared to Manufacturers or industry accepted standards and tolerances.
    f. Conclusion and recommendation.
    g. Signature of responsible test organization authority.
3. Furnish completed test report to Engineer no later than 30-days after completion of testing, unless otherwise directed.

K. Substitutions:

1. All requests for substitutions shall conform to the general requirements and procedure outlined in Division 01.
2. Where items are noted as "or equal," a product of equal design, construction and performance will be considered. Contractor must submit to the Engineer all pertinent test data, catalog cuts and product information required substantiating that the product is in fact equal to that specified. Only one substitution will be considered for each product specified.
3. Manufacturers' names and model numbers used in conjunction with materials, processes or equipment included in the Contract Documents are used to establish standards of quality, utility, and appearance. Materials, processes, or equipment, which in the opinion of the Engineer is equal in quality, utility, and appearance, will be approved as substitutions to that specified.
4. Whenever any material, process or equipment is specified in accordance with a Federal specification, an ASTM standard, an ANSI specification, UL rating or other association standard, the Contractor shall present an affidavit from the Manufacturer certifying that the product complies with the particular standard specification. When requested by the Engineer, support test data to substantiate compliance shall be submitted by the Contractor at no additional cost.
5. Substitutions shall be equal, in the opinion of the Architect/Engineer, to the specified product. The burden of proof of such shall rest with the Contractor.

When the Architect/Engineer in writing accepts a substitution, it is with the understanding that the Contractor guaranteed the substituted article or material to be equal to the one specified and dimensioned to fit within the construction. Approved substitutions shall not relieve the Contractor of responsibilities for the proper execution of the Work or from any provisions of the Specifications.

6. The Contractor shall be responsible for all expenses in connection with the substitution materials, processes, and equipment, including the effect of the substitution on the Contractor, Subcontractor's, or other Contractor's Work. No substitution of material, processes or equipment shall be permitted without written authorization of the Architect/Engineer. Any assumptions on the acceptability of a proposed substitution prior to acceptance by the Engineer are at the sole risk of the Contractor.

1.05 COORDINATION

A. Discrepancies:

1. In the event of discrepancies within the Contract Documents, the Engineer shall be so notified, within sufficient time, as delineated in Division 01, prior to the Bid Opening to allow the issuance of an Addendum.

2. If, in the event that time does not permit notification or clarification of discrepancies prior to the Bid Opening, the following shall apply: The Drawings govern in matters of quantity and the Specifications govern in matters of quality. In the event of conflict within the Drawings involving quantities or within the Specifications involving quantities or within the Specifications involving quality, the greater quantity and higher quality shall apply. Such discrepancies shall be noted and clarified in the Contractor's Bid. No additional allowances will be made because of errors, ambiguities or omissions that reasonably should have been discovered during the preparation of the Bid.

B. Project conditions:

1. Examination of Project site: The Contractor shall visit the Project site and thoroughly review the locale, working conditions, conflicting utilities, and the conditions in which the Electrical Work will take place. Verify all existing conditions in the field. No allowances will be made subsequently for any costs that may be incurred because of any error or omission due to failure to examine the Project site and to notify the Engineer of any discrepancies between Contract Documents and actual Project site conditions.

2. Protection: Keep conduits, junction boxes, outlet boxes and other openings closed to prevent entry of foreign matter. Cover fixtures, equipment, devices, and apparatus and protect them against dirt, paint, water, chemical or mechanical damage, before and during construction period. Prior to final acceptance, restore to original condition any fixture, apparatus or equipment damaged including restoration of damaged factory applied painted finishes. Protect bright finished surfaces and similar items until in service. No rust or damage will be permitted.

3. Supervision: Contractor shall personally or through an authorized and competent representative constantly supervise the Work from beginning to completion and,

within reason, keep the same foreman and workmen on the Project throughout the Project duration.

C. Preparation:

1. Drawings:

a. Layout: General layout indicated on the Drawings shall be followed except where other Work may conflict with the Drawings.

b. Accuracy: Drawings for the Work under this Section are essentially diagrammatic within the constraints of the symbology applied.

1.06 RECORD DOCUMENTS

A. Provide Project Record Drawings as described herein:

1. Drawings shall fully represent installed conditions including actual locations of outlets, true panelboard connections following phase balancing routines, correct conduit, and wire sizing as well as routing, revised luminaire schedule listing Manufacturers and products installed and revised panel schedules. Contractor shall record all changes in the Work during the course of construction on blue or black line prints. These prints shall be made subject of monthly review by the Owner's Representative to ascertain that they are current. If not current, monthly payments may be withheld.

2. Record Drawings shall be the transfer of information on these prints to the construction documents via computer aided drafting (CAD) process. A set of CAD files of the electrical construction documents will be provided to the Contractor by the Engineer.

3. Record drawing submissions shall be provided to the Engineer to review upon the completion of the following phases of Work:

a. Final electrical installation.

4. Include in the record drawing submission the following shop drawing submission with all updated installation information:

a. Fire alarm system.

5. A single set of half size prints of the Record Drawings shall be submitted for review. Upon receipt of the Engineer's review comments, corrections shall be made, and the Contractor shall provide the following:

a. Two sets of full-size prints.

b. Four sets of half-size prints.

c. One set of full size reproducibles.

d. Electronic files of Drawings in PDF and CAD.

B. Panel schedules:

1. Typewritten panel schedules shall be provided for panelboards indicating the loads served and the correct branch circuit number. Schedules shall be prepared on forms provided by the Manufacturer and inserted in the pocket of the

inner door of each panelboard. See Section 262416: Panelboards for requirements.

1.07 OPERATION AND MAINTENANCE MANUALS

A. Prior to Project closeout furnish to the Owner, six (6) hard back 3-ring binders containing all bulletins, operation and maintenance instructions, part lists, service telephone numbers and other pertinent information as noted in each Section all equipment furnished under Division 26. Binders shall be indexed into Division Sections and labeled for easy reference. Bulletins containing more information than the equipment concerned shall be properly stripped and assembled.

PART 2 - PRODUCTS (NOT APPLICABLE)

PART 3 - EXECUTION

3.01 ROUGH-IN

A. Contractor shall verify lines, levels and dimensions indicated on the Drawings and shall be responsible for the accuracy of the setting out of Work and for its strict conformance with existing conditions at the Project site.

B. Verify final locations for rough ins with field measurements and with the requirements for the actual equipment to be connected.

C. Refer to equipment specification in Divisions 22 through 33 for rough-in requirements.

3.02 ELECTRICAL INSTALLATION

A. Preparation, sequencing, handling, and installation shall be in accordance with Manufacturer's written instructions and technical data particular to the product specified and/or accepted equal except as otherwise specified. Comply with the following requirements:

1. Shop Drawings prepared by Manufacturer.
2. Verify all dimensions by field measurements.
3. Arrange for chases, slots, and openings in other building components during progress of construction, to allow for electrical installations.
4. Coordinate the installation of required supporting devices and sleeves to be set in poured-in-place concrete and other structural components, as they are constructed.
5. Sequence, coordinate and integrate installations of electrical materials and equipment for efficient flow of the Work. Give attention to large equipment requiring positioning prior to closing in the building.
6. Where mounting height is not detailed or dimensioned, contact the Architect for direction prior to proceeding with rough-in.
7. Install systems, materials, and equipment to conform with approved submittal data, including coordination Drawings, to greatest extent possible. Conform to arrangements indicated by the Contract Documents, recognizing that portions of the Work are indicated only in diagrammatic form. Where coordination

requirements conflict with individual system requirements, refer conflict to the Architect.

8. Install systems, materials, and equipment level and plumb, parallel, and perpendicular to other building systems and components, where installed exposed in finished spaces.
9. Install electrical equipment to facilitate servicing, maintenance and repair or replacement of equipment components. As much as practical, connect equipment for ease of disconnecting, with minimum of interference with other installations.
10. Coordinate electrical systems, equipment, and materials installations with other building components.
11. Provide access panel or doors where devices or equipment are concealed behind finished surfaces. Furnish and install access doors per the requirements of Division 08.
12. Install systems, materials and equipment giving right-of-way priority to other systems that are required to maintain a specified slope.
13. Conform to the National Electrical Contractors Association "Standard of Installation" for general installation practice.

3.03 CUTTING, PATCHING, PAINTING AND SEALING

A. Structural members shall in no case be drilled, bored, or notched in such a manner that will impair their structural value. Cutting of holes, if required, shall be done with core drill and only with the approval of the Architect and Structural Engineer.

B. Protection of Installed Work: During cutting and patching operations, protect adjacent installations.

C. Cut, remove, and legally dispose of selected electrical equipment, components and materials as indicated, including but not limited to removal of electrical items indicated to be removed and items made obsolete by the new work.

D. Protect the structure, furnishings, finishes and adjacent materials not indicated or scheduled to be removed.

E. Provide and maintain temporary partitions or dust barriers adequate to prevent the spread of dust and dirt to adjacent areas.

F. Patch existing surfaces and building components using experienced installers and new materials matching existing materials and the original installation. For installers' qualifications refer to the materials and methods required for the surface and building components being patched.

G. Application of joint sealers:

1. General: Comply with joint sealer Manufacturers' printed application instructions applicable to products and applications indicated, except where more stringent requirements apply.
2. Installation of fire-stopping sealant: Install sealant, including forming, packing and other accessory materials, to fill openings around electrical services penetrating floors and walls, to provide fire-stops and fire-resistance ratings

indicated for floor or wall assembly in which penetration occurs. Comply with installation requirements established by testing and inspecting agency.

3.04 FIELD QUALITY CONTROL

A. General testing requirements:

1. The purpose of testing is to ensure that all tested electrical equipment, both Contractor and Owner supplied, is operational and within industry and Manufacturer's tolerances and is installed in accordance with design Specifications.
2. Tests and inspections shall determine suitability for energization.
3. Perform tests in presence of the Owner's Representative and furnish test equipment, facilities and technical personnel required to perform tests.
4. Tests shall be conducted during the construction period and at completion to determine conformity with applicable codes and with these Specifications.

B. Tests: In addition to specific system test described elsewhere, tests shall include:

1. Equipment operations: Test motors for correct operation and rotation.
2. Lighting control circuits: Test lighting circuits for correct operation through their control devices.
3. Alarm and interlock systems: Produce malfunction symptoms in operating systems to test alarm and interlock systems. In addition, all specific tests described in the fire alarm system shall be performed.
4. Circuit numbering verification: Select on a random basis, various circuit breakers within the panelboards and cycle them on and off to verify compliance of the typed panel directories with actual field wiring.
5. Voltage check:
    a. At completion of job, check voltage at several points of utilization on the system that has been installed under this Contract. During test, energize all installed loads.
    b. If proper voltage cannot be obtained, inform the Owner and the serving Utility Company.

C. Contractor shall provide test power required when testing equipment before service energization and coordinate availability of test power with General Contractor after service energization. The Contractor shall provide any specialized test power as needed or specified herein.

D. Testing safety and precautions:

1. Safety practices shall include the following requirements:
    a. Applicable State and Local safety operating procedures.
    b. OSHA.
    c. NSC.
    d. NFPA 70E.

2. All tests shall be performed with apparatus de-energized and grounded except where otherwise specifically required ungrounded by test procedure.

E. Calibration of test equipment:

1. Testing Agency shall have calibration program that assures test instruments are maintained within rated accuracy.
2. Instruments shall be calibrated in accordance with the following frequency schedule:
   a. Field instruments: Analog, 6-months maximum; Digital, 12-months maximum.
   b. Laboratory instruments: 12-months.
   c. Leased specialty equipment: 12-months where accuracy is guaranteed by lessor.
3. Dated calibration labels shall be visible on test equipment.
4. Records, which show date and results of instruments calibrated or tested, must be kept up to date.
5. Up-to-date instrument calibration instructions and procedures shall be maintained for test instrument.
6. Calibration standards shall be of higher accuracy than instrument tested.
7. Equipment used for field testing shall be more accurate than instrument being tested.

F. Coordinate with General Contractor regarding testing schedule and availability of equipment ready for testing.

G. Notify Owner and Engineer one week in advance of any testing.

H. Any products which fail during the tests or are ruled unsatisfactory by the Owner's Representative shall be replaced, repaired, or corrected as prescribed by the Owner's Representative at the expense of the Contractor. Tests shall be performed after repairs, replacements or corrections until satisfactory performance is demonstrated.

I. Testing Agency shall maintain written record of tests and shall assemble and certify final test report.

J. Include all test results in the maintenance manuals.

3.05 CLEANING

A. Prior to energizing of electrical equipment, the Contractor shall thoroughly clean the interior of enclosures from construction debris, scrap wire, etc. using Manufacturer's approved methods and materials.

B. Upon completion of Project, prior to final acceptance, the Contractor shall thoroughly clean both the interior and exterior of all electrical equipment per Manufacturers approved methods and materials. Remove paint splatters and other spots, dirt, and debris.

C. Touch-up paint any marks, blemishes or other finish damage suffered during installation.

3.06 PROJECT CLOSEOUT

A. Training: At the time of completion, a period of not less than 24-hours shall be allotted by the Contractor for instruction of building operating and maintenance personnel in the use of all systems. This 24-hour training is in addition to any instruction time called out in the Specifications for specific systems, i.e., Fire Alarm, etc. All personnel shall be instructed at one time, the Contractor making all necessary arrangements with Manufacturer's Representative. The equipment Manufacturer shall be requested to provide product literature and application guides for the users' reference. Costs, if any, for the above services shall be paid by the Contractor.

B. Special tools: Provide one of each tool type required for proper operation and maintenance of the equipment provided under this Section. All tools shall be delivered to the Owner at the Project completion.

C. Keying: Provide two keys for each lock furnished under this Section and turn over to Owner.

3.07 INTERFACE / RESPONSIBILITY MATRIX

INTERFACE / RESPONSIBILITY MATRIX							
System Equipment	**Specified Under Division**	**Furnished Under Division**	**Installed Under Division**	**Conduit & Box Rough-in Under Division**	**Wired & Cabled Under Division**	**Terminated Under Division**	**Remarks**
Fire Sprinkler System:							
Flow Switches	21	21	21	26	26	26	
Valve Monitors	21	21	21	26	26	26	
Post Indicating Valves	21	21	21	26	26	26	
Smoke Detection System:							
Duct-Mounted Detectors	26	26	23	26	26	25/26	1
In-Duct Mounted Detectors	26	26	23	26	26	26	2
Ceiling Mounted Detectors	26	26	26	26	26	26	
Magnetic Door Hold Open/Release	08	08	26	26	26	26	3
Door Closures	08	08	08	26	26	26	4
Fire/Smoke Dampers:							

INTERFACE / RESPONSIBILITY MATRIX							
System Equipment	Specified Under Division	Furnished Under Division	Installed Under Division	Conduit & Box Rough-in Under Division	Wired & Cabled Under Division	Terminated Under Division	Remarks
Motor Operated Dampers	23	23	23	25/26	25/26	25/26	5, 6
Smoke Detectors at Unducted FSD	26	26	26	26	26	26	7
Smoke Detectors at Ducted FSD	26	26	23	26	26	26	8
Area Coverage Smoke Detectors	26	26	26	26	26	26	9
HVAC Equipment:							
Package Mechanical Equipment	23	23	23	25/26	25/26	25/26	10
Chillers	23	23	23	25/26	25/26	25/26	10
VFD's, Field Mounted	23	23	26	25/26	25/26	25/26	10
Motors, 3 Phase	23	23	23	25/26	25/26	25/26	11
Motor Starters, 3 Phase	26	26	26	25/26	25/26	25/26	12
Motors, 1 Phase	23	23	23	25/26	25/26	25/26	11
Other Powered Equipment	23	23	23	25/26	25/26	25/26	11
Safety Disconnects	26	26	26	26	26	26	
Building Automation System (BAS):							
Central Control Workstation	25	25	25	25/26	25/26	25/26	13
Control Panels	25	25	25	25/26	25/26	25/26	13
Lighting Relay Panels	25	25	26	25/26	25/26	25/26	14
Low-Voltage Switches	26	26	26	26	26	26	
Emergency Generator System:							
Muffler and Exhaust	26	26	23	-	-	-	15
Generator Fuel System	22	22	22	22/26	22/26	22/26	16
Irrigation Control System:							
Controllers	32	32	32	32/26	32/26	32/26	17

INTERFACE / RESPONSIBILITY MATRIX							
System Equipment	Specified Under Division	Furnished Under Division	Installed Under Division	Conduit & Box Rough-in Under Division	Wired & Cabled Under Division	Terminated Under Division	Remarks
Control Valves	32	32	32	32	32	32	
Luminaire Seismic Safety Support Wires:							
Acoustical Tile Ceiling Areas	09	09	09	09	09	09	
Exposed Structure Areas	26	26	26	26	26	26	
Telecommunication System							
Incoming Service	27	Utility	Utility	26	Utility	Utility	
Riser Backbone	27	27	27	26	27	27	
Active Electronic Components	27	27	27	26	26/27	26/27	18
Patch Panels & Terminal Blocks	27	27	27	-	27	27	
Equipment Racks	27	27	27	-	-	-	
Terminal Backboards	27	06	06	-	-	-	
Cable Trays	27	26	26	-	27	-	
Workstation Modular Jacks	27	27	27	26	27	27	
Electrified Partition Sys. Interface	27	27	27	26	27	27	
Security Systems:							
Control Panels	28	28	28	26/28	26/28	26/28	19
Electric Door Locks or Strikes	08	08	08	26	28	28	
Alarm Contacts	28	28	28	26	28	28	
Panic Hardware	08	08	08	26	26/28	26/28	20
Remote Power Supplies	08/28	08/28	28	26	26/28	26/28	20
Request-to-Exit Devices	08	08	08	26	28	28	
Door Release Motion Sensors	28	28	28	26	28	28	
Glass Break Detectors	28	28	28	26	28	28	

INTERFACE / RESPONSIBILITY MATRIX							
System Equipment	Specified Under Division	Furnished Under Division	Installed Under Division	Conduit & Box Rough-in Under Division	Wired & Cabled Under Division	Terminated Under Division	Remarks
Motion Sensor Detector	28	28	28	26	28	28	
Card Readers and Controllers	28	28	28	26	28	28	
Intercom Station	28	28	28	26	28	28	
Fixed Position CCTV Cameras	28	28	28	26	28	28	
P/T/Z CCTV Cameras	28	28	28	26	26/28	26/28	20
CCTV Monitors	28	28	28	26	26/28	26/28	20
Parking Garage Controls:							
Roll-Down Overhead Doors	08	08	08	26/28	26/28	26/28	21
Parking Arm Control Gates	28	28	28	26/28	26/28	26/28	21
Loop Sensors	28	28	28	28	28	28	
Ticket Booth	28	28	28	26/28	26/28	26/28	21
Ticket Dispenser	28	28	28	26/28	26/28	26/28	21
Audio/Visual Systems:							
Equipment Racks	27	27	27	26/27	26/27	26/27	22
Power Receptacles	26	26	26	26	26	26	
Wall Mounted Audio Device	27	27	27	27	27	27	
Wall Mounted Control Device	27	27	27	27	27	27	
Custom Floor Boxes	27	27	27	26/27	26/27	26/27	22
Recessed Speakers	27	27	26/27	26	26	27	23
Surface or Pendant Speakers	27	27	27	26	26	27	
Projection Screens	11	11	11	26	26	26	
Pull Boxes	27	26	26	26	26	27	

MATRIX REMARKS	
1	These are sampling tube type smoke detector mounted exterior to HVAC ducts with sampling tubes extending across duct interior. Duct-mounted detectors are generally associated with HVAC supply fans required to initiate fan shutdown for units that supply over 2000 cfm. Division 25 shall terminate wiring within fan controller for equipment shutdown upon smoke detection. Division 26 shall make all other terminations related to this equipment via the fire alarm system.
2	These are spot type smoke detectors mounted within HVAC ducts, generally associated with fire/smoke dampers in a ducted system.
3	Division 26 shall wire device for both power and control via the fire alarm system. Local smoke detector(s) shall provide the initiation to fire alarm system, which shall activate the closure of doors.
4	Division 26 shall wire device for power and monitoring via the fire alarm system. Control will be internal to device from integral smoke detector. Fire alarm system shall monitor the smoke detector utilizing an addressable monitoring module for alarm initiation at the control panel.
5	Division 25 shall provide conduit, boxes, wiring, cabling, and terminations to fire/smoke dampers related to HVAC controls, if required. Division 26 shall provide conduit, boxes, wiring, cabling, and terminations to fire/smoke dampers related to power and control via the fire alarm system. For fire alarm control, Division 26 shall provide a programmable control relay as part of the fire alarm system at each fire/smoke damper.
6	If position monitoring is required at fire/smoke dampers, Division 23 shall furnish dampers with integral end switches for both open and closed position monitoring. Division 26 shall provide dual input addressable monitoring modules as part of fire alarm system to monitor end switches for annunciation at control panel.
7	Division 26 shall furnish and install spot type smoke detector(s), mounted over the wall penetration opening in front, and within 5 feet, of the fire/smoke damper. Quantities of detectors shall vary based on the opening size of penetration per NFPA 72.
8	These are the in-duct type smoke detectors as outlined above and shall be located within 5 feet of fire/smoke damper. Quantities of detectors shall vary based on the opening size of duct penetration per NFPA 72.
9	These are ceiling mounted spot type smoke detectors, providing full coverage of areas served by fire/smoke dampers, in lieu of the two methods outlined above for detection related to fire/smoke dampers.
10	Equipment shall be furnished with an integral main circuit breaker, OSHA lockout/ tagout padlockable in OFF position capability, SCCR of 100,000 amps, and pre-wired control panel mounted on unit for chillers and packaged mechanical equipment. Division 25 shall provide conduit, boxes, wiring, cabling, and terminations to equipment related to HVAC controls. Division 23 shall provide externally mounted harmonic mitigating devices (e.g. line reactors, DV/DT filters, etc.). Division 26 shall provide conduit, boxes, wiring and terminations to equipment related to single point power service along with installing and terminating the externally mounted harmonic mitigating devices. Local motor disconnect shall be provided under Division 26 as required and/or indicated on plans where the VFD is located out-of-sight from the motor and the addition of a local motor disconnect does not introduce additional or increased hazards to persons or property.
11	Division 25 shall provide conduit, boxes, wiring, cabling, and terminations to equipment related to HVAC controls. Division 26 shall provide conduit, boxes, wiring and terminations to equipment related to power service and extension. Local safety disconnect shall be provided under Division 26 as required and/or indicated on plans.

MATRIX REMARKS	
12	For equipment other than packaged systems or those furnished with VFD's, Division 26 shall provide motor starters. Division 25 shall provide conduit, boxes, wiring, cabling, and terminations to equipment related to HVAC controls. Division 26 shall provide conduit, boxes, wiring and terminations to equipment related to power service and extension. Local safety disconnect shall be integral "combination type" with the starters.
13	Division 25 shall provide conduit, boxes, wiring, cabling, and terminations for communication cable intertie between central control equipment, control panels and control devices. Division 26 shall provide conduit, boxes, wiring and terminations to equipment for 120volt power service.
14	Division 25 shall provide conduit, boxes, wiring, cabling, and terminations for communication cable intertie between central control equipment or control panels to lighting relay panels. Division 26 shall provide conduit, boxes, wiring and terminations to relay panels for 120volt power service as well as for all line-voltage controlled lighting circuits routed through relays.
15	Division 26 shall furnish generator muffler for exhaust system. Division 23 shall install muffler and exhaust piping as required.
16	Division 22 shall provide fuel tank with alarm and level sensors and associated fuel piping and venting. Also, provided will be remote fill station, piping to fuel tank, and fill station alarm panels. Division 22 shall provide conduit, boxes, wiring, cabling, and terminations to equipment related to fill station controls and alarm. Division 26 shall provide conduit, boxes, wiring and terminations to equipment related to power service for fuel pumps and control panels. Division 26 shall also monitor fuel system status for annunciation through generator control panel.
17	Division 32 "Irrigation" shall provide conduit, boxes, wiring and terminations for low-voltage cabling between controller and valves. Division 26 shall provide conduit, boxes, wiring and terminations to controller related to power service.
18	Division 27 "Telecommunication" shall provide wiring and terminations for low-voltage communication cabling between equipment. Division 26 shall provide devices, wiring and terminations to equipment for 120volt power service.
19	Division 28 "Security" shall provide wiring and terminations for low-voltage communication cable intertie between control panel, remote panels, and control devices. Division 26 shall provide wiring and terminations to equipment for 120volt power service.
20	Division 28 "Security" shall provide wiring and terminations for low-voltage cabling between equipment. Division 26 shall provide devices, wiring and terminations to equipment for 120volt power service.
21	Division 28 "Security" shall provide wiring and terminations for low-voltage cabling controls of equipment. Division 26 shall provide wiring and terminations to equipment for line-voltage power service.
22	Division 27 "Audio/Visual" shall provide audio and control devices to include their installation and termination of low-voltage cabling. Division 26 shall provide floor box, power receptacle and termination of line-voltage power service.
23	Division 27 "Audio/Visual" shall install speakers but shall turn speaker backbox over to Division 26 for installation.

END OF SECTION

SECTION 260090

ELECTRICAL DEMOLITION

PART 1 - GENERAL

1.01 SUMMARY

A. Work included: Labor and equipment necessary to complete the demolition required for the item specified under this Division, including but not limited to:

1. Electrical demolition

1.02 SYSTEM DESCRIPTION

A. Disconnection, removal and relocation of all wiring, luminaires, outlets, conduit, and all other types of electrical equipment as described on Drawings.

B. Purpose is to remove, relocate and extend existing installations to accommodate new construction.

PART 2 - PRODUCTS

2.01 MATERIALS AND EQUIPMENT

A. Materials and equipment necessary for patching and extending Work, as specified in other Sections.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Contractor shall thoroughly review conditions in the area of demolition prior to commencing Work to ensure complete understanding of existing installation in relationship to demolition Work.

3.02 GENERAL REQUIREMENTS

A. Remove all wiring, luminaires, outlets, conduit, and all other types of electrical equipment indicated to be removed. Devices that are to be removed may require reworking conduit and wiring in order to maintain service to other devices. If removed devices are on walls or ceilings that are to remain, blank coverplates are to be installed on outlet boxes.

B. Where remodeling interferes with circuits in areas that are otherwise undisturbed, circuits shall be reworked as required.

C. Existing devices and circuiting that are indicated are indicated only for informational purposes. Contractor shall visit the Project site and shall verify conditions as they exist and shall remove, relocate, and/or rework any electrical equipment or circuits affected (whether indicated or not) due to removal of existing walls, ceilings, etc. Coordinate all Work with that of other trades.

D. All equipment, luminaires, devices, etc., which are removed shall be delivered to the Owner for disposition. All items which are removed and not wanted by the Owner and which are not reused shall become the property of the Contractor and shall be legally removed from the Project site.

E. Cutting and patching necessary for the removal of Electrical Work shall be included.

F. Remove and replace luminaires, rework, relocate or replace conduit and wiring and do other Work required by the installation of new ductwork, piping, etc., above the ceiling. Coordinate with other trades and verify the extent of the Work.

3.03 LUMINAIRES

A. Disconnect and remove abandoned luminaires. Remove conduits, wiring, boxes, brackets, stems, hangers, and other accessories that are no longer needed for the new replacement fixtures.

3.04 OUTLETS

A. Disconnect abandoned outlets and remove devices. Remove abandoned outlets if conduit servicing them is abandoned and removed. Provide blank cover for abandoned outlets that are not removed.

3.05 CONDUIT

A. Remove abandoned conduit, including abandoned conduit above accessible ceiling finishes. Cut conduit flush with walls and floors and patch surfaces.

3.06 WIRING

A. Removed abandoned wiring to source of supply.

3.07 EXISTING SYSTEMS

A. Electrical distribution system: Disable system only to make switchovers and connections. Obtain permission from Owner's designated representative at least 24-hours before partially or completely disabling system. Minimize outage duration. Make temporary connections to maintain service in areas adjacent to Work area.

B. Fire alarm system: Maintain the existing system in service. Disable system only to make temporary connections to maintain service in areas adjacent to Work area(s). Notify Owner and Fire Supervisory Service at least 24-hours before partially or completely disabling the system.

3.08 CLEANING AND REPAIR

A. Clean and repair existing materials and equipment that shall remain.

END OF SECTION

SECTION 260519

BUILDING WIRE AND CABLE

PART 1 - GENERAL

1.01 SUMMARY

A. Work included: Labor, materials, and equipment necessary to complete the installation required for the item specified under this Division, including but not limited to:

1. Building wire.
2. Cable.
3. Wiring connections and terminations.

B. Related Work: Consult all other Sections, determine the extent and character of related Work, and properly coordinate Work specified herein with that specified elsewhere to produce a complete installation.

1.02 REFERENCES

A. Comply with the latest edition of the following applicable Specifications and standards except as otherwise indicated or specified:

1. Underwriters Laboratories, Inc. (UL):

UL 44;	Thermoset-Insulated Wires and Cables.
UL 62;	Flexible Cord and Fixture Wire.
UL 83;	Thermoplastic-Insulated Wires and Cables.
UL 183;	Manufactured Wiring Systems.
UL 310;	Electrical Quick-Connect Terminals.
UL 486A & B;	Wire Connectors.
UL 486C;	Splicing Wire Connectors.
UL 486D;	Insulated Wire Connector Systems for Underground Use or in Damp or Wet Locations.
UL 493;	Thermoplastic-Insulated Underground Feeder and Branch Circuit Cables.
UL 510;	Polyvinyl Chloride, Polyethylene and Rubber Insulating Tape.
UL 1581;	Reference Standard for Electrical Wires, Cables and Flexible Cords.
UL 2196;	Standard for Tests of Fire Resistive Cables.

2. National Electrical Manufacturer Association (NEMA):

NEMA WC-5;	Thermoplastic Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy.

NEMA WC-7; Cross-Linked Thermosetting Polyethylene Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy.

3. Institute of Electrical and Electronic Engineers (IEEE):

IEEE 82; Test Procedure for Impulse Voltage Tests on Insulated Conductors.

IEEE 576; Recommended Practice for Installation, Termination, and Testing of Insulated Power Cable as Used in Industrial and Commercial Applications.

1.03 SUBMITTALS

A. Submit in accordance with the requirements of Section 260010: Basic Electrical Requirements, the following items:

1. Data/catalog cuts for each product and component specified herein, listing all physical and electrical characteristics and ratings indicating compliance with all listed standards.
2. Clearly mark on each data sheet the specific item(s) being submitted and the proposed application.
3. Submit Manufacturer's installation instructions.
4. Final test results.

1.04 QUALITY ASSURANCE

A. All materials, equipment and parts comprising the units specified herein shall be new, unused, and currently under production.

B. Only products and applications listed in this Section may be used on the Project unless otherwise submitted.

C. Independent Testing Agency qualifications: Refer to Section 260010: Basic Electrical Requirements.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Products furnished by the following Manufacturers shall be acceptable if in compliance with all features specified herein and indicated on the Drawings.

1. Building wire:
   a. Cerrowire
   b. General Cable
   c. Southwire Company
   d. Stabiloy (aluminum only)
   e. United Wire and Cable
2. Flexible cords and cables:
   a. Carol Cable Company
   b. Cerrowire

c. PWC Corp

3. Wiring connectors and terminations:
   a. 3M Company.
   b. Ideal.
   c. Blackburn-Holub.
   d. Burndy.
   e. Thomas & Betts Corp.
   f. Beau Barrier.

B. Substitutions: Under provisions of Section 260010: Basic Electrical Requirements.

2.02 BUILDING WIRE

A. Conductor material:
   1. Provide annealed copper for all wire, conductor, and cable, unless otherwise indicated.
   2. Copper wire AWG #8 and larger shall be stranded, unless otherwise indicated.
   3. Copper wire AWG #10 and smaller may be solid or stranded as best suited for the installation.

B. Insulation material:
   1. All insulated wire, conductor and cable shall be 600volt rated, unless otherwise noted on the Drawings.
   2. Thermoplastic-insulated building wire: NEMA WC 5.
   3. Rubber-insulated building wire: NEMA WC 3.
   4. Copper feeders and branch circuits larger than #6 AWG: Type THW, XHHW or dual rated THHN/THWN.
   5. Copper feeders and branch circuits #6 AWG and smaller: Type TW, THW, XHHW or dual rated THHN/THWN.
   6. Control Circuits: Type THW or dual rated THHN/THWN.
   7. Identify system conductors as to voltage and phase connections by means of color-impregnated insulation.

2.03 FLEXIBLE CORDS AND CABLES (TYPE'S')

A. Provide flexible cords and cables of size, type and arrangement as indicated on the Drawings.

B. Type 'S' flexible cords and cables shall be manufactured in accordance with CEC Article 400 and composed of two or more conductors and a full size green insulated ground wire with an outer jacket of rubber or neoprene as noted.

C. Flexible cords and cables shall be fitted with wire mesh strain relief grips either as an integral component of the connector or as an independently supported unit.

D. Suspended flexible cords and cables shall incorporate safety spring(s) unless otherwise noted.

2.04 WIRING CONNECTIONS AND TERMINATIONS

A. Bolted pressure connectors: Provide wide range-taking connectors with cast bronze compression bolts, designed for parallel taps, tees, crosses or end-to-end connections.

B. Electrical spring wire connectors:

1. Provide multi-part construction incorporating a non-restricted, zinc coated square cross-section steel spring enclosed in a steel sheet with an outer jacket of plastic and insulating skirt.

2. Self-striping pigtail and tap U-contact connectors shall not be used.

C. Push-in wire connectors:

1. Multi-port push-in wire connectors for a maximum of 8-wires, as required for specific application. Connectors are manufactured to accommodate a wide range of sizes with either solid or stranded conductors, up to a maximum wire size of #10 AWG. Low insertion force required for ease of installation.

2. Housing shall be 105-degrees C and transparent for visual connection verification.

3. 600volt maximum rating with copper contacts.

4. UL Listed to 486C and UL 467 Listed for grounding and bonding applications.

D. Compression type terminating lugs:

1. Provide tin-plated copper high-compression type lugs for installation with hand or hydraulically operated circumference-crimping tools and dies as stipulated by the lug Manufacturer or as indicated on Drawings. Notch or single point type crimping is NOT acceptable.

2. Two-hole, long barrel lugs shall be provided for size #4/0 and larger wire where terminated to bus bars. Use minimum of three crimps per lug, on sizes where possible.

E. Splicing and insulating tape: Provide black, ultraviolet proof, self-extinguishing, 7-mil thick vinyl general purpose electrical tape with a dielectric strength of 10,000volts suitable for temperatures from minus 18-degrees C to 105-degrees C.

F. Insulating putty:

1. Provide pads or rolls of non-corrosive, self-fusing, one-eighth inch thick rubber putty with PVC backing sheet. Scotch vinyl mastic pads and roll or equal.

2. Use putty suitable for temperatures from minus 17.8-degrees C to 37.8-degrees C with a dielectric strength of 570volts/mil minimum.

G. Insulating resin:

1. Provide two-part liquid epoxy resin with resin and catalyst in pre-measured, sealed mixing pouch. Scotchcast 4 or equal for wet or underground vaults, boxes, etc. splices or terminations.

2. Use resin with a set up time of approximately 30-minutes at 21.1-degrees C and with thermal and dielectric properties equal to the insulating properties of the cables immersed in the resin.

H. Terminal strips:

1. Provide box type terminal strips in the required quantity plus 25% spare. Install in continuous rows in terminal cabinets.
2. Use the box type terminal strips with barrier open backs and with ampere ratings as required.
3. Identify all terminals with numbering sequence being used for a system.

I. Crimp type connectors:

1. Provide insulated fork or ring crimp terminals with tinned electrolytic copper-brazed barrel with funnel wire entry and insulation support
2. Fasten crimp type connectors or terminals using a crimping tool recommended by the connector Manufacturer.
3. Provide insulated overlap splices with tinned seamless electrolytic copper barrel with funnel wire entry and insulation support.
4. Provide insulated butt splices with tinned seamless electrolytic copper barrel with center stop, funnel wire entry and insulation support.

J. Cable ties: Provide harnessing and point-to-point wire bundling with nylon cable ties. All cable ties shall be installed using tool supplied by Manufacturer of ties.

K. Wire lubricating compound:

1. UL listed for the wire insulation and conduit type and shall not harden or become adhesive.
2. Shall not be used on wire for isolated type electrical power systems.

L. Bolt termination hardware:

1. Bolts shall be plated, medium carbon steel heat-treated, quenched and tempered equal to ASTM A-325 or SAE grade 5; or silicon bronze alloy ASTM B-9954 Type B.
2. Nuts shall be heavy semi-finished hexagon, conforming to ANSI B18.2.2, threads to be unified coarse series (UNC), class 2B steel or silicon bronze alloy.
3. Flat washers shall be steel or silicon bronze, Type A plain standard wide series, confirming to ANSI B27.2. SAE or narrow series shall not be used.
4. Belleville conical spring washers shall be hardened steel, cadmium plated or silicon bronze.
5. Each bolt connecting lug(s) to a terminal or bus shall not carry current exceeding the following values:
   a. 1/4" bolt: 125amps
   b. 5/16" bolt: 175amps
   c. 3/8" bolt: 225amps
   d. 1/2" bolt: 300amps
   e. 5/8" bolt: 375amps
   f. 3/4" bolt: 450amps

PART 3 - EXECUTION

3.01 EXAMINATION

A. Contractor shall thoroughly examine Project site conditions for acceptance of wire and cable installation to verify conformance with Manufacturer and Specification tolerances. Do not commence with installation until all conditions are made satisfactory.

3.02 APPLICATION

A. All wire, conductor and cable with their respective connectors, fittings and supports shall be UL listed for the installed application and ambient condition.

B. Feeders and branch circuits in wet locations shall be rated 75-degree C.

C. Feeders and branch circuits in dry locations shall be rated 90-degree C.

D. For wiring of the following, refer to the indicated Code Articles:

1. Fire alarm systems shall comply with CEC Article 760.

E. Minimum conductor size:

1. Provide minimum AWG #12 for all power and lighting branch circuits.
2. Provide minimum AWG #14 for all line voltage signal and control wiring unless otherwise indicated.

F. Color coding:

1. For 120/208volt, 3-phase, 4-wire systems:
   a. Phase A - Black
   b. Phase B - Red
   c. Phase C - Blue
   d. Neutral - White
   e. Ground - Green
2. For 277/480volt, 3-phase, 4-wire systems:
   a. Phase A - Brown
   b. Phase B - Orange
   c. Phase C - Yellow
   d. Neutral - Gray
   e. Ground - Green
3. Switch leg individually installed shall be the same color as the branch circuit to which they are connected, unless otherwise noted.
4. Travelers for 3-way and 4-way switches shall be a distinct color and pulled with the circuit switch leg or neutral.

3.03 WIRING METHODS

A. Install wires and cables in accordance with Manufacturer's written instructions, as indicated on Drawings and as specified herein.

B. Install all single conductors in raceway system, unless otherwise noted.

C. Parallel circuit conductors and terminations shall be equal in length and identical in all ways.

D. Provide adequate length of conductors within electrical enclosures and train the conductors to terminal points with no excess. Bundle multiple conductors, with conductors larger than #10 AWG cabled in individual circuits. Make terminations so there is no bare conductor at the terminal.

E. 20amp power and lighting branch circuit containing no more than four (4) current carrying conductors (phases and neutrals). Use #10 AWG conductor for 120/208volt circuits located outside a 75-foot radius of panel source and for 277/480volt branch circuits located outside a 200-foot radius of panel source, unless otherwise noted.

F. 20amp power and lighting branch circuits containing no more than eight (8) current carrying conductors (phases and neutrals). Use #10 AWG conductors for 120/208volt circuits located outside a 65-foot radius of panel source and for 277/480volt circuits located outside a 150-foot radius of panel source.

G. Provide #10 AWG pig tails on all 20amp and 30amp wiring devices served by #8 AWG conductors and larger.

H. Splice cables and wires only in outlet boxes, junction boxes, pull boxes, manholes or handholes. Group and bundle with tie wrap each neutral with its associated phase conductor where more than one neutral is present in a conduit.

I. Install cable supports for all vertical feeders in accordance with the CEC Article 300. Provide split wedge type fittings, which firmly clamp each individual cable and tighten due to cable weight.

J. Neatly form, train, and tie the cables in individual circuits. For panelboards, cabinets, wireways, switches, and equipment assemblies.

K. Seal cable or wire, entering a building from underground, between the wire or cable and conduit, where it exits the conduit, with a non-hardening approved compound, i.e. duct seal or equal.

L. Provide UL-listed factory-fabricated, solderless metal connectors of size, ampacity rating, material, type, and class for applications and for services indicated. Use connectors with temperature ratings equal to or greater than the wires that are being terminated.

M. Stranded wire shall be terminated using fitting, lugs or devices listed for the application. However, in no case shall stranded wire be terminated solely by wrapping it around a screw or bolt.

N. Flexible cords and cables supplied, as part of a pre-manufacturer fixture or unit assembly shall be installed according to Manufacturers published installation instructions.

3.04 WIRING INSTALLATION IN RACEWAYS

A. Install wire in raceway in accordance with IEEE 576, Manufacturer’s written instructions, as indicated on the Drawings and as specified herein after interior of building has been physically protected from the weather and all mechanical Work likely to injure conductors has been completed. Pull all conductors into a raceway at the same time. Exercise care in pulling conductors so that insulation is not

damaged. Use UL listed, non-petroleum base and insulating type pulling compound as needed.

B. Completely mandrel all underground or concrete encased conduits prior to installing conductors.

C. Completely and thoroughly swab raceway system before installing conductors.

D. Do not use block and tackle, power driven winch or other mechanical means for pulling conductors of size smaller than #1 AWG.

E. Wire pulling:

1. Provide installation equipment that will prevent the cutting or abrasion of insulation during pulling of cables.
2. Use rope made of nonmetallic material for pulling feeders.
3. Attach pulling lines for feeders by means of either woven basket grips or pulling eyes attached directly to the conductors.
4. Pull in together multiple conductors or cables in a single conduit.
5. Pulling tensions and sidewall pressures shall not exceed 60% of the manufacturer’s recommended maximum values. Pulling tension shall be continuously monitored during the pull by a calibrated dynamometer. If pulling tension is exceeded during the pull, immediately notify the engineer to determine if the cables will be considered damaged and require contractor replacement.

F. Install and test all cables in accordance with Manufacturer's instructions and warranty.

G. Install MC cable in accordance with Manufacturer’s instructions and in strict accordance with CEC Article 330. Secure and support MC cable with straps, independent hanger wire per CEC 300.11 (B), or cable ties listed for the purpose. Follow Manufacturer's explicit instructions when connecting the cable to fittings and boxes. Connectors shall be firmly secured to the cable, but not over-tightened. Connector shall be firmly attached to the metal boxes.

H. Support cables every 6-feet and within 12-inches of boxes, per CEC Article 330, using separate spring metal clip or metal cable ties (not steel tie wire) for each cable. Cables shall not be bundled together.

I. Hanger wire used to support suspended ceilings may not be used to directly support MC cables.

J. Do not rest cables on ceiling tiles or allow contact with mechanical piping systems.

K. Bend the cable per CEC Article 330.

L. Provide separate sleeves and/or fire barriers where cable penetrated firewalls, unless cable is UL listed for the application.

3.05 WIRE SPLICES, JOINTS AND TERMINATION

A. Join and terminate wire, conductors, and cables in accordance with UL 486A, C, CEC and Manufacturer's instructions.

B. Thoroughly clean wires before installing lugs and connectors.

C. Make splices, taps and terminations to carry full ampacity of conductors without perceptible temperature rise.

D. Splices and terminations shall be made mechanically and electrically secure.

E. Where it's determined that unsatisfactory splice or terminations have been installed, remove the devices and install approved devices at no addition cost.

F. Terminate wires in Terminal Cabinets, relay, and contactor panels, etc. using terminal strip connectors.

G. Insulate spare conductors with electrical tape and leave sufficient length to terminate anywhere in the panel or cabinet.

H. Install cable ties and maintain harnessing.

I. Encapsulate splices in exterior outlets, pull boxes and junction boxes using specified insulating resin kits. Make all splices watertight for exterior equipment and equipment in pump rooms.

J. Make up all splices and taps in accessible junction or outlet boxes with connectors as specified herein. Pigtails and taps shall be the same color as the feed conductor. Form conductor prior to cutting and provide at least 6-inches of tail and neatly packed in box after splice is made up.

K. Branch circuits (#10 AWG and smaller):

1. Connectors: Solderless, screw-on, reusable spring pressure cable type, 600volt, 105-degree C. with integral insulation, approved for copper conductors.
2. The integral insulator shall have a skirt to completely cover the stripped wires.
3. The number, size and combination of conductors as listed on the Manufacturers packaging shall be strictly complied with.

L. Feeder circuits: (#6 to 750 kCMIL)

1. Join or tap conductors from #6 AWG to 750 kCMIL using bolted pressure connectors or insulate mechanical compression (hi-press) taps with pre-molded, snap-on insulating boots or specified conformable insulating pad and over wrapped with two half-lapped layers of vinyl insulating tape starting and ending at the middle of the joint.
2. Terminate conductors from size #6 AWG to 750 kCMIL copper using bolted pressure or mechanical compression lugs in accordance with Manufacturer recommendation or as specified elsewhere.
3. Field installed compression connectors for cable sizes 250 kCMIL and larger shall have not less than two clamping elements or compression indents per wire.
4. Insulate splices and joints with materials approved for the particular use, location, voltage, and temperature. Insulate with not less than that of the conductor level that is being joined.

M. Termination hardware assemblies:

1. AL/CU lugs connected to aluminum plated or copper buss, shall be secured using a steel bolt, flat washer (two per bolt), Belleville washer and nut.

2. Copper lugs connected to copper bus, shall be secured using silicon bronze alloy bolt, flat washer (two per bolt), Belleville washer and nut.
3. The crown of Belleville washers shall be under the nut.
4. Bolt assemblies shall be torque to Manufacturer recommendation. Where manufacture recommendations are not obtainable, the following values shall be used:
    a. 1/4" - 20 bolt at 80-inch pounds torque.
    b. 5/16" - 18 bolt at 180-inch pounds torque.
    c. 3/8" - 16 bolt at 20-foot pounds torque.
    d. 1/2" - 13 bolt at 40-foot pounds torque.
    e. 5/8" - 11 bolt at 55-foot pounds torque.
    f. 3/4" - 10 bolt at 158-foot pounds torque.

3.06 IDENTIFICATION

A. Refer to Section 260553: Electrical Identification for additional requirements.

B. Securely tag all branch circuits. Mark conductors with specified vinyl wrap-around markers. Where more than two conductors run through a single outlet, mark each conductor with the corresponding circuit number.

C. Color code conductors' size #8 and larger using specified phase color markers and identification tags.

D. Provide all terminal strips with each individual terminal identified using specified vinyl markers.

E. In manholes, pull boxes and handholes, provide tags of the embossed brass type and show the cable type and voltage rating. Attach the tags to the cables with slip-free plastic cable lacing units.

3.07 FIELD QUALITY CONTROL

A. Independent testing: Contractor shall arrange and pay for the services of an independent Testing Agency to perform all quality control electrical testing required herein. Independent Testing Agency shall meet the requirements as outlined in Section 260010: Basic Electrical Requirements.

B. Prefunctional testing:
    1. Visual and mechanical inspection:
        a. Compare cable data with Contract Documents.
        b. Inspect exposed sections of wires and cables for physical damage and proper connections.
        c. Verify tightness of accessible bolted connections with calibrated torque wrench in accordance with Manufacturer's published data.
        d. Inspect compression applied connectors for correct cable match and indention.
        e. Verify visible cable bend meet or exceed ICEA and Manufacturer's minimum allowable bending radius.

f. If cables are terminated through window type current transformers, inspect to verify neutral and ground conductors are correctly placed for operation of protective devices.

g. Ensure wire and cable identification has been installed as specified herein.

2. Electrical testing:

   a. Contractor shall perform feeder and branch circuit insulation test after installation and prior to connection to utilization devices such as fixtures, motors, or appliances. Testing shall be as follows:

      1) 100% of all feeders 100amp rated and above.

      2) 50% of all feeders smaller than 100amps.

      3) 10% of all branch circuits at each individual panelboard.

   b. Perform insulation-resistance test using megohm meter with applied potential of 1000volt DC for a continuous duration of 60-seconds. Test conductors' phase-to-phase and phase-to-ground. Conductors shall test free from short-circuit and ground faults.

   c. Perform continuity test of all feeder and branch circuits to ensure correct cable connections. Test all neutrals for improper grounds.

   d. Contractor shall furnish instruments, materials, and labor for these tests.

3. Test values: Investigate resistance values less than 50-megohms.

4. Furnish test results in typewritten report form for review and inclusion in the operation and maintenance manuals.

END OF SECTION

SECTION 260526

GROUNDING AND BONDING

PART 1 - GENERAL

1.01 SUMMARY

A. Work included: Labor, materials, and equipment necessary to complete the installation required for the item specified under this Division, including but not limited to:

1. Power system grounding.
2. Electrical equipment and raceway grounding and bonding.

B. Related Work: Consult all other Sections, determine the extent and character of related Work, and properly coordinate Work specified herein with that specified elsewhere to produce a complete installation.

1.02 REFERENCES

A. Comply with the latest edition of the following applicable Specifications and standards except as otherwise indicated or specified:

1. Underwriters Laboratories, Inc. (UL):

UL 467;	Grounding and Bonding Equipment.

2. Institute of Electrical and Electronics Engineers, Inc. (IEEE):

IEEE No. 142;	Recommended Practice for Grounding of industrial and Commercial Power Systems.
IEEE No. 81	Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System.

1.03 SYSTEM DESCRIPTION

A. Ground each separately derived system neutral as described herein and indicated on Drawings.

B. Except as otherwise indicated, the complete electrical installation including the neutral conductor, metallic conduits and raceways, boxes, cabinets and equipment shall be completely and effectively grounded in accordance with all code requirements, whether or not such connections are specifically indicated or specified.

C. Resistance:

1. Resistance from the main switchboard ground bus through the ground electrode to earth shall not exceed 5-OHMS unless otherwise noted.
2. Resistance from the farthest panelboard, switchboard, etc. ground bus through the ground electrode to earth shall not exceed 20-OHMS

1.04 SUBMITTALS

A. Submit in accordance with the requirements of Section 260010: Basic Electrical Requirements, the following items:

1. Data/catalog cuts for each product and component specified herein, listing all physical and electrical characteristics and ratings indicating compliance with all listed standards.
2. Clearly mark on each data sheet the specific item(s) being submitted and the proposed application.
3. Submit Manufacturer's installation instructions.

1.05 QUALITY ASSURANCE

A. All materials, equipment and parts comprising the units specified herein shall be new, unused, and currently under production.

B. Only products and applications listed in this Section may be used on the Project unless otherwise submitted.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Products furnished by the following Manufacturers shall be acceptable if in compliance with all features specified herein and indicated on the Drawings.

1. Ground Rods:
   a. Weaver.
   b. Erico "Cadweld" Products, Inc.
2. Ground Wells:
   a. Christy Concrete Products, Inc.
   b. Forni Corp.
3. Ground Bushings, Connectors, Jumpers and Bus:
   a. O-Z/Gedney.
   b. Thomas & Betts Corp.

B. Substitutions: Under provisions of Section 260010: Basic Electrical Requirements.

2.02 GROUND CONDUCTORS

A. Refer to Specification Section 260519: Building Wire and Cable for conductor specifications.

B. General purpose insulated:

1. UL approved and code sized copper conductor, with dual rated THHN/THWN insulation, color identified green.
2. Where continuous color-coded conductors are not commercially available, provide a minimum 4" long color band with green, non-aging, plastic tape in accordance with CEC.

C. Bonding pigtails: Insulated copper conductor, identified green, sized per code, and provide with termination screw or lug. Provide solid conductors for #10 AWG or smaller and stranded conductors for #8 AWG or larger.

2.03 DRIVEN (GROUND) RODS

A. Copper clad steel, minimum 3/4-inch diameter by 8 feet long, unless otherwise noted.

2.04 GROUND WELL BOXES FOR GROUND RODS

A. Precast concrete box nominal 9" throat diameter x 14" deep with light duty concrete cover for non-traffic areas or steel plate for traffic areas. Cover shall be embossed or engraved with "GROUND ROD".

2.05 INSULATED GROUNDING BUSHINGS

A. Plated malleable iron or steel body with 150-degree Centigrade molded plastic insulating throat and lay-in grounding lug.

2.06 CONNECTIONS TO STRUCTURAL STEEL, GROUND RODS OR SPLICES

A. Where required by the Drawings, grounding conductors shall be spliced together, connected to ground rods or connected to structural steel using exothermic welds or high-pressure compression type connectors.

1. Exothermic welds shall be used for cable-to-cable and cable-to-ground rod and for cable to structural steel surfaces. Exothermic weld kits shall be as manufactured by Cadweld or equal. Each particular type of weld shall use a kit unique to that type of weld.

2. High-pressure compression type connectors shall be used for cable-to-cable and cable-to-ground rod connections.

2.07 EXTRA FLEXIBLE, FLAT BONDING JUMPERS

A. Where required by Code, indicated on the Drawing, and specified herein.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Contractor shall thoroughly examine Project site conditions for acceptance of grounding system installation to verify conformance with Manufacturer and Specification tolerances. Do not commence with installation until all conditions are made satisfactory.

3.02 INSTALLATION

A. Grounding electrode conductor: Provide grounding electrode conductor as indicated on the Drawings or sized per CEC Article 250, whichever is greater.

B. Separately derived electrical system grounding:

1. Ground each separately derived system per requirements in CEC Article 250 as a minimum, unless greater requirements are required elsewhere in the Contract Documents.

2. Transformers: Provide copper terminal bar for grounding and bonding the transformer in accordance with CEC Articles 250.30 and 450.10. Bond the terminal bar to the enclosure and connect the following to the terminal bar:

a. Primary feeder equipment ground conductor(s).

b. Secondary feeder supply-side bonding jumper(s).

c. Grounding electrode conductor.

d. Main bonding jumper to neutral (when present).

C. Equipment bonding/grounding:

1. Provide a CEC sized insulated copper ground conductor in all 120volt AC through 600volt AC feeder and branch circuit distribution conduits and cables.
2. Provide a separate grounding bus at panelboards, switchboards. Connect all metallic enclosed equipment so that with maximum fault current flowing, shall be maintained at not more than 35volts above ground.
3. Conduit terminating in concentric, eccentric, or oversized knockouts at panelboards, cabinets, gutters, etc. shall have grounding bushings and bonding jumpers installed interconnecting all such conduits.
4. Provide bonding jumpers across expansion and deflection couplings in conduit runs, pipe connections to water meters, dielectric couplings in metallic cold-water piping system.
5. Provide internal ground wire in flexible conduit connected at each end via grounding bushing.

END OF SECTION

SECTION 260529

ELECTRICAL HANGERS AND SUPPORTS

PART 1 - GENERAL

1.01 SUMMARY

A. Work included: Labor, materials, and equipment necessary to complete the installation required for the item specified under this Division, including but not limited to:

1. Conduit supports.
2. Equipment supports.
3. Fastening hardware.

B. Related Work: Consult all other Sections, determine the extent and character of related Work, and properly coordinate Work specified herein with that specified elsewhere to produce a complete installation.

1. Division 03: Cast-in-place concrete. Concrete equipment pads.
2. Division 05: Miscellaneous metals. Hangers for electrical equipment.
3. Division 09: Ceiling suspension systems. Slack support wires.

1.02 REFERENCES

A. Comply with the latest edition of the following applicable Specifications and standards except as otherwise indicated or specified:

1. Underwriters Laboratories, Inc. (UL):

UL 2239; Hardware for the Supports of Conduit, Tubing and Cable.

1.03 SYSTEM DESCRIPTION

A. Provide devices specified in this Section and related Sections for support of electrical equipment furnished and installed under Division 26.

B. Provide support systems that are adequate for the weight of equipment, conduit and wiring to be supported.

1.04 SUBMITTALS

A. Submit in accordance with the requirements of Section 260010: Basic Electrical Requirements, the following items:

1. Data/catalog cuts for each product and component specified herein.
2. Clearly mark on each data sheet the specific item(s) being submitted and the proposed application.
3. Submit Manufacturer's installation instructions.

1.05 QUALITY ASSURANCE

A. All materials, equipment and parts comprising the units specified herein shall be new, unused, and currently under production.

B. Only products and applications listed in this Section may be used on the Project unless otherwise submitted.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Products furnished by the following Manufacturers shall be acceptable if in compliance with all features specified herein and indicated on the Drawings.

1. Concrete fasteners:
    a. Phillips "Red-Head".
    b. Remington.
    c. Ramset.
2. Concrete inserts and construction channel:
    a. Unistrut Corp.
    b. GS Metals "Globe Strut."
    c. Thomas & Betts "Kindorf" Corp.
3. Conduit straps:
    a. O-Z/Gedney.
    b. Erico "Caddy" Fastening Products.
    c. Thomas & Betts "Kindorf" Corp.

B. Substitutions: Under provisions of Section 260010: Basic Electrical Requirements.

2.02 CONCRETE FASTENERS

A. Provide expansion-shield type concrete anchors.

B. Provide powder driven concrete fasteners with washers. Obtain approval by Architect and Structural Engineer prior to use.

2.03 CONCRETE INSERTS

A. Provide pressed galvanized steel, concrete spot insert, with oval slot capable of accepting square or rectangular support nuts of ¼ inch to ½ inch diameter thread for rod support.

2.04 THREADED ROD

A. Provide steel threaded rod, sized for the load unless otherwise noted on the Drawings or in the Specifications.

2.05 CONSTRUCTION CHANNEL

A. Provide 1.5-inch by 1.5-inch, 12-gauge galvanized steel channel with 17/32-inch diameter bolt holes and 1-1/2 inch on center in the base of the channel.

2.06 CONDUIT STRAPS

A. One-hole strap, steel, or malleable iron, with malleable iron clamp-back spacer for surface mounted wall and ceiling applications.

1. Use malleable strap with spacers for exterior and wet locations.
2. Use steel strap without spacers for interior locations.

B. Steel channel conduit strap for support from construction channel.

C. Steel conduit hanger for pendant support with threaded rod

D. Steel wire conduit support strap for support from independent #12-gauge hanger wires.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Contractor shall thoroughly examine Project site conditions for acceptance of supporting device installation to verify conformance with Manufacturer and Specification tolerances. Do not commence with installation until all conditions are made satisfactory.

3.02 PREPARATION

A. Coordinate size, shape, and location of concrete pads with Division 03, Cast-in-place concrete.

B. Layout support devices to maintain headroom, neat mechanical appearance and to support the equipment loads.

C. Where indicated on the Contract Documents, install freestanding electrical equipment on concrete pads.

3.03 INSTALLATION

A. Furnish and install supporting devices as noted throughout Division 26.

B. Electrical device and conduit supports shall be independent of all other system supports that are not structural elements of the building, unless otherwise noted.

C. Fasten hanger rods, conduit clamps, outlet, and junction boxes to building structure using precast inserts, expansion anchors, preset inserts, or beam clamps.

D. Use toggle bolts or hollow wall fasteners in hollow masonry, plaster or gypsum board partitions and walls.

E. Use expansion anchors or preset inserts in solid masonry walls.

F. Use self-drilling anchors, expansion anchor or preset inserts on concrete surfaces.

G. Use sheet metal screws in sheet metal studs and wood screws in wood construction.

H. Do not fasten supports to piping, ductwork, mechanical equipment, conduit, or acoustical ceiling suspension wires.

I. Do not drill structural steel members unless first approved in writing by the Architect or Structural Engineer.

J. Fabricate supports from structural steel or steel channel, rigidly welded, or bolted to present a neat appearance. Use hexagon head bolts with spring lock washers under all nuts.

K. Install surface-mounted cabinets and panelboards with minimum of four anchors. Provide additional support backing in stud walls prior to sheet rocking as required to adequately support cabinets and panels.

L. Bridge studs top and bottom with channels to support flush mounted cabinets and panelboards in stud walls.

3.04 ERECTION OF METAL SUPPORTS

A. Cut, fit and place miscellaneous metal fabrications accurately in location, alignment and elevation to support and anchor electrical materials and equipment.

B. Field Welding: Comply with AWS "Structural Welding Code."

3.05 WOOD SUPPORTS

A. Cut, fit, and place wood grounds, nailers, blocking and anchorage accurately in location, alignment and elevation to support and anchor electrical materials and equipment.

3.06 ANCHORAGE

A. All floor mounted, free standing electrical equipment such as transformers, switchboards, distribution boards, etc. shall be securely fastened to the floor structure.

B. Anchorage of electrical equipment shall comply with the seismic requirements as outlined in Section 260010: Basic Electrical Requirements.

END OF SECTION

SECTION 260531

CONDUIT

PART 1 - GENERAL

1.01 SUMMARY

A. Work included: Labor, materials, and equipment necessary to complete the installation required for the item specified under this Division, including but not limited to:

1. Rigid steel conduit and fittings.
2. PVC insulated rigid steel conduit and fittings.
3. Intermediate metal conduit and fittings.
4. Electrical metallic tubing and fittings.
5. Flexible metallic conduit and fittings.
6. Liquidtight flexible metallic conduit and fittings.
7. Miscellaneous conduit fittings and products.

B. Related Work: Consult all other Sections, determine the extent and character of related Work, and properly coordinate Work specified herein with that specified elsewhere to produce a complete installation.

1. Division 01: Cutting and patching.
2. Division 07: Sheet metal flashing and trim.
3. Division 09: Painting. Exposed conduit and other devices.

1.02 REFERENCES

A. Comply with the latest edition of the following applicable Specifications and standards except as otherwise indicated or specified:

1. American National Standards Institute, Inc. (ANSI):

ANSI C80.1;	Rigid Steel Conduit, Zinc-Coated.
ANSI C80.3;	Electrical Metallic Tubing, Zinc Coated.

2. Underwriters Laboratories, Inc. (UL):

UL 1;	Flexible Metal Conduit.
UL 6;	Rigid Metal Conduit.
UL 360;	Liquid-Tight Flexible Steel Conduit.
UL 514B;	Conduit, Tubing and Cable Fittings.
UL 635;	Insulating Bushings.
UL 797;	Electrical Metallic Tubing - Steel.
UL 1242;	Intermediate Metal Conduit - Steel.

3. National Electrical Manufacturer Association (NEMA):

NEMA RN1; PVC Externally coated Galvanized Rigid Steel Conduit.

1.03 SUBMITTALS

A. Submit in accordance with the requirements of Section 260010: Basic Electrical Requirements the following items:

1. Data/catalog cuts for each product and component specified herein, listing all physical and electrical characteristics and ratings indicating compliance with all listed standards.
2. Clearly mark on each data sheet the specific item(s) being submitted and the proposed application.
3. Submit Manufacturer's installation instruction. Provide written instructions for raceway products requiring glues, special tools, or specific installation techniques.

1.04 QUALITY ASSURANCE

A. All materials, equipment and parts comprising the units specified herein shall be new, unused, and currently under production.

B. Only products and applications listed in this Section may be used on the Project unless otherwise submitted and approved.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Products furnished by the following Manufacturers shall be acceptable if in compliance with all features specified herein and indicated on the Drawings.

1. Metal conduit:
   a. Allied Tube and Conduit Co.
   b. Triangle PWC, Inc.
   c. Western Tube and Conduit Corp.
   d. Spring City Electrical Manufacturing Co.
   e. Occidental Coating Co. (OCAL).
   f. Alflex Corp.
   g. American Flexible Metal Conduit Co.
   h. Anaconda.
2. Fittings:
   a. Appleton Electric Co.
   b. OZ/Gedney.
   c. Thomas & Betts Corp.
   d. Spring City Electrical Manufacturing Co.
   e. Occidental Coating Co. (OCAL).
   f. Carlon.

B. Substitutions: Under provisions of Section 260010: Basic Electrical Requirements.

2.02 GALVANIZED RIGID STEEL CONDUIT (GRS)

A. Conduit: Full weight, threaded, hot-dip galvanized steel, conforming to ANSI C80.1 and UL 6.

B. Standard threaded couplings, locknuts, bushings, and elbows: Only materials of steel or malleable iron are acceptable. Locknuts shall be bonding type with sharp edges for digging into the metal wall of an enclosure.

C. Three-piece couplings: Hot dip galvanized, cast malleable iron.

D. Insulating bushings: Threaded polypropylene or thermosetting phenolic rated 150-degree C minimum.

E. Insulated grounding bushings: Threaded cast malleable iron body with insulated throat and steel "lay-in" ground lug with compression screw.

F. Insulated metallic bushings: Threaded cast malleable iron body with plastic insulated throat rated 150-degrees C.

G. All fittings and connectors shall be threaded.

2.03 PVC INSULATED GALVANIZED RIGID STEEL CONDUIT (PVC GRS)

A. Conduit: Full weight, threaded, hot-dip galvanized steel, conforming to ANSI C80.1 and NEMA RN-1 with nominal 20 or 40 mil thermoplastic vinyl coating, heat fused and bonded to the exterior of the conduit.

B. Fittings: Conduit couplings and connectors shall be as specified for galvanized rigid steel conduit and shall be factory PVC coated with an insulating jacket equivalent to that of the coated material.

2.04 INTERMEDIATE METAL CONDUIT (IMC)

A. Conduit: Hot dip galvanized steel meeting the requirements of CEC Article 345 and conforming to ANSI C80.6 and UL 1242.

B. Fittings: Conduit couplings, connector and bushing shall be as specified for galvanized rigid steel conduit. Integral retractable type IMC couplings are also acceptable.

2.05 ELECTRICAL METALLIC TUBING (EMT)

A. Conduit: Shall be formed of cold rolled strip steel, electrical resistance welded continuously along the longitudinal seam and hot dip galvanized after fabrication. Conduit shall conform to ANSI C80.3 Specifications and shall meet UL requirements.

B. Set screw type couplings: Hot dip galvanized, steel or cast malleable iron, UL listed concrete tight. Use set screw type couplings with four setscrews each of conduit sizes over 2 inches. Setscrews shall be of case-hardened steel with hex-head and cup point to firmly seat in wall of conduit for positive grounding.

C. Set screw type connectors: Hot dip galvanized, steel or cast malleable iron UL listed concrete tight with male hub and insulated plastic throat, 150-degree C temperature rated. Setscrew shall be same as for couplings.

D. Raintight couplings: Hot dip galvanized, steel or cast malleable iron; UL listed raintight and concrete tight, using gland and ring compression type construction.

E. Raintight connectors: Hot dip galvanized, steel or cast malleable iron, UL listed raintight and concrete tight, with insulated throat, using gland and ring compression type construction.

2.06 FLEXIBLE METALLIC CONDUIT (FMC)

A. Conduit: Shall be fabricated in continuous lengths from galvanized steel strip, spirally wound and formed to provide an interlocking design and conforming to UL 1.

B. Fittings: Connectors shall be of the single screw clamp variety with steel or cast malleable iron bodies and threaded male hubs with insulated throats. Exception: Pressure cast screw-in connectors shall be acceptable for luminaire connection in suspended ceilings and cut-in outlet boxes within existing furred walls.

2.07 LIQUIDTIGHT FLEXIBLE METALLIC CONDUIT (LFMC)

A. Conduit: Shall be fabricated in continuous lengths from galvanized steel strips, interlocking spirally wound, covered with extruded liquidtight jacket of polyvinyl chloride (PVC) and conforming to UL 360. Provide conduit with a continuous copper-bonding conductor wound spirally between the convolutions.

B. Fittings: Connector body and gland nut shall be of cadmium plated steel or cast malleable iron, with tapered, male, threaded hub; insulated throat and neoprene "O" ring gasket recessed into the face of the stop nut. The clamping gland shall be of molded nylon with an integral brass push-in ferrule.

2.08 MISCELLANEOUS CONDUIT FITTINGS AND PRODUCTS

A. Watertight conduit entrance seals: Steel or cast malleable iron bodies and pressure clamps with PVC sleeve, neoprene sealing grommets and PVC coated steel pressure rings. Fittings shall be supplied with neoprene sealing rings between the body and PVC sleeve.

B. Watertight cable sealing bushings: One piece, compression molded sealing ring with PVC coated steel pressure disks, stainless steel sealing screws and zinc plated cast malleable iron locking collar.

C. Expansion fittings: Multi-piece unit comprised of a hot dip galvanized malleable iron or steel body and outside pressure bussing designed to allow a maximum of 4" conduit movement (2" in either direction). Furnish with external braid tinned copper bonding jumper. Unit shall be UL listed for wet or dry locations.

D. Expansion/deflection couplings: Multi-piece unit comprised of a neoprene sleeve with internal flexible tinned copper braid attached to bronze end couplings with stainless steel bands. Coupling shall accommodate 0.75-inch deflection, expansion or contraction in any direction and allow 30-degree angular deflections. Flexible, corrosion-resistant, watertight, moisture and heat resistant molded rubber jacket and stainless-steel jacket clamps. Unit shall comply with UL467 and UL514. Manufacturer shall be OZ/Gedney Type DX, Steel City Type EDF or equal.

E. Fire rated penetration seals:

1. UL building materials directory classified.

2. Conduit penetrations in fire rated separation shall be sealed with a UL classified fill, void or cavity material.

3. The fire rated sealant material shall be the product best suited for each type of penetration and may be a caulk, putty, composite sheet, or wrap/strip.

F. Standard products not herein specified:

1. Provide listing of standard electrical conduit hardware and fittings not herein specified for approval prior to use or installation, i.e. locknuts, bushings, etc.
2. Listing shall include Manufacturers name, part numbers and a written description of the item indicating type of material and construction.
3. Miscellaneous components shall be equal in quality, material and construction to similar items herein specified.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Contractor shall thoroughly examine Project site conditions for acceptance of conduit system installation to verify conformance with Manufacturer and Specification tolerances. Do not commence with installation until all conditions are made satisfactory.

3.02 APPLICATION

A. Galvanized rigid steel conduit (GRS) shall be used in the following applications:

1. For feeders and branch circuits located indoors, concealed or exposed above suspended ceilings, in damp/wet locations, in crawl spaces, in attics, chases, furred spaces, equipment rooms, loading docks or in hazardous locations in accordance with CEC and local Codes.
2. For feeders and branch circuits concealed in concrete floors and walls when not in contact with earth.

B. PVC insulated galvanized rigid steel conduit shall be used in the following applications:

1. Use 40-mil coating for feeders and branch circuits in damp or wet locations.
2. Use 20- or 40-mil for feeders and branch circuits concealed in concrete walls or slabs in contact with earth.
3. Use 20- or 40-mil for runs beneath floor slabs on grade.
4. Use 40-mil for all below grade penetrations through floor slabs on grade or exterior walls.

C. Intermediate metal conduit (IMC): Shall be used for the same application as galvanized rigid steel conduit as specified herein.

D. Electrical metallic tubing (EMT): Shall be used exposed or concealed for interior electrical feeders 4" and smaller, interior power and lighting branch circuits and low tension distribution system where run above suspended ceilings, in concrete slabs and walls not in contact with earth; in stud walls, furred spaces and crawl spaces. EMT shall not be installed exposed below 6 feet above the finish floor except within electrical, communication or signal rooms or closets.

E. Flexible metallic conduit (FMC): Shall be used only in dry locations for connections from an adjacent outlet box or conduit to all motors, transformers, vibrating

equipment or machinery, controllers, solenoid valves, float and flow switches or similar devices and to luminaires installed in suspended ceilings, minimum sizes shall be 3/8" for luminaires and control wiring and 1/2" for motor and transformer connections. U.O.N.

F. Liquidtight flexible metallic conduit (LFMC): Shall be used in wet or damp locations for connections from adjacent outlet box or conduit to all motors, transformers, vibrating equipment or machinery, controllers, solenoid valves, float and flow switches or similar devices. These areas are typically food preparation and dishwashing areas, sump wells, loading docks, pump rooms, exterior areas, etc. Minimum sizes shall be 1/2".

3.03 PREPARATION

A. Locations of conduit runs shall be planned in advance of the installation and coordinated with ductwork, plumbing, ceiling and wall construction in the same areas and shall not unnecessarily cross other conduits or pipe, nor prevent removal of ceiling tiles or panels, nor block access to mechanical or electrical equipment.

B. Where practical, install conduits in groups in parallel vertical or horizontal runs and at elevations that avoid unnecessary offsets.

C. All conduits shall be run parallel or at right angles to the centerlines of columns and beams, whether routed exposed, concealed above suspended ceiling or in concrete slabs.

D. Conduits shall not be placed closer than 12-inches to a flue, parallel hot water, steam line or other heat producing source or three inches from such lines when crossing perpendicular to the runs.

E. Exposed conduit installation shall not encroach into the ceiling height headroom of walkways or doorways. Where possible, install horizontal raceway runs above water and below steam piping.

F. The largest trade size conduits in concrete floor and wall slabs shall not exceed 1/3 the floor or wall thickness and conduits shall be spaced a minimum of three conduit diameters apart unless otherwise noted on the Drawings. All conduits shall be installed in the center of concrete slabs or wall and shall not be placed between reinforcing steel and the bottom of floor slabs.

G. In long runs of conduit, provide sufficient pull boxes inside buildings to facilitate pulling wires and cables, with spacing not to exceed 150-feet. Support pull boxes from structure independent of conduit supports. These pull boxes are not indicated on the Drawings.

H. Provide all reasonably inferred standard conduits fitting and products required to complete conduit installation to meet the intended application whether noted, indicated, or specified in the Contract Documents or not.

I. Connect recessed luminaires to conduit runs with maximum six feet of flexible metal conduit.

3.04 INSTALLATION

A. Install conduit in accordance with Manufacturer's written instructions, as indicated on Drawings and as specified herein.

B. Minimum Conduit Size: Unless otherwise noted herein or on Drawings, minimum conduit size shall be 1/2" for interior applications and 3/4" for exterior and underground applications.

C. All conduit sizes indicated on the Drawings are sized for copper conductors with THHN/THWN insulation. If conductor type or size is changed the Contractor shall be responsible for resizing conduits upward to meet Code.

D. In general, all conduit work shall be concealed where possible. Exceptions shall be electrical, communication and mechanical rooms, exposed ceiling areas, and parking garages.

E. Conduit connections to motors and surface cabinets shall be concealed, except for electrical, communication and mechanical rooms, or unless exposed Work is clearly called for on the Drawings.

F. Install conduits in complete runs before pulling in cables or wires.

G. Install conduit free from dented, bruises or deformations. Remove and replace any damaged conduits with new undamaged material.

H. Conduits shall be well protected and tightly covered during construction using metallic bushings and bushing "pennies" to seal open ends.

I. In making joints in rigid steel conduit, ream conduit smooth after cutting and threading. Coat all field-threaded joints with UL approved conductive type compound to ensure low resistance ground continuity through conduit and to prevent seizing and corrosion.

J. Clean any conduit in which moisture or any foreign matter has collected before pulling in conductors. Paint all field-threaded joints to prevent corrosion.

K. In all empty conduits or ducts, install a “True Tape” conduit measuring tape line to provide overall conduit length for determining length of cables/conductors for future use.

L. Conduit systems shall be mechanically and electrically continuous throughout. Install code size, insulated, copper, green-grounding conductors in all conduit runs for branch circuits and feeders. This conductor is not indicated on the Drawings. Refer to Section 260526: Grounding and Bonding.

M. Metallic conduit shall not be in contact with other dissimilar metal pipes (i.e. plumbing).

N. Make bends with standard conduit bending hand tool or machines. The use of any item not specifically designed for the bending of electrical conduit is strictly prohibited.

O. A run of conduit between terminations at wire pulling points shall not contain more than the equivalent of four quarter bends (360-degrees, total).

3.05 PENETRATIONS

A. Locate penetrations and holes in advance where they are proposed in the structural sections such as footings, beams, wall, etc. Penetrations are acceptable only when the following occurs:

1. Where indicated on the Structural Drawings.

2. As approved by the Structural Engineer prior to construction and after submittal of Drawing showing location, size, and position of each penetration.

B. Cutting or holes:

1. Cut holes through concrete, masonry block or brick floors and floors of structure with a diamond core drill or concrete saw. Pneumatic hammer, impact electric, hand or manual hammer type drills are not allowed, except where permitted by the Structural Engineer as required by limited working space. Obtain the approval of the Structural Engineer prior to drilling through structural sections.
2. Provide sleeves or “can outs” for cast-in-place concrete floors and walls. Following conduit installation, seal all penetrations using non-iron bearing, chloride free, non-shrinking, dry-pack grouting compounds; or fire rated penetration-sealing materials.
3. Cut holes for conduit penetrations through non-concrete and non-masonry walls, partitions, or floors with a hole saw. The hole shall be only as large as required to accommodate the size of the conduit.
4. Provide single piece escutcheon plates around all exposed conduit penetrations in public places.

C. Sealing:

1. Non-rated penetrations: Pack opening around conduits with non-flammable insulating material and seal with gypsum wallboard taping compound.
2. Fire stop: Where conduits, wireways and other electrical raceways pass through fire rated partitions, walls, smoke partitions or floor; install a UL classified fire stop material to provide an effective barrier against the spread of fire, smoke, and gases. Completely fill and seal clearances between raceways and openings with the fire stop material.

D. Waterproofing: At floor, exterior wall, and roof conduit penetrations, completely seal clearances around the conduit and make watertight as specified in Division 07: Sealants and Caulking.

1. Install specified watertight conduit entrance seals at all below grade wall and floor penetrations. Conduits penetrating exterior building walls and building floor slab shall be PVC coated rigid galvanized steel.
2. For roof penetrations furnish and install roof flashing, counter flashing and pitch-pockets as specified under Roofing and Sheet Metal Sections of the Specifications.
3. Provide membrane clamps and cable sealing fittings for any conduit that horizontally penetrates the waterproof membrane.
4. Conduits that horizontally penetrate a waterproof membrane shall fall away from and below the penetration on the exterior side a minimum of two times the conduit diameters.

3.06 CONCEALED IN CONCRETE

A. Install conduits approximately in the center of the slab so that there will be a minimum of 3/4-inch of concrete around the conduits.

B. Installation of conduit in structural concrete that is less than three inches thick is prohibited. Topping slabs, maintenance pads and curbs are exempted.

C. Tie conduits to reinforcing rods or otherwise secure them to prevent sagging or shifting during concrete placement. Run conduit larger than 1-inch trade size, parallel with or at right angles to the main reinforcement; where at right angles to the reinforcement, the conduit shall be close to one of the supports of the slab.

D. Where nonmetallic conduit or tubing is used, raceways must be converted to PVC coated rigid steel conduit before rising above floor.

E. Make couplings and connections watertight.

F. Protect stub-ups from damage where conduits rise from floor slabs. Arrange so curved portion of bends is not visible above the finished slab.

3.07 TERMINATIONS AND JOINTS

A. Use raceway fittings that are of types compatible with the associated raceway and suitable for the use and location. For intermediate steel conduit, use threaded rigid steel conduit fittings except as otherwise indicated.

B. Raceways shall be joined using specified couplings or transition couplings where dissimilar raceway systems are joined.

C. Conduits shall be securely fastened to cabinets, boxes and gutters using two locknuts and an insulating bushing or specified insulated connectors. Where joints cannot be made tight, use bonding jumpers to provide electrical continuity of the raceway system. Where terminations are subject to vibration, use bonding bushings or wedges to assure electrical continuity. Where subject to vibration or dampness, use insulating bushings to protect conductors. Install grounding bushings or bonding jumpers on all conduits terminating at concentric or eccentric knockouts.

D. Conduit terminations exposed at weatherproof enclosures and cast outlet boxes shall be made watertight using specified connectors and hubs.

E. Stub-up connections: Extend conduits through concrete floor for connection to freestanding equipment with an adjustable top or coupling threaded inside for plugs and set flush with the finished floor. Extend conductors to equipment with rigid steel conduit; flexible metal conduit may be used 6 inches above the floor. Where equipment connections are not made under this contract, install screwdriver operated threaded flush plugs with floor.

F. Install specified cable sealing bushings on all conduits originating outside the building walls and terminating in switchgear, cabinets, or gutters inside the building. Install cable sealing bushings or raceway seal for conduit terminations in all grade level or below grade exterior pull, junction, or outlet boxes.

G. Install expansion couplings where any conduit crosses a building separation or expansion joint as follows:

1. Conduits three inches and larger, shall be rigidly secured to the building structure on opposite sides of a building expansion joint and provided with expansion or deflection couplings. Install the couplings in accordance with the Manufacturer's recommendations.

2. Conduits smaller than three inches shall be rigidly secured to the building structure on opposite sides of a building expansion joint with junction boxes on

both sides of the joint. Connect conduits to junction boxes with 15 inches of slack flexible conduit. Flexible conduit shall have a green copper ground-bonding jumper installed. For concrete embedded conduit, use expansion and deflection couplings as specified above for three inches and larger conduits.

H. Use short length (maximum of 6ft) of the appropriate FMC or LFMC conduit for connections to motors and other electrical equipment subject to movement, vibration, misalignment, cramped quarters, or noise transmission. Provide liquidtight flexible metal conduit for installation in exterior locations, moisture or humidity-laden atmosphere, corrosive atmosphere, water hose or spray wash-down operations and locations subject to seepage or dripping of oil, grease, or water. Provide a green ground wire with FMC or LFMC conduit.

3.08 SUPPORTS

A. Provide supports for raceways as specified in Section 260529: Electrical Hangers and Supports.

B. All raceways systems shall be secured to building structures using specified fasteners, clamps and hangers spaced according to the CEC.

C. Support single runs of conduit using one-hole pipe straps. Where run horizontally on walls in damp or wet locations, install "clamp backs" to space conduit off the surface.

D. Multiple conduit runs shall be supported using "trapeze" hangers fabricated from specified construction channel, mounted to 3/8-inch diameter, threaded steel rods secured to building structures. Fasten conduit to construction channel with standard one-hole pipe clamps or the equivalent. Provide lateral seismic bracing for hangers.

E. Individual 1/2" and 3/4" conduits installed above suspended ceilings may be attached to the ceiling's hanger wire using spring steel support clips provided that not more than two conduits are attached to any single support wire.

F. Support exposed vertical conduit runs at each floor level, independent of cabinets or switches to which they run, by means of acceptable supports.

G. Fasteners and supports in solid masonry and concrete:

1. Use steel or malleable iron concrete inserts set in place prior to placing the concrete.
2. After concrete installation:
    a. Steel expansion anchors not less than ¼ inch bolt size and not less than 1-1/8” embedment.
    b. Power set fasteners not less than ¼ inch diameter with depth of penetration not less than three inches.
    c. Use vibration and shock resistant anchors and fasteners for attaching to concrete ceilings.

H. Hollow masonry: Toggle bolts are permitted. Bolts supported only by masonry block are not acceptable.

I. Metal structures: Use machine screw fasteners or other devices specifically designed and approved for the application.

END OF SECTION

SECTION 260533

BOXES

PART 1 - GENERAL

1.01 SUMMARY

A. Work included: Labor, materials, and equipment necessary to complete the installation required for the item specified under this Division, including but not limited to:

1. Wall and ceiling outlet boxes.
2. Pull and junction boxes.

B. Related Work: Consult all other Sections, determine the extent and character of related Work, and properly coordinate Work specified herein with that specified elsewhere to produce a complete installation.

1. Division 08: Access doors. Wall and ceiling access doors.

1.02 REFERENCES

A. Comply with the latest edition of the following applicable Specifications and standards except as otherwise indicated or specified.

1. American National Standards Institute/National Electrical Manufacturer Association:

ANSI/NEMA OS-1;	Sheet-Steel Outlet Boxes, Device Boxes, Covers and Box Supports.
ANSI/NEMA OS-2;	Nonmetallic Outlet Boxes, Device Boxes, Covers and Box Supports.
NEMA 250;	Enclosures for Electrical Equipment (1000 volts maximum).

2. Underwriters Laboratories (UL):

UL 50;	Enclosures for Electrical Equipment.
UL 514A;	Metallic Outlet Boxes.
UL 1773;	Termination Boxes.

1.03 SUBMITTALS

A. Submit in accordance with the requirements of Section 260010: Basic Electrical Requirements, the following items:

1. Data/catalog cuts for each product and component specified herein, listing all physical and electrical characteristics and ratings indicating compliance with all listed standards.
2. Clearly mark on each data sheet the specific item(s) being submitted and the proposed application.
3. Submit Manufacturer's installation instructions.

1.04 QUALITY ASSURANCE

A. All materials, equipment and parts comprising the units specified herein shall be new, unused, and currently under production.

B. Only products and applications listed in this Section may be used on the Project unless otherwise submitted.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Products furnished by the following Manufacturers shall be acceptable if in compliance with all features specified herein and indicated on the Drawings.

1. Outlet and junction boxes:
    a. Spring City Electrical Manufacturing Co.
    b. Thomas & Betts Corp.
    c. Raco, Inc.
2. Cast boxes:
    a. Appleton Electric Co.
    b. Crouse-Hinds.
3. Pullboxes:
    a. Circle AW Products.
    b. Hoffman Engineering Co.

B. Substitutions: Under provisions of Section 260010: Basic Electrical Requirements.

2.02 OUTLET BOXES

A. Standard outlet box:

1. Provide galvanized, one-piece die formed or drawn steel or welded, knockout type box of size and configuration best suited to the application indicated on the Drawings.
2. 4-inch square by 1.5-inch deep shall be minimum box size.
3. ANSI/NEMA OS 1.

B. Cast metal outlet body:

1. Provide 4-inch round, galvanized cast iron alloy with threaded hubs and mounting lugs as required.
2. Provide boxes with cast cover plates of the same material as the box and neoprene cover gaskets.

C. Conduit outlet body: Provide Cadmium plated cast iron alloy, oblong conduit outlet bodies with threaded conduit hubs and neoprene gasket, cast iron covers.

2.03 PULL AND JUNCTION BOXES

A. Sheet metal pull and junction box:

1. Provide standard outlet or concrete ring boxes wherever possible; otherwise use minimum 16-gauge galvanized sheet metal, NEMA 1 boxes, sized to Code

requirements with covers secured by cadmium plated machine screws located 6 inches on centers.

2. ANSI/NEMA OS 1.

B. Cast metal pull and junction box: Provide standard cast malleable iron outlet or device boxes wherever possible; otherwise use cadmium plated, cast malleable iron boxes with bolt-on, interchangeable conduit hub plates with neoprene gaskets.

C. Flush mounted pullboxes and junction boxes: Provide overlapping covers with flush head cover retaining screws, prime coated.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Contractor shall thoroughly examine Project site conditions for acceptance of box installation to verify conformance with Manufacturer and Specification tolerances. Do not commence with installation until all conditions are made satisfactory.

3.02 PREPARATION

A. Install all outlet boxes flush with building walls, ceilings, and floors except where boxes are installed in mechanical and electrical rooms, in cabinetry, above accessible ceilings or where exposed Work is called for on the Drawings.

B. Locate pullboxes and junction boxes in concealed locations above removable ceilings or exposed in electrical rooms, utility rooms or storage areas.

C. Install outlet boxes at the locations and elevations indicated on the Drawings or specified herein. Make adjustments to locations as required by structural conditions and to suit coordination requirements of other trades.

D. Locate switch outlet boxes on the latch side of doorways unless otherwise indicated.

E. Locate outlet boxes above hung ceilings having concealed suspension systems, adjacent to openings for removable recessed luminaires.

F. Do not install outlet boxes back-to-back, separate boxes by at least 6". In fire-rated walls separate boxes by at least 24" and wall stud.

G. Adjust position of outlet boxes in finished masonry walls to suit masonry course lines. Coordinate cutting of masonry walls to achieve neat openings for boxes.

3.03 INSTALLATION

A. Install boxes in accordance with Manufacturer's written instructions, as indicated on Drawings and as specified herein.

B. Locate electrical boxes as indicated on Drawings and as required for splices, taps, wire pulling, equipment connections and Code compliance.

C. Install junction or pullboxes where required to limit bends in conduit runs to not more than 360 degrees or where pulling tension achieved would exceed the maximum allowable for the cable to be installed. Note that these boxes are not indicated on the Drawings.

D. Install raised covers (plaster rings) on all outlet boxes in stud walls or in furred, suspended, or exposed concrete ceilings. Covers shall be of a depth to suit the wall or ceiling finish.

E. Leave no unused openings in any box. Install close-up plugs as required to seal openings.

F. Provide cast metal boxes with gasketed cast metal cover plates where boxes are exposed in damp or wet locations.

G. Welded outlet boxes shall only be used in concealed interior installations.

H. Provide an access panel in permanent ceiling or wall where boxes are installed and will be inaccessible.

I. For boxes mounted in exterior walls, make sure that there is insulation behind outlet boxes to prevent condensation in boxes.

J. For outlets mounted above counters, benches or backsplashes, coordinate location and mounting heights with built-in units. Adjust mounting height to agree with required location for equipment served.

K. Use conduit outlet bodies to facilitate pulling of conductors or to make changes in conduit direction only. Do not make splices in conduit outlet bodies.

L. Add additional sheet rock as necessary to maintain original fire rating of walls where boxes are installed.

M. Install galvanized steel coverplates on boxes in unfinished areas, above accessible ceilings and on surface mounted outlets.

3.04 SUPPORTS

A. Provide boxes installed in metal stud walls with brackets designed for attaching directly to the studs or mount boxes on specified box supports.

B. Mount boxes, installed in suspended ceilings of gypsum board or lath and plaster construction, to 16-gauge metal channel bars attached to main ceiling runners.

C. Support boxes independently of conduit system.

D. Support boxes, installed in suspended ceilings supporting acoustical tiles or panels, directly from the structure above wherever pendant mounted luminaires are to be installed from the box.

E. Support boxes mounted above suspended acoustical tile ceilings, directly from the structure above.

END OF SECTION

SECTION 260553

ELECTRICAL IDENTIFICATION

PART 1 - GENERAL

1.01 SUMMARY

A. Work included: Labor, materials, and equipment necessary to complete the installation required for the item specified under this Division, including but not limited to:

1. Electrical equipment nameplates.
2. Panelboard directories.
3. Wire and cable identification.
4. Junction box identification.
5. Inscribed device coverplates.

B. Related Work: Consult all other Sections, determine the extent and character of related Work, and properly coordinate Work specified herein with that specified elsewhere to produce a complete installation.

1. Division 09: Painting.

1.02 SUBMITTALS

A. Submit in accordance with the requirements of Section 260010: Basic Electrical Requirements, the following items:

1. Data/catalog cuts for each product and component specified herein.
2. Schedules for nameplates to be furnished.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Products furnished by the following Manufacturers shall be acceptable if in compliance with all features specified herein and indicated on the Drawings.

1. Conduit and wire markers:
   a. Thomas & Betts Corp.
   b. Brady.
   c. Griffolyn.
2. Inscription Tape:
   a. Kroy.
   b. Merlin.

B. Substitutions: Under provisions of Section 260010: Basic Electrical Requirements.

2.02 NAMEPLATES

A. Type NP: Engraved, plastic laminated labels, signs, and instruction plates. Engrave stock melamine plastic laminate 1/16-inch minimum thickness for signs up to 20-

square inches or 8-inches in length; 1/8-inch thick for larger sizes. Engraved nameplates shall have white letters and be punched for mechanical fasteners.

B. Color and letter height as specified in Part 3: Execution.

2.03 LEGEND PLATES

A. Type LP: Die-stamped metal legend plate with mounting hole and positioning key for panel mounted operator devices, i.e. motor control pilot devices, hand-off-auto switches, reset buttons, etc.

B. Stamped characters to be paint filled.

2.04 PANELBOARD DIRECTORIES (400 AMP OR LESS)

A. Directories: A 6" x 8" minimum size circuit directory frame and card with clear plastic covering shall be provided inside the inner panel door.

B. Circuit numbering: Starting at the top, odd numbered circuits in sequence down the left-hand side and even numbered circuits down the right-hand side. Multi-section panelboards shall have continuous consecutive circuit numbers, i.e. Section 1 (circuit numbers 1-42), Section 2 (circuit numbers 43-84), Section 3 (circuit numbers 85-126) for all 42-pole panelboards. For 84-pole panelboards the numbering is Section 1 (circuit numbers 1-84), Section 2 (circuit numbers (85-168), etc.

2.05 WIRE AND TERMINAL MARKERS

A. Provide self-adhering, pre-printed, machine printable or write-on, self-laminating vinyl wrap around strips.

B. Blank markers shall be inscribed using the printer or pen recommended by Manufacturer for this purpose.

2.06 CONDUCTOR PHASE MARKERS

A. Colored vinyl plastic electrical tape, 3/4" wide, for identification of phase conductors. Scotch 35 Brand Tape or equal.

2.07 INSCRIBED DEVICE COVERPLATES

A. Coverplate material shall be as specified in Section 262726: Wiring Devices.

B. Methods of inscription: (Unless otherwise noted)

1. Type-on-tape:

a. Imprinted or thermal transfer characters onto tape lettering system.

b. Tape trimmer.

c. Matte finish spray-on clear coating.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Contractor shall thoroughly examine Project site conditions for acceptance of identification device installation to verify conformance with Manufacturer and Specification tolerances. Do not commence with installation until all conditions are made satisfactory.

3.02 NAMEPLATES

A. Installation:
   1. Degrease and clean surfaces to receive nameplates.
   2. Install nameplates parallel to equipment lines.
   3. Secure nameplates to equipment fronts using machine screws.

B. Provide type 'NP' color coded nameplates that present, as applicable, the following information:
   1. Equipment or device designation:
      a. Equipment designations shall conform to the following:
         1) Power source:
            a) Normal - __
            b) Emergency – E
         2) Equipment description:
            a) Main switchboard – MS
            b) 277/480volt distribution board – HD
            c) 277/480volt panelboard – H
            d) 120/208volt distribution board – LD
            e) 120/208volt panelboard – L
            f) Transformer – TX
         3) Floor number where equipment is located – 03
         4) Equipment designation – B
      b. Example: EHD03A
         1) Emergency source.
         2) 277/480volt distribution board.
         3) Floor level 03.
         4) Board designation A
   2. Amperage, KVA or horsepower rating, where applicable.
   3. Voltage or signal system name.
   4. Source of power or control.
   5. Examples:
      a. Boards: EHD03A; 1200A, 277/480volt, 3-phase, 4-wire; Served from EATS03A
      b. Transformers: ETX03A; 150KVA, 480volt primary, 120/208volt, 3-phase, 4-wire secondary; Served from EHD03A; Load Served: EL03A
      c. Disconnects or Individual Motor Starters: EF-1; 20HP; 480volt, 3-phase,3-wire; Served from EHD03A

C. Nameplates for power system distribution equipment and devices are to be black.

D. Nameplates for signal systems equipment and devices are to be black except as follows:

1. Fire alarm and life safety - Red.

E. Minimum letter height shall be as follows:

1. For panelboards, switchboards, etc.: ½ inch letters to identify equipment designation. Use ¼ inch letters to identify voltage, phase, wires, etc.
2. For individual circuit breakers, switches and motor starters in panelboards, distribution boards, and switchboards use 3/8-inch letters to identify equipment designation. Use 1/8-inch letters to identify all other.
3. For individual mounted circuit breakers, disconnect switches, enclosed switches and motor starters use 3/8-inch letters to identify equipment designation. Use 1/8" letters to identify all other.
4. For transformers use ½-inch letters to identify equipment designation. Use ¼-inch letters to identify primary and secondary voltages, etc.
5. For equipment cabinets, terminal cabinets, control panels and other cabinet enclosed apparatus use 3/8-inch letters to identify equipment designation.

3.03 LEGEND PLATES

A. Provide panel-mounted operators devices such as pilot lights, reset buttons, “HAND-OFF-AUTO” switches, etc.

3.04 PANELBOARD DIRECTORIES (400AMP OR LESS)

A. Provide typewritten directories arranged in numerical order denoting loads served by room number or area for each circuit.

B. Verify room numbers or area designation with Project Manager.

C. Mount panelboard directories in a minimum 6" x 8" metal frame under clear plastic cover inside every panelboard.

3.05 WIRE AND CABLE IDENTIFICATION

A. Provide wire markers on each conductor in panelboards, pull boxes, outlet, and junction boxes and at load connection. Identify with branch circuit or feeder number for power and lighting circuits and with control wire number as indicated on equipment Manufacturer's Shop Drawings for control wiring.

B. Provide colored phase markers for conductors as noted in Section 260519: Building Wire and Cable. Apply colored, pressure sensitive plastic tape in half-lapped turns for a distance of 3-inches from terminal points and in boxes where splices or taps are made. Apply the last two laps of tape with no tension to prevent possible unwinding. Do not cover cable identification markings by taping.

3.06 JUNCTION BOX IDENTIFICATION

A. The cover of junction, pull and connection boxes for both power and signal systems, located above suspended ceilings and below ceilings in non-public areas, shall be clearly marked with a permanent ink felt pen. Identify the circuit(s) (panel designation and circuit numbers) contained in each box, unless otherwise noted or specified.

3.07 INSCRIBED DEVICE COVERPLATE

A. General:
   1. Lettering type: Helvetica, 12 point or 1/8" high.
   2. Color of characters shall be black.
   3. Locate the top of the inscription ½" below the top edge of the coverplate.
   4. Inscription shall be centered and square with coverplate.

B. Application:
   1. Provide inscribed coverplates for devices as outlined below:
      a. Recptacles.
      b. Outlets in surface raceways.
      c. Multi-ganged (four or more) switch arrangement.
      d. Special purpose switches, i.e. projection screens, shades, exhaust fans, etc.
   2. Type-on-tape inscriptions shall be provided for the following devices:
      a. Receptacles.
      b. Outlets in surface raceways.
   3. Engraved inscriptions shall be provided for the following devices:
      a. Multi-ganged switches.
      b. Special purpose switches.
   4. Type-on-tape installation:
      a. Tape shall be trimmed to the height of the letters.
      b. Trim tape length to ¼-inch back from each edge of coverplate.
      c. Contractor hands shall be clean or covered with surgical type glove prior to application of tape. Tape installations with visible fingerprints or smudges will not be acceptable.

END OF SECTION

SECTION 260942

DIGITAL LIGHTING CONTROL

PART 1 - GENERAL

1.01 SUMMARY

A. Work included: Labor, materials, and equipment necessary to complete the installation required for the item specified under this Division, including but not limited to:

1. Lighting control modules.
2. Control stations.
3. Occupancy sensors.
4. Daylight sensors.
5. Relay panels.
6. Network communication cabling.
7. Startup and field quality control.
8. Commissioning.

B. Related Work: Consult all other Sections, determine the extent and character of related Work, and properly coordinate Work specified herein with that specified elsewhere to produce a complete installation.

1. Division 25 – Building Automation System (BAS): Lighting control interface.

1.02 REFERENCES

A. Comply with the latest edition of the following applicable Specifications and standards except as otherwise indicated or specified:

1. National Electrical Manufacturer Association (NEMA):

NEMA 250;	Enclosures for Electrical Equipment.
NEMA ICS 1;	Industrial Control and Systems.
NEMA ICS 4;	Terminal Blocks and Industrial use.
NEMA ICS 6;	Enclosures for Industrial Controls and Systems.

2. Underwriters Laboratories, Inc. (UL):

UL 50;	Cabinets and Boxes.
UL 916;	Energy Management.
UL 924	Standard for emergency lighting and power equipment.

1.03 SYSTEM DESCRIPTION

A. A standalone digital lighting control system that interconnects and lighting components such as occupancy and daylight sensors, control stations, etc. to control luminaires connected to the system. All components are locally connected and function independently of any central control software.

B. Control of luminaries will come from distributed control modules capable of "ON/OFF" control and 0-10volt dimming.

C. The lighting control components shall be capable of adjusting their specific parameters such as dimming presets, time delays, etc. per the device type. Handheld or computer-based commissioning tools shall be available during startup to reduce the time required at startup and commissioning. These tools shall be available to the Owner after startup and commissioning.

D. The control system is connected independent of electrical lighting circuits.

E. The system shall utilize either hardwired or wireless components.

1.04 SUBMITTALS

A. Submit in accordance with the requirements of Section 260010: Basic Electrical Requirements, the following items:

1. Data/catalog cuts for each product and component specified herein, listing all physical and electrical characteristics and ratings indicating compliance with all listed standards.
2. Describe system operation, equipment and dimensions and indicate features of each component.
3. Clearly mark on each data sheet the specific item(s) being submitted and the proposed application.
4. Furnish structural calculations for equipment anchorage as described in Section 260010: Basic Electrical Requirements.
5. Submit Manufacturer's installation instructions.
6. Complete bill of materials listing all components.
7. Warranty.

1.05 OPERATION AND MAINTENANCE MANUAL

A. Supply operation and maintenance manuals in accordance with the requirements of Section 260010: Basic Electrical Requirements to include the following:

1. Operation and maintenance manuals shall include the following:
   a. A detailed explanation of the operation of the system.
   b. Instructions for routine maintenance.
   c. Pictorial parts list and part numbers.
2. Telephone numbers for the authorized parts and service distributors.
3. Final testing report.

1.06 QUALITY ASSURANCE

A. All materials, equipment and parts comprising the units specified herein shall be new, unused, and currently under production.

B. Only products and applications listed in this Section may be used on the Project unless otherwise submitted.

1.07 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Delivery: Digital lighting control components shall not be delivered to the Project site until protected storage space is available. Storage outdoors covered by rainproof material is not acceptable. Equipment damaged during shipment shall be replaced and returned to Manufacturer at no cost to Owner.

B. Storage: Store in a clean, dry, ventilated space free from temperature extremes. Maintain factory wrapping or provide a heavy canvas/plastic cover to protect units from dirt, water, construction debris and traffic. Provide heat where required to prevent condensation.

C. Handling: Handle in accordance with Manufacturer's written instructions. Be careful to prevent internal component damage, breakage, denting and scoring. Damaged units shall not be installed. Replace damaged units and return equipment to Manufacturer.

1.08 WARRANTY

A. Units and components offered under this Section shall be covered by a minimum 2-year parts and labor warranty for malfunctions resulting from defects in materials and workmanship. Warranty shall begin upon acceptance by the Owner.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Products furnished by the following Manufacturers shall be acceptable if in compliance with all features specified herein and indicated on the Drawings.

1. Network addressable lighting control system:

a. Wattsopper “DLM”.

b. Acuity “nLight”.

c. Douglas “Dialog”.

d. ETC “Echo”.

e. Eaton “Greengate Room Controller”.

B. Substitutions: Under provisions of Section 260010: Basic Electrical Requirements.

2.02 GENERAL

A. The lighting control system shall be standalone with no central control software. Lighting components shall tie together and communicate directly with each other as required for the device type.

B. Control stations, occupancy sensors, and daylight sensors shall tie into dimming and relay modules to control luminaires.

C. The control parameters shall be set within each device, either as dip switches or dials on the device itself or with handheld or computer-based commissioning tools. The parameters remain set until they are manually changed.

D. Daylight sensors shall rationalize changes to light levels when daylight is available and shall maintain a steady light level when subjected to fluctuating ambient conditions.

E. Where required in a sequence of operation an astronomical time clock function shall be integrated into the control modules or relay panels.

F. During an emergency condition (loss of normal power), the system shall not impede the emergency lighting to function properly, i.e. the control system shall control emergency lighting to turn on at full light output and lock out user controls.

G. The control system shall allow occupancy sensor, when relaying a vacant status to either turn lights off or dim lights to a preset level.

H. The control system components shall comply with the latest edition of the California Building Energy Efficiency Standards, California Building Code, Part 6 and be certified by The California Energy Commission.

2.03 LIGHTING CONTROL MODULES

A. General:

1. Lighting control modules provide an interface between the control system and luminaires. Modules take inputs from the system and convert the commands through the power and control wiring to the fixture providing “ON/OFF/DIMMING” functions.

2. Lighting control modules contain a 16amp minimum rated relay(s) for “ON/OFF” control as well as a 0-10volt dimming signal.

3. In the event of a power failure, control modules connected to luminaires shall default to the “on” state at full light output.

B. The following lighting control modules shall be available with the system, at a minimum:

1. Single zone 0-10volt control module with a relay.

2. Multi-zone 0-10volt control module with one relay per 0-10volt zone (“Room Controller”).

C. Mounting:

1. Single zone modules shall have a ½” nipple to mount directly to a ½” knockout on a junction box.

2. Multi-zone modules shall mount stand alone or onto a 4 square junction box.

2.04 CONTROL STATIONS

A. General:

1. The controllers are configurable wall mounted devices that provide local “ON/OFF/DIMMING” control to lighting zones.

2. Each device can be set-up and modified through the control systems software interface.

B. Dimmer switch controller:

1. Software configurable dimmer switch that provides “ON/OFF” switching and the capability to dim.

2. Dimming to be continuous over the full range of the driver or ballast it is controlling.

C. Dimming scene controller:

1. Multi-button controller allowing the end user to recall zones or scenes for “ON/OFF/DIMMING” control.
2. Scenes are made up of multiple zones, where each zone is dimmed to a specific light output.
3. Scene configuration can be changed via control systems software.
4. The scene controller shall also allow for a custom labeling feature that allows scene labels on the controller to be easily modified.

D. Specifics:

1. Mounting:
   a. Controllers utilize a standard single-gang device strap configuration for ease in mounting. Where multiple controllers are ganged together, they shall allow for a single multi-gang cover plat to be used.
   b. Mounts to standard switch box or cut-in ring.
2. Controllers shall tie to the system in one of the following ways:
   a. Hardwired low voltage, wiring and connections per manufacturer’s requirements.
   b. Wireless with a 10-year minimum battery life. Mechanically triggered wireless switches shall not be allowed unless approved by The Owner.

2.05 OCCUPANCY SENSOR

A. General:

1. Occupancy sensors shall automatically detect movement within a space, reporting the state of occupancy to the control modules for “ON/OFF/DIMMING” control of lighting zones and “ON/OFF” control of the controlled receptacle circuits within that space.
2. All setpoints for the occupancy sensor shall be accessible on the device or through the commissioning tool.
3. Sensors shall capable of being linked together via hard wired connections to provide a larger coverage area.
4. Provide enough occupancy sensors as required for complete area coverage they are installed in, regardless of how many sensors are shown on the Drawings.

B. Specifics:

1. Sensor shall have a coverage of 1,000 square feet. Manufacturer to provide additional sensors if coverage is less than 1,000 square feet.
2. Sensors shall be infrared or dual technology or microphonic. Dual technology sensors shall be capable of disabling either infrared or ultrasonic sensing.

2.06 DAYLIGHT SENSOR

A. General:

1. Daylight sensors shall automatically measure the amount of ambient light within a space, reporting the state of occupancy to the control modules for “ON/OFF/DIMMING” control of lighting zones.

2. Setpoints for the sensors shall be adjusted directly on the device or through commissioning tool. The setpoints refer to the range at which electric lighting will dim in response to the amount of light the sensor detects.
3. Daylight sensors shall continuously monitor the ambient light level.
4. Interior daylight sensors shall operate on a “closed loop” protocol, measuring both daylight and electric light contributions.
5. Exterior daylight sensors shall operate on an “open loop” protocol, measuring only daylight contributions.

B. Specifics:

1. Sensor shall mount directly to any surface, no junction box required.
2. Integrated sensors on luminaires shall be installed at the lighting manufacturer’s factory.
3. Sensors shall tie to the system in one of the following ways:
   a. Hardwired low voltage, wiring and connections per manufacturer’s requirements.
   b. Wireless with a 10-year minimum battery life.
4. Exterior sensors shall be outdoor rated.

2.07 RELAY PANEL

A. Addressable relay panel that fully integrates with the addressable control system, consisting of individual relays, control module, power supplies, network connection interface, etc.

B. Cabinet: NEMA 1 enclosure sized to accept the quantity of relays as noted on the Drawings.

C. Control relays: Heavy-duty momentary pulsed mechanically latching contactors. Operating voltage is 24volt AC; contacts are rated at 20amp at 120 or 277volt AC. Power supply: 120/277volt AC input transformer with 24volt AC, 60Hz, 1.6amp (40 VA) Class II power supplies output.

D. Network connection: Per manufacturer.

E. Panel shall be UL924 rated. Systems which integrate a UL924 sensing module for the entire panel or system shall not require the panel to be UL924 rated.

F. Panel shall allow for barriers between voltage classes, 120volt, 277volt, normal, and emergency.

2.08 DEVICE COMMUNICATION CABLING

A. General:

1. The device communication cabling integrates devices such as occupancy sensors, photocell sensors, control modules and control stations with each other to provide a complete standalone system.
2. The network communication cabling provides low-voltage power to all devices on the network, eliminating the need for external power supplies and power packs

for devices such as occupancy sensors. Where a device requires 120volt power it shall be noted on the submittal.

3. Cabling shall be topology free.
4. Cabling shall be plenum rated.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Contractor shall thoroughly examine Project site conditions for acceptance of low-voltage lighting control installation to verify conformance with Manufacturer and Specification tolerances. Do not commence with installation until all conditions are made satisfactory.

3.02 INSTALLATION

A. Install the addressable lighting control system in accordance with the Manufacturer's written instructions, as indicated on the drawings and as specified herein.

B. Locate relay panel(s) where indicated on the plans.

C. All interior luminaires shall be controlled via the control system unless otherwise noted on the plans. Refer to the drawing symbols list for the differentiation between networked luminaire devices and standalone devices.

3.03 OCCUPANCY SENSOR

A. Occupancy sensors shall be placed in a location that provides maximum coverage and minimizes false positives such as being triggered through an open door.

B. Refer to the architectural RCPs and locate sensors as shown or if not shown, locate in line with other ceiling devices while still maximizing area coverage.

C. Where the coverage of a sensor is inadequate for the space it is being installed in, the manufacturer shall provide additional sensors for the contractor to install. The cost of these sensors and installation shall be included at the time of bid.

3.04 DAYLIGHT SENSORS

A. Locate daylight sensors per the manufacturer’s requirements in order to provide accurate electric and daylight light levels.

B. Coordinate the final location of the sensor with other devices in the area.

3.05 CONTROL MODULES

A. Install all control modules per the shop drawings and manufacturer’s requirements. Ensure devices are in an accessible location. Avoid locations where the devices are visible to the public.

3.06 AUXILIARY DEVICES

A. Where devices, not covered under these Division 26 specifications, are required to provide a complete lighting control system, furnish and install such devices per the manufacturer’s instructions.

3.07 STARTUP AND FIELD QUALITY CONTROL

A. General:

1. All work related to the startup of the addressable lighting control system shall be by a factory-authorized agent of the Manufacturer of the system along with the assistance of the electrical contractor.
2. All programming, testing, trouble shooting, etc. shall be included in this contract.

B. Prefunctional resting:

1. Visual and mechanical inspection:
   a. Inspect for physical damage, defects alignment and fit.
   b. Perform mechanical operational tests in accordance with Manufacturer's instructions.
   c. Compare nameplate information and connections to Contract Documents.
   d. Check tightness of all control and power connections.
   e. Check that all covers, barriers, and doors are secure.
2. Contractor shall provide all necessary programming assistance to set up and program the lighting control parameters.
3. Electrical tests:
   a. The system shall be completely tested in accordance with operational parameters, tolerances, and Manufacturer's instructions. Any problem shall be documented and corrected.
   b. Test all control circuits and verify proper operation of all lighting circuits throughout the control system.
   c. Ensure the lighting zone controls match that of the Contract Documents.
   d. Verify the proper integration with the mechanical control system for override control and monitoring of low-voltage lighting control system.
   e. Provide a complete report listing every device, the date it was tested, the results and the date retested (if failure occurred during the previous test). The test report shall indicate that every device tested successfully.

C. Contractor shall replace at no costs to the Owner all devices which are found defective or do not operate within factory specified tolerances.

D. Contractor shall submit the testing final report for review prior to Project closeout and final acceptance by the Owner. Test report shall indicate test dates, devices tested, results, observation, deficiencies, and remedies. Test report shall be included in the operation and maintenance manuals.

3.08 COMMISSIONING

A. General:

1. Once startup of the system is complete and no defects to the system are detected the commissioning process shall begin; furthermore, it is acceptable to program the system per the commissioning requirements during the startup phase.

2. All work related to the commissioning of the digital lighting controls shall be by the electrical contractor or by a factory-authorized agent of the Manufacturer of the system.
3. At least three weeks prior to any commissioning verification, notify the Engineer so that arrangement can be made for witnessing test, if deemed necessary. All pretesting shall have been tested satisfactorily prior to the Engineer's witnessed test.

B. Occupancy sensors:
1. All occupancy sensors shall have a sensitivity appropriate for the space. Contractor shall be responsible for testing the sensitivity of the sensor in the space and adjusting as needed.
2. Where no direction is provided in a sequence of operation or by the owner set the occupancy sensor timeout to 15 minutes.

C. Daylight sensors:
1. Where no direction is provided in a sequence of operation or by the owner, the daylight sensor setpoint to dim the electric light should be at 150% of the maximum electric light output.

D. Scene controllers:
1. Where no scenes have been described in a sequence of operation or by the owner the contractor shall provide the following scenes as appropriate for the space:
a. Scene 1: All luminaires on at 100%
b. Scene 2: Luminaires near screen displays off, all other luminaires on at 75%.
c. Scene 3: All indirect luminaires off, all direct luminaires on at 100%.
d. Scene 4: All direct luminaires off, all indirect luminaires on at 100%.
e. Scene 5: All luminaires off.

E. Time schedules:
1. All time schedules required shall be done through an astronomical time clock integral to the devices and equipment. The building location and date shall be programmed to ensure proper time schedule functions.
2. If no sequence of operations is provided program time schedules as follows:
a. Interior spaces: Per owner’s direction, do not assume hours of operation.
b. Exterior spaces: on 30 minutes before sunset, and off 30 minutes after sunrise.

F. Contractor shall be responsible for all acceptance testing requirements related to the lighting control system as outlined in the California Energy Code Title 24 Part 6.

3.09 TRAINING

A. Factory authorized service representative shall conduct a 1-hour training session for Owner's Representatives upon completion and acceptance of system. Instruction shall include operation, programming, and maintenance of equipment.

B. Contractor shall schedule training with a minimum of 7 days advanced notice.

END OF SECTION

SECTION 262416

PANELBOARDS

PART 1 - GENERAL

1.01 SUMMARY

A. Work included: Labor, materials, and equipment necessary to complete the installation required for the item specified under this Division, including but not limited to:

1. Branch circuit panelboards.
2. Distribution panelboards (400amps to 800amps).

B. Related Work: Consult all other Sections, determine the extent and character of related Work, and properly coordinate Work specified herein with that specified elsewhere to produce a complete installation.

1.02 REFERENCES

A. Comply with the latest edition of the following applicable Specifications and standards except as otherwise indicated or specified.

1. National Electrical Manufacturers Association (NEMA):

NEMA AB 1;	Molded Case Circuit Breakers.
NEMA PB 1;	Panelboards.
NEMA PB 1.1;	General Instructions for Proper Installation, Operation, and Maintenance of Panelboards Rated 600 Volts or Less.

2. Underwriters Laboratories, Inc. (UL):

UL 67;	Panelboards.
UL 486E;	Equipment Wiring Terminals for Use with Aluminum and/or Copper Conductors.
UL 489;	Molded-Case Circuit Breakers, Molded-Case Switches and Circuit Breaker Enclosures.
UL 870;	Wireways, Auxiliary Gutters and Associated Fittings.

1.03 SUBMITTALS

A. Submit in accordance with the requirements of Section 260010: Basic Electrical Requirements, the following items:

1. Data/catalog cuts for each product and component specified herein, listing all physical and electrical characteristics and ratings indicating compliance with all listed standards
2. Clearly mark on each data sheet the specific item(s) being submitted and the proposed application.
3. Shop Drawings: Include elevations, cabinet dimensions, gutter sizes, layout of contactors, relays, time clocks, lug sizes, bussing diagrams; make, location and

capacity of installed equipment; mounting style; finish and panelboard nameplate inscription.

4. Furnish structural calculations for equipment anchorage as described in Section 260010: Basic Electrical Requirements.
5. Submit Manufacturer's installation instructions.
6. Complete bill of material listing all components.
7. Warranty.

B. Dimensions and configurations of panelboards shall conform to the spaces allocated on the Drawings for their installation. The Contractor shall include with the submittal a layout of the electrical room if it differs from construction documents for review and approval by the Engineer prior to release of order.

1.04 OPERATION AND MAINTENANCE MANUAL

A. Supply operation and maintenance manuals in accordance with the requirements of Section 260010: Basic Electrical Requirements, to include the following:

1. A detailed explanation of the operation of the system.
2. Instructions for routine maintenance.
3. Pictorial parts list and parts number.
4. Telephone numbers for authorized parts and service distributors.
5. Final testing reports.

1.05 QUALITY ASSURANCE

A. All materials, equipment and parts comprising the units specified herein shall be new, unused, and currently under production.

B. Only products and applications listed in this Section may be used on the Project unless otherwise submitted.

1.06 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Delivery: Panelboard components shall not be delivered to the Project site until protected storage space is available. Storage outdoors covered by rainproof material is not acceptable. Equipment damaged during shipment shall be replaced and returned to Manufacturer at no cost to Owner.

B. Storage: Store in a clean, dry, ventilated space free from temperature extremes. Maintain factory wrapping or provide a heavy canvas/plastic cover to protect units from dirt, water, construction debris and traffic. Provide heat where required to prevent condensation.

C. Handling: Handle in accordance with NEMA PB1.1 and Manufacturer's written instructions. Be careful to prevent internal component damage, breakage, denting and scoring. Damaged units shall not be installed. Replace damaged units and return equipment to Manufacturer.

1.07 WARRANTY

A. Units and components offered under this Section shall be covered by a 1-year parts and labor warranty for malfunctions resulting from defects in materials and workmanship. Warranty shall begin upon acceptance by the Owner.

1.08 EXTRA MATERIAL

A. Turn over two (2) sets of panelboard keys to the Owner at completion of Project. All panelboards shall be keyed alike.

B. Provide one spray can of matching finish paint for touching up damaged surfaces after installation.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Products furnished by the following Manufacturers shall be acceptable if in compliance with all features specified herein and indicated on the Drawings.

1. ABB/ General Electric.
2. Eaton.
3. Siemens.
4. Square D

B. Substitutions: Under provisions of Section 260010: Basic Electrical Requirements.

2.02 PANELBOARDS - GENERAL

A. Enclosure:

1. Cabinets shall be NEMA Type 1 enclosure, door, and trim of code gauge galvanized steel.
2. Panelboard covers shall be door-in-door construction such that inner door exposes the overcurrent protective devices and the outer door exposes the complete panelboard interior (i.e. branch circuit conductors, lugs, neutral and ground bus, overcurrent protective devices, etc.). Outer door shall have full-length piano hinge and inner door shall have two-point hinges.
3. Provide combination spring catch and lock on inside edge of the inner door trims with flush fitting joint between door and trim. Locks on all panelboards shall be keyed alike. Doors 36 inches and over in height shall be provided with three-point catch and lock. Provide quarter-turn captive bolts on the outer door.

B. Bus assembly and terminations:

1. Bus shall be bolted copper with taps arranged for distributed phase connections to branch circuit devices
2. Cross connectors shall be copper, drilled and tapped for bolt-on device connections, arranged for double row placement of device and designed to permit removal or addition of overcurrent protection devices without disturbing adjacent devices or removing main bus connections.
3. Neutral bus shall be 100 percent rated of phase bus bars and shall have lugs for each outgoing branch circuit or feeder requiring a neutral connection unless otherwise noted.

4. Ground bus shall be full size with lugs for each outgoing branch circuit and feeder.
5. Refer to panelboard schedules on Drawings for bus rating. Bus rating shall match or be greater than main device or main lug rating.
6. As a minimum, bus bars shall be rated 10,000 AIC for 120/208volt panelboards and 14,000 AIC for 277/480volt panelboards. Unless otherwise noted.
7. Provide full sized bussing in all sections of multi-section panelboards.
8. No panelboard section shall have greater than 42 poles.
9. Termination Lugs: Rated for use with aluminum/copper conductors.
10. All "SPACES" shall be ready for installation of future overcurrent protective device.

C. Miscellaneous requirements:
1. Circuit numbering: Starting at the top, indicate odd numbered circuits in sequence down the left-hand side and even numbered circuits down the right-hand side. Multi-section panelboards shall have continuous consecutive circuit numbers, i.e. Section 1 (circuit numbers 1 to 42), Section 2 (circuit numbers 43 to 84), Section 3 (circuit numbers 85 to 126). Provide metal embossed circuit identification of panelboards.
2. Directories: A 6" x 8" minimum size circuit directory frame and card with clear plastic covering shall be provided inside the inner panelboard door to reflect conditions at completion of Work. Directory shall be typewritten denoting loads served by room number or area for each circuit.
3. Nameplates: Provide engraved nameplate for each panelboard. See Section 260533: Electrical Identification for requirements.

D. Refer to Panelboard Schedules for the following:
1. Mounting style; service voltage; terminal lug size, location, and quantity; bus ampacity; interrupting capacity of bus and breakers; quantity, poles and rating of overcurrent protective devices.

E. Overcurrent protective devices:
1. Refer to Section 262816: Overcurrent Protection Devices.
2. Overcurrent protective devices shall be molded case circuit breakers.
3. Main devices shall be hard bus connected to the panelboard bus bars.
4. In all cases, panelboards fed directly from a transformer shall have a main overcurrent protective device. If not indicated on the Drawings or Panelboard Schedules, provide this device sized to provide the full capacity of the transformer rating.
5. Main devices shall be vertically mounted and shall have their operating handle in the up position when energized. Main devices that are mounted in the same manner as the branch devices are NOT acceptable, i.e. main devices shall be individually mounted at the top or bottom of the phase bus bars.

6. Panelboards overcurrent protective devices layout shall conform to the layout indicated on the panelboard schedules.
7. Provide handle ties for single pole circuit breakers that share a neutral conductor.

F. Finish: Five step zinc phosphate pre-treatment, one coat of rust inhibiting dichromate primer and one coat of baked-on enamel finish, ANSI 61 (light gray).

2.03 DISTRIBUTION PANELBOARDS

A. Enclosures shall be sized as required and shall meet the space restriction allocated on Drawings. Panelboard shall comply with NEMA PB 1.

B. Provide necessary hardware to permit locking every overcurrent protective device handle in the "OFF" position.

C. Where "SPACE" is indicated on panelboard schedules or Drawings, install cross connectors and mounting hardware to match the frame size ampere rated noted.

2.04 BRANCH CIRCUIT PANELBOARDS

A. Enclosure shall be 20" wide x 5-3/4" deep, surface or flush mounted and shall comply with NEMA PB 1.

B. Flush panelboards mounted adjacent to each other shall be same physical size.

C. Where "SPACE" is indicated on panelboard schedules or Drawings, install minimum 100amp branch circuit cross connectors and mounting hardware. For future device spaces larger than 100amps, cross connectors shall match the frame size ampere rated noted.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Contractor shall thoroughly examine Project site conditions for acceptance of panelboard installation to verify conformance with Manufacturer and Specification tolerances. Do not commence with installation until all conditions are made satisfactory.

B. Where panelboards are shown to be flush mounted in walls, the contractor shall insure that 6” deep studs are employed in wall construction to accommodate the 5-3/4” deep panelboard enclosure.

3.02 INSTALLATION

A. Install panelboards in accordance with Manufacturer's written instructions, as indicated on the Drawings and as specified herein.

B. Set panels plumb and symmetrical with building lines in conformance with PB1.1. Furnish and install all construction channel bolts, angles, etc., required to mount the equipment furnished under this Section.

C. Mounting height shall be 6 feet.

D. Panelboards shall be anchored and braced to withstand seismic forces as calculated per Section 260010: Basic Electrical Requirements.

E. Provide mounting hardware brackets, busbar drillings and filler pieces for all unused spaces.

F. "Train" interior wiring; bundle and clamp, using specified plastic wire wraps specified under Section 260519: Building Wire and Cable.

G. Replace panel pieces, doors or trim exhibiting dents, bends, warps, or poor fit that may impede ready access, security, or integrity.

H. Conduits terminating in concentric, eccentric, or oversized knockouts at panelboards shall have ground bushings and bonding jumpers installed interconnecting all such conduits and the panelboard.

I. Check and tighten all bolts and connections with a torque wrench using Manufacturer's recommended values.

J. Visually inspect panelboard for rust and corrosion. If signs of rust and corrosion are present, restore or replace panelboard to new condition.

K. In damp and wet locations, mount panelboards with a minimum one inch of air space between cabinet and the wall or other support material.

L. Provide close up plugs in all unused openings in the cabinet.

M. Field install handle ties on single pole circuit breakers that share a neutral conductor.

N. Circuit breakers feeding "Fire Alarm Control Panel(s)" shall be red in color.

3.03 FIELD QUALITY CONTROLS

A. Independent testing: Contractor shall arrange and pay for the services of an independent Testing Agency to perform all quality control electrical testing, calibration and inspection required herein. Testing Agencies objectives shall be to:

1. Assure panelboard installation conforms to specified requirements and operates within specified tolerances.
2. Field test and inspect to ensure operation in accordance with Manufacturer's recommendations and Specifications.
3. Prepare final test report including results, observations, failures, adjustments, and remedies.
4. Apply label on panelboards upon satisfactory completion of tests and results.
5. Verify ratings and settings and make final adjustments.

B. At least three weeks prior to any testing, notify the Engineer so that arrangement can be made for witnessing test, if deemed necessary. All pretesting shall have been tested satisfactorily prior to the Engineer's witnessed test.

C. The Contractor shall supply a suitable and stable source of electrical power to each test site. The Testing Agency shall specify the specific power requirements.

D. Testing of overcurrent protective devices shall be done only after all devices are installed and system is energized.

E. Prefunctional testing:

1. Provide Testing Agency with Contract Documents and Manufacturer instructions for installation and testing.
2. Visual and mechanical inspection:
   a. Inspect for physical damage, defects alignment and fit.

b. Perform mechanical operational tests in accordance with Manufacturer's instructions.

c. Compare nameplate information and connections to Contract Documents.

d. Check tightness of all power connections.

e. Check that all covers, barriers, and doors are secure.

3. Electrical tests:

a. Insulation resistance: 1000volt DC tests for one minute on all 600volt and lower rated equipment, components, buses, feeder and branch circuits and control circuits. Test phase-to-phase and phase-to-ground circuits showing less than 10-megohms resistance to ground shall be repaired or replaced.

b. Circuit continuity: All feeders shall be tested for continuity. All neutrals shall be tested for improper grounds.

c. Ground resistance: Test resistance to ground of system and equipment ground connection.

d. Test overcurrent protection devices per Section 262816: Overcurrent Protective Devices.

F. In the event that the system fails to function properly during the testing as a result of inadequate pretesting or preparation. The Contractor shall bear all costs incurred by the necessity for retesting including test equipment, transportation, subsistence, and the Engineer's hourly rate.

G. Contractor shall replace at no costs to the Owner all devices which are found defective or do not operate within factory specified tolerances.

H. Contractor shall submit the Testing Agency's final report for review prior to Project closeout and final acceptance by the Owner. Test report shall indicate test dates, devices tested, results, observation, deficiencies, and remedies. Test report shall be included in the operation and maintenance manuals.

3.04 CLEANING

A. Prior to energizing of panelboards, the Contractor shall thoroughly clean the interior of enclosure of all construction debris, scrap wire, etc. using Manufacturer's approved methods and materials.

B. Upon completion of Project prior to final acceptance the Contractor shall thoroughly clean both the interior and exterior of panelboards per Manufacturers approved methods and materials. Remove paint splatters and other spots, dirt, and debris.

C. Touch-up paint any marks, blemishes or other finish damage suffered during installation.

END OF SECTION

SECTION 262716

CABINETS AND ENCLOSURES

PART 1 - GENERAL

1.01 SUMMARY

A. Work included: Labor, materials, and equipment necessary to complete the installation required for the item specified under this Division, including but not limited to:

1. Hinged cover enclosures.
2. Cabinets.

B. Related Work: Consult all other Sections, determine the extent and character of related Work, and properly coordinate Work specified herein with that specified elsewhere to produce a complete installation.

1.02 REFERENCES

A. Comply with the latest edition of the following applicable Specifications and standards except as otherwise indicated or specified:

1. National Electrical Manufacturer's Association (NEMA):

NEMA 250;	Enclosures for Electrical Equipment.
NEMA ICS 1;	Industrial Control and Systems.
NEMA ICS 4;	Terminal Blocks and Industrial use.
NEMA ICS 6;	Enclosures for Industrial Controls and Systems.

2. Underwriters Laboratories (UL):

UL 50;	Enclosures for Electrical Equipment.
UL 65;	Standards for Wired Cabinets.
UL 1059;	Terminal Blocks.
UL 1773;	Termination Boxes.

1.03 SUBMITTALS

A. Submit in accordance with the requirements of Section 260010: Basic Electrical Requirements, the following items:

1. Data/catalog cuts for each product and component specified herein, listing all physical and electrical characteristics and ratings indicating compliance with all listed standards.
2. Describe Project construction, material, finish, and any specific features of each component.
3. Clearly mark on each data sheet the specific item(s) being submitted and the proposed application.
4. Submit Manufacturer's installation instructions.

5. Furnish structural calculations for equipment anchorage as described in Section 260010: Basic Electrical Requirements.

1.04 QUALITY ASSURANCE

A. All materials, equipment and parts comprising the units specified herein shall be new, unused, and currently under production.

B. Only products and applications listed in this Section may be used on the Project unless otherwise submitted.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Products furnished by the following Manufacturers shall be acceptable if in compliance with all features specified herein and indicated on the Drawings.

1. Hoffman Engineering Co.

2. Circle AW Products.

B. Substitutions: Under provisions of Section 260010: Basic Electrical Requirements.

2.02 CABINETS AND ENCLOSURES

A. Construction: Shall be code gauge galvanized steel with standard concentric knockouts for conduit terminations. Size shall be as indicated on Drawings. Cabinet shall be NEMA 250 Type 1.

B. Finish: Manufacturer's standard gray baked enamel finish.

C. Covers: Continuous hinged steel door, lockable and keyed to match panelboard locks.

D. Mounting:

1. Flush cabinets shall be furnished with concealed trim clamps and shall be not less than 4 inches deep.

2. Surface cabinets shall be furnished with screw cover trim, flush hinged door and shall not be less than 6 inches deep.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Contractor shall thoroughly examine Project site conditions for acceptance of cabinets and enclosures installation to verify conformance with Manufacturer and Specification tolerances. Do not commence with installation until all conditions are made satisfactory.

3.02 INSTALLATION

A. Set cabinets and enclosures plumb and symmetrical with building lines. Furnish and install all construction channel bolts, angles, etc. required to mount all equipment furnished under this Section of the Specifications.

B. Cabinets and enclosures shall be anchored and braced to withstand seismic forces calculated in accordance with that referenced in Section 260010: Basic Electrical Requirement.

C. "Train" interior wiring, bundle and clamp using specified plastic wire wraps.

D. Replace doors or trim exhibiting dents, bends, warps, or poor fit that may impede ready access, security, or integrity.

E. Terminate conduit in cabinet with lock nut and grounding bushing.

F. Terminate wiring on terminal blocks and identify each with heat shrink tags.

3.03 CLEANING

A. Touch-up paint any marks, blemishes, or other finish damage suffered during installation.

B. Vacuum clean cabinet on completion of installation.

END OF SECTION

SECTION 262726

WIRING DEVICES

PART 1 - GENERAL

1.01 SUMMARY

A. Work included: Labor, materials, and equipment necessary to complete the installation required for the item specified under this Division, including but not limited to:

1. Wall switches.
2. Occupancy/vacancy sensors, including wallbox and ceiling mounted.
3. Time switches.
4. Receptacles.
5. Floor mounted service boxes.
6. Coverplates.

B. Related Work: Consult all other Sections, determine the extent and character of related Work, and properly coordinate Work specified herein with that specified elsewhere to produce a complete installation.

1.02 REFERENCES

A. Comply with the latest edition of the following applicable Specifications and standards except as otherwise indicated or specified.

1. National Electrical Manufacturer's Association (NEMA):

NEMA WD-1;	General-Purpose Wiring Devices.
NEMA WD-2;	Semiconductor Dimmers for Incandescent Lamps.
NEMA WD-5;	Specific-Purpose Wiring Devices.
NEMA SSL 7A;	Phase-Cut Dimming for Solid State Lighting

2. Underwriter's Laboratories (UL):

UL 20	General-Use Snap Switches.
UL 231;	Power Outlets.
UL 310;	Electrical Quick-Connect Terminals.
UL 498;	Attachment Plugs and Receptacles.
UL 514A;	Metallic Outlet Boxes.
UL 514D;	Cover Plates for Flush-Mounted Wiring Devices.
UL 943;	Ground-Fault Circuit-Interrupters.
UL 1681;	Wiring Device Configurations.

1.03 SUBMITTALS

A. Submit in accordance with the requirements of Section 260010: Basic Electrical Requirements, the following items:
   1. Data/catalog cuts for each product and component specified herein, listing all physical and electrical characteristics and ratings indicating compliance with all listed standards.
   2. Clearly mark on each data sheet the specific item(s) being submitted and the proposed application.
   3. Provide color finishes for Architect to select from.
   4. Submit Manufacturer's installation instructions.

B. Where inscribed device coverplates are noted on the Drawings or in the Specifications, conform to the requirements of Section 260553: Electrical Identification.

1.04 QUALITY ASSURANCE

A. All materials, equipment and parts comprising the units specified herein shall be new, unused, and currently under production.

B. Only products and applications listed in this Section may be used on the Project unless otherwise submitted.

1.05 WARRANTY

A. Occupancy sensors offered under this Section shall be covered by a 1-year parts and labor warranty for malfunctions resulting from defects in materials and workmanship. Warranty shall begin upon acceptance by the Owner.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Products furnished by the following Manufacturers shall be acceptable if in compliance with all features specified herein and indicated on the Drawings.
   1. Switches, receptacles and coverplates:
      a. Hubbell.
      b. Pass & Seymour.
      c. Leviton.
   2. Occupancy/vacancy sensors switches, time switches:
      a. Cooper Controls “Greengate”
      b. Wattstopper
      c. Leviton
      d. SensorSwitch, Inc.
      e. Hubbell Building Automation, Inc.
   3. Floor mounted service boxes:
      a. Hubbell.
      b. Walker.

B. Substitutions: Under provisions of Section 260010: Basic Electrical Requirements.

2.02 WALL SWITCHES

A. Standards: Provide general-purpose 120/277volt AC switches that conform to NEMA WD-1 Specifications.

B. Color: Device color shall be white or as selected by the Architect, unless otherwise noted.

C. Wall switches:

1. Provide twenty amperes, 120/277volt, Specification grade, toggle handle style, quick-make slow-break, quiet type snap switch with silver cadmium alloy contacts, binding head terminal screws, back and side wired with totally enclosed case.

2. Single-pole, single-throw switches: Hubbell #1221 series, Pass & Seymour #20AC1 series or Leviton #1221 series.

3. Three-way switches: Hubbell #1223 series, Pass & Seymour #20AC3 series or Leviton #1223 series.

2.03 OCCUPANCY/VACANCY SENSOR SWITCHES

A. Occupancy sensors: automatic on, automatic off.

B. Vacancy sensors: manual on, automatic off.

C. General:

1. Occupancy sensors shall comply with the latest edition of the California Building Energy Efficiency Standards, California Building Code, Part 6 and be certified by The California Energy Commission. All sensors shall be listed in the most current directory of Certified Occupancy Sensing Devices or be on file with the CEC.

2. Sensors shall be dual-technology type infrared/ultrasonic or infrared/microphonic or as specified herein.

3. Neutral connection required. Sensors that rely on ground leakage current for operation shall not be provided.

4. All sensors shall have an adjustable time delay off setting and a sensitivity adjustment.

5. Ceiling mounted sensors shall operate be line voltage or low voltage with separate control unit. Control unit shall contain power supply and relays for switching loads.

6. Units shall be furnished with area coverage to suit application. No allowance shall be given for providing sensors improperly sized for the square footage of the controlled area.

D. Color: Device color shall be white, unless otherwise noted.

E. Wallbox mounted single level control sensors:

1. Sensor shall provide minimum coverage of 900-square feet.

2. Time delay adjustment from 30-seconds to 20-minutes. Set initial time-out setting at 4-minutes, unless otherwise specified. Set sensitivity adjustment at maximum.
3. Load capacity of 0 to 1800watts at connected voltage.
4. For use in small utility closets and similar areas where dual level switching is not indicated.

F. Wallbox mounted dual level control sensors:

1. Sensor shall provide dual level switching capability and minimum coverage of 1000-square feet.
2. Operation shall be manual (in two levels) “ON” and manual (in two levels) or automatic (full) “OFF”.
3. Time delay adjustment from 30-seconds to 20-minutes. Set initial time-out setting at 20-minutes, unless otherwise specified. Set sensitivity adjustment at maximum.
4. Load capacity of 50 to 1000watts at connected voltages.
5. Integral photocell. Provide with ambient light control adjustment.
6. For use in offices and similar areas where dual level switching is indicated.

G. Wallbox mounted combination sensor and dimmer:

1. Sensor shall provide 0-10volt dimming capability for LED loads.
2. Sensor shall provide minimum coverage of 20-feet for clear line-of-sight applications.
3. Infrared only or dual-technology sensor.
4. Time delay adjustment from 3-minutes to 20-minutes. Set initial time-out setting at 15-minutes, unless otherwise specified. Set sensitivity adjustment at maximum.
5. For use in private offices and similar areas where dimming is indicated.

H. Ceiling or wall mounted single-directional sensors:

1. Sensor shall provide minimum coverage of 900-square feet.
2. Operation shall be automatic “ON” and automatic “OFF”. Provide with a manual override switch.
3. Time delay adjustment from 30-seconds to 20-minutes. Set initial time-out setting at 10-minutes. Set sensitivity adjustment at maximum.
4. Load capacity of 20amps per power or slave pack at connected voltage.
5. Power pack, if required, consisting of Class 2, 24volt output transformer and relay in single housing, capable of powering up 2 sensors and mounted inside standard 4-inch square box.
6. For use in small office, classroom, and similar areas.

I. Ceiling mounted omnidirectional sensors:

1. Sensor shall provide minimum omnidirectional coverage of 1000-square feet.

2. Operation shall be automatic “ON” and automatic “OFF”. Provide with a manual override switch.
3. Time delay adjustment from 30-seconds to 20-minutes. Set initial time-out setting at 10-minutes. Set sensitivity adjustment at maximum.
4. Load capacity of 20amps per power or slave pack at connected voltage.
5. Power pack, if required, consisting of Class 2, 24volt output transformer and relay in single housing, capable of powering up to 2 sensors and mounted inside standard 4-inch square box.
6. For use in large storage rooms and similar areas.

2.04 RECEPTACLES

A. Standards:
1. Provide general purpose 20amp, 125/250volt AC receptacles that conform to NEMA WD-1 Specifications. Specialty receptacles shall conform to NEMA WD-5 Specifications as applicable.
2. Provide NEMA 5-20R, industrial (heavy-duty) specification grade as noted herein, 20amp, 125volt AC, 2-pole, 3-wire grounding type receptacles.
3. Receptacles shall be the standard conventional style device.

B. Color:
1. Device color shall be white or as selected by the Architect, unless otherwise noted.
2. Devices connected to an emergency circuit shall be red.

C. General purpose single outlets:
1. Provide self-grounding back and side wired with binding head staked terminal screw.
2. Use Hubbell #5361 series, Pass & Seymour #5361 series Leviton #5361 series.

D. General purpose duplex receptacles:
1. Provide self-grounding, back and side wired with binding head staked terminal screws and break-off strip for two-circuit wiring.
2. Use Hubbell #5362 series, Pass & Seymour #5362 series or Leviton #5362 series.

E. Ground fault circuit interrupting (GFCI) receptacles:
1. Provide 20amp, 125volt AC, receptacles consisting of NEMA 5-20R duplex device with integral solid state sensing and signaling circuitry capable of detecting and interrupting a maximum 5-milli-amp line-to-ground fault current in approximately 1/40th of a second.
2. Provide visual device with trip indication, manual reset, and test mechanisms and with point of use and multi-outlet protection.
3. Provide self-test and monitor feature with visual indicators on device face representing power status, trip condition, ground fault condition and end of life status.

4. Provide weather resistant devices at all damp and wet locations.
5. Use Pass & Seymour #2097TR series, Hubbell GFTRST20 series, Leviton #S7899 series, for Specification grade GFCI receptacles.
6. Use Pass & Seymour #2097TRWR series, Hubbell GFTWRST20 series, Leviton #WT899 series for weather resistant GFCI receptacles.

F. Special purpose receptacles: Provide Specification grade devices with the NEMA configuration, voltage and current rating, number of poles and ground provisions as noted on the Drawings.

2.05 FLOOR MOUNTED SERVICE BOXES

A. Cast flush floor box:

1. Single or multi-gang floor box for flush applications in concrete floor. Box shall be cast iron with brass coverplates and carpet flange. Furnish with provisions for adjustments before and after pour. Provide with all accessories such as receptacles, compartment dividers, coverplate options, rings, etc. as indicated for application on Drawings.
2. Furnish box in either shallow or deep sizes as determined by the concrete floor depth and in ganged configurations indicated on Drawings.
3. Use Hubbell #B-2400, B-4200 and B-4300 series or Walker #880C series.

2.06 COVERPLATES

A. General:

1. Provide all coverplates with rounded edges and corners, smooth and free of grooves, embossing or other embellishment.
2. Provide mounting screws to match the plate finish.
3. Provide gang type coverplates where two or more devices are installed at one location. Individual gangable coverplates are not acceptable.
4. Provide plates of one design, standard conventional style, throughout the Project unless otherwise specified.

B. Color: Coverplate color shall be white or as specified by the Architect, unless otherwise noted.

C. Plastic coverplates:

1. Provide smooth, high impact, self-extinguishing thermoplastic coverplates and 0.100 inches thick with rounded edges and corners.
2. Provide openings to accommodate the devices indicated on the Drawings and in the Specifications.

D. Weatherproof coverplates:

1. Non-public areas:

a. Provide horizontal mounted, weatherproof in-use coverplate for one duplex or one GFCI receptacle. Provide gasketed, spring loaded, vertically self-closing covers suitable for use in damp and wet locations as described in UL 514 and CEC 406. Covers shall allow the use of the device with the cover closed.

b. Furnish base plates, covers, hinge pins, spring, and screws of corrosion resistant type 302 stainless steel.

2. Public area receptacles:

a. Provide horizontal mounted weatherproof in-use coverplate for one duplex or one GFCI receptacle. Provide gasketed, spring loaded, lockable, vertically self-closing covers suitable for use in damp and wet locations as described in UL 514 and CEC 406. Covers shall allow the use of the device with the cover closed.

b. Furnish base plates, covers, hinge pins, spring and screws of corrosion resistant type 302 stainless steel.

c. Provide two (2) keys for each locking type coverplate.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Contractor shall thoroughly examine Project site conditions for acceptance of wiring device installation to verify conformance with Manufacturer and Specification tolerances. Do not commence with installation until all conditions are made satisfactory.

3.02 PREPARATION

A. Coordinate device heights in vending, kitchen and utility areas with benches and counters.

B. Coordinate switch mounting location with Architectural details. Unless otherwise noted, locate switches on latch side of door.

3.03 INSTALLATION

A. Install wiring devices in accordance with Manufacturer's written instructions, as indicated on the Drawings and as specified herein.

B. Install devices with the vertical centerline plumb and with all edges of the device flush against the adjacent wall surfaces.

C. Mount switches at 42 inches to center above finished floor unless otherwise noted.

D. Mount receptacles vertically with the centerline 18-inches above finished floor and with grounding slot at bottom.

E. Mount receptacles vertically when mounting above counters, mount with grounding slot to the left.

F. Mount GFCI receptacles in the following locations, whether indicated as GFCI type or not on the drawings:

1. In bathrooms.

2. Where receptacles are installed within 6’0” from edge of sinks.

3. In kitchens above counters.

4. On rooftops.

5. Outdoors.

6. Where serving vending machines.

7. Where serving electric drinking fountains.

G. Derate ganged dimmer switches as instructed by Manufacturer. Do not use common neutrals in dimmer circuits.

H. Provide coverplates for all outlet boxes, switches, receptacles, etc.

I. Install blank coverplates on all outlet boxes in which no device is required or installed.

J. Provide coverplates that completely cover wall opening and seat against wall.

3.04 OCCUPANCY/VACANCY WALLBOX SENSORS

A. All occupancy/vacancy sensors shall have a sensitivity appropriate for the space. Contractor shall be responsible for testing the sensitivity of the sensor in the space and adjusting as needed.

B. Where no direction is provided in a sequence of operation or by the owner set the occupancy sensor timeout to values as indicated in Part 2 above.

C. Install wall mounted devices with the vertical centerline plumb and alleges of device flush against adjacent wall surfaces. Mount devices at 42-inches to center above finished floor unless otherwise noted.

3.05 FLOOR MOUNTED SERVICE BOXES

A. Installation:

1. Install floor boxes to be level or within 1/16" below screed line.
2. Make conduit connections and anchor box to sub-flooring.
3. Core drill hole in floor (core sized based on Manufacturer's installation instructions) for insert of poke-through device.
4. Make conduit connection to poke-through box from floor below.

B. Coordination: Contractor shall mark the location of all floor boxes with paint prior to installation or core drilling for review and approval by Architect.

3.06 FIELD QUALITY CONTROL

A. Electrical testing:

1. Test proper polarity of all receptacles.
2. Test ground continuity of all wiring devices.
3. Test ground fault interrupting device operation.

B. Visual and mechanical inspection:

1. Check proper operation of all switches.
2. Visually inspect and replace damaged or defective devices.

3.07 CLEANING

A. Clean interior of all boxes from dirt and paint prior to installation of devices.

B. Clean wiring devices and coverplates from dirt and paint over spray.

END OF SECTION

SECTION 262816

OVERCURRENT PROTECTIVE DEVICES

PART 1 - GENERAL

1.01 SUMMARY

A. Work included: Labor, materials, and equipment necessary to complete the installation required for the item specified under this Division, including but not limited to:

1. Fuses.
2. Molded case circuit breakers.

B. Related Work: Consult all other Sections, determine the extent and character of related Work, and properly coordinate Work specified herein with that specified elsewhere to produce a complete installation.

1.02 REFERENCES

A. Comply with the latest edition of the following applicable Specifications and standards except as otherwise indicated or specified:

1. Underwriters Laboratories, Inc. (UL):

UL 248(1-16);	Low-Voltage Fuses.
UL 489;	Molded-Case Circuit Breakers, Molded-Case Switches and Circuit Breaker Enclosures.
UL 512;	Fuseholders.

2. National Electrical Manufacturer Association (NEMA):

NEMA AB 1;	Molded Case Circuit Breakers.

1.03 SUBMITTALS

A. Submit in accordance with the requirements of Section 260010: Basic Electrical Requirements, the following items:

1. Data/catalog cuts for each product and component specified herein, listing all physical and electrical characteristics and ratings indicating compliance with all listed standards.
2. Describe product operation, equipment and dimensions and indicate features of each component.
3. Clearly mark on each data sheet the specific item(s) being submitted and the proposed application.
4. Provide factory certification of trip characteristics for each type and rating of circuit breaker.
5. Provide current let-through and melting time information for each type and rating of fuses.

6. Confirmation in writing of compliance with Arc Energy Reduction per CEC Articles 240.67 and 240.87.
7. Submit Manufacturer's installation instructions.
8. Complete bill of material listing all components.
9. Warranty.

1.04 OPERATION AND MAINTENANCE MANUAL

A. Supply operation and maintenance manuals in accordance with the requirements of Section 260010: Basic Electrical Requirements, to include the following:

1. A detailed explanation of the operation of the system.
2. Instructions for routine maintenance.
3. Parts list and part numbers.
4. Telephone numbers for authorized parts and service distributors.
5. Final testing reports.

1.05 QUALITY ASSURANCE

A. All materials, equipment and parts comprising the units specified herein shall be new, unused and currently under production.

B. Only products and applications listed in this Section may be used on the Project unless otherwise submitted.

1.06 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Delivery: Overcurrent Protective Device components shall not be delivered to the Project site until protected storage space is available. Storage outdoors covered by rainproof material is not acceptable. Equipment damaged during shipment shall be replaced and returned to Manufacturer at no cost to Owner.

B. Storage: Store in a clean, dry, ventilated space free from temperature extremes. Maintain factory wrapping or provide a heavy canvas/plastic cover to protect units from dirt, water, construction debris and traffic. Provide heat where required to prevent condensation.

C. Handling: Handle in accordance with Manufacturer's written instructions. Be careful to prevent internal component damage, breakage, denting and scoring. Damaged units shall not be installed. Replace damaged units and return equipment to Manufacturer.

1.07 WARRANTY

A. Units and components offered under this Section shall be covered by a 1-year parts and labor warranty for malfunctions resulting from defects in materials and workmanship. Warranty shall begin upon acceptance by the Owner.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Products furnished by the following Manufacturers shall be acceptable if in compliance with all features specified herein and indicated on the Drawings.

1. Fuses:
    a. Bussmann Division, Cooper Industries.
    b. Gould Shawmut Co.
2. Circuit breakers:
    a. ABB/ General Electric.
    b. Eaton.
    c. Siemens.
    d. Square D.

B. Substitutions: Under provisions of Section 260010: Basic Electrical Requirements.

2.02 GENERAL

A. Overcurrent protective devices shall satisfy all CEC mandated selective coordination requirements (e.g. CEC Articles 517, 620, 645, 695, 700, 701, 708).

B. Fuses rated 1200 amps or higher shall satisfy CEC Article 240.67 requirements.

C. Circuit breakers rated (or can be adjusted) 1200amps or higher shall satisfy CEC Article 240.87 requirements.

2.03 FUSES

A. General: All power fuses shall be time-delay, high interrupting (300K AIC), current limiting type, unless otherwise noted on the Drawings. All fuses shall be the product of a single Manufacturer and shall be selectively coordinated when applied in 2:1 ratio. Types of fuses shall be as follows:

1. Motor branch circuit fuses (0 to 600amps): UL Class J dual element, time delay type fuse. Motor branch circuit fuses shall be sized for Type 2 coordination for the motor controller and back-up motor overload protection and shall be coordinated with motor starter overload relay heaters. See Section 262900: Motor Controls.

B. Control and instrument fuses shall be suitable for installing in blocks or fuseholders. Exact type and rating shall be as recommended by the Manufacturer of the equipment being protected.

C. Fuses for installation in current limiting circuit breakers or motor circuit protectors shall meet the specific requirements of the Manufacturers of that equipment to ensure compatibility.

2.04 MOLDED CASE CIRCUIT BREAKERS

A. Branch and feeder circuit breakers shall be molded case, bolt on and trip indicating.

B. Where stationary molded case circuit breakers are indicated on the Drawings to be current limiting type, they shall be current limiting as defined by UL 489 and shall not employ any fusible elements.

C. Circuit breakers shall have interrupting capacity not less than that indicated on the Drawings or if not indicated, not less than 14,000 RMS symmetrical amps for 480volt systems and 10,000 RMS symmetrical amps for 208volt systems.

D. Covers shall be sealed on non-interchangeable breakers and trip unit covers shall be sealed on interchangeable trip breakers to prevent tampering. Circuit breaker ratings shall be clearly visible after installation or engraved nameplates shall be provided stating the rating. All ferrous parts shall be plated to minimize corrosion.

E. Circuit breakers shall be toggle, quick-make and quick-break operating mechanisms with trip-free feature to prevent contacts being held closed against overcurrent conditions in the circuit. Trip position of the breakers shall be clearly indicated by operating handles moving to a center position.

F. Multipole breakers shall have a single handle to open and close all contacts simultaneously in both manual operation and under automatic tripping. Interpole barriers shall be provided inside the breaker to prevent any phase-to-phase flashover. Each pole of the breaker shall have means for Arc extinguishing.

G. All terminals shall be dual rated for aluminum or copper wire.

H. Circuit breakers with frame ratings 100amps and smaller shall be ambient temperature compensated, thermal magnetic type unless otherwise noted. Breakers shall be of full size, 1" per pole type. Panels with more than one branch breaker larger than 100amps shall be installed in distribution type panels.

I. Circuit breakers with frame ratings above 100amps through 400 amps shall have solid state electronic trips with true RMS reading through the 13th harmonic with 1% accuracy, interchangeable trip via front accessible current plug, adjustable instantaneous and short time be rated as indicated on Drawings at the voltage indicated.

J. Circuit breakers with frame ratings above 400 amps through 1200 amps shall have microprocessor-based RMS sensing trip units with the following characteristics:

1. Interchangeable current rating plug or an adjustable trip setting to match the trip rating as indicated on Drawings.
2. Adjustable long-time pick-up setting. Minimum of five settings from 50% to 100%.
3. Adjustable long-time delay setting. Minimum of three delay bands.
4. Adjustable short time pick-up setting. Minimum of five settings from 200% to 800%.
5. Adjustable short-time delay setting. Minimum of three delay bands with I2t IN and OUT curves.
6. Adjustable instantaneous pick-up setting. Minimum of five settings from 200% to 1000%. Where the instantaneous feature is omitted on the Drawings, the trip unit shall have an instantaneous override feature.
7. Zone selective interlocking (ZSI) for short-time delay and ground-fault delay trip functions, if indicated on the drawings.
8. LED status indication to show “health” of trip unit.
9. Three-phase ammeter, if indicated on the drawings.
10. Trip indication targets on overload, ground fault and short circuit, if indicated on the drawings.

K. Accessories: Provide accessories as noted on the Drawings, i.e. shunt-trip, auxiliary contacts, undervoltage trip, alarm switch, etc.

L. Spaces in the boards shall be able to accept any combination of 1, 2 or 3-pole circuit breakers as indicated. Provide all necessary bus, device supports, and mounting hardware sized for frame, not trip rating.

M. Series rated breakers are not acceptable unless specifically noted on the Drawings.

N. Breaker shall be rated to operate in an ambient temperature of 40-degrees C.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Contractor shall thoroughly examine Project site conditions for acceptance of overcurrent protective device installation to verify conformance with Manufacturer and Specification tolerances. Do not commence with installation until all conditions are made satisfactory.

3.02 INSTALLATION

A. Install overcurrent protective devices in accordance with Manufacturer's written instructions, as indicated on the Drawings and as specified herein.

B. Tighten electrical connectors and terminals; including screws and bolts, in accordance with equipment Manufacturers published torque-tightening values for equipment connectors. Where Manufacturers torque requirements are not indicated tighten connectors and terminals to comply with tightening torque specified in UL Standard 486A.

C. Install overcurrent protective devices and accessories in accordance with Manufacturer's written instructions and with recognized industry practices to ensure that protective devices comply with requirements. All devices shall be installed in accordance with applicable CEC and NEMA standards for installation.

D. Circuit breakers serving “Fire Alarm Control Panel(s)” shall be red in color.

3.03 FIELD QUALITY CONTROL

A. Independent testing: Contractor shall arrange and pay for the services of an independent Testing Agency to perform all quality control electrical testing, calibration and inspection required herein. Testing Agencies objectives shall be to:

1. Assure overcurrent protective device installation conforms to specified requirements and operates within specified tolerances.
2. Field test and inspect to ensure operation in accordance with Manufacturer's recommendations and Specifications.
3. Prepare final test report including results, observations, failures, adjustments, and remedies.
4. Verify ratings and settings and make final adjustments.

B. Testing of overcurrent protective devices shall be done only after all devices are installed and prior to system being energized.

C. Prefunctional testing:

1. Provide Testing Agency with Contract Documents and Manufacturer instructions for installation and testing.
2. Visual and mechanical inspection:
    a. Inspect for physical damage, defects alignment and fit.
    b. Perform mechanical operational tests in accordance with Manufacturer's instructions.
    c. Compare nameplate information and connections to Contract Documents.
    d. Check tightness of all control and power connections.
    e. Check that all covers, barriers, and doors are secure.
3. Electrical tests:
    a. Circuit continuity: All new or altered feeders shall be tested for continuity. All new or altered neutrals shall be tested for improper grounds.
    b. Test all circuit breakers with frame size 225amps and larger in each panelboard, distribution board, switchboard, etc. unless otherwise noted via primary current injection testing. Testing shall verify the following:
        1) Determine that circuit breaker will trip under overcurrent conditions, with tripping time in conformance with NEMA AB 1 requirements.
        2) Circuit breaker pickup and delay measurements are within the manufacturers published tolerances for long time, short time, instantaneous, and ground fault.

D. Contractor shall replace at no costs to the Owner all devices which are found defective or do not operate within factory specified tolerances.

E. Contractor shall submit the Testing Agency's final report for review prior to Project closeout and final acceptance by the Owner. Test report shall indicate test dates, devices tested, results, observation, deficiencies, and remedies. Test report shall be included in the operation and maintenance manuals.

3.04 ADJUSTING

A. Adjust circuit breaker trip settings for coordination with other overcurrent protective devices in system.

B. Adjust circuit breaker trip settings for adequate protection from overcurrent and fault currents.

3.05 CLEANING

A. Upon completion of Project prior to final acceptance the Contractor shall thoroughly clean overcurrent protective devices per Manufacturer's approved methods and materials. Remove paint splatters and other spots, dirt, and debris.

END OF SECTION

SECTION 262819

DISCONNECT SWITCHES

PART 1 - GENERAL

1.01 SUMMARY

A. Work included: Labor, materials, and equipment necessary to complete the installation required for the item specified under this Division, including but not limited to:

1. Disconnect Switches.

B. Related Work: Consult all other Sections, determine the extent and character of related Work, and properly coordinate Work specified herein with that specified elsewhere to produce a complete installation.

1.02 REFERENCES

A. Comply with the latest edition of the following applicable Specifications and standards except as otherwise indicated on specified:

1. National Electrical Manufacturer Association (NEMA):

NEMA KS 1; Enclosed Switches.

2. Underwriters Laboratories, Inc. (UL):

UL 512; Fuseholders.

1.03 SUBMITTALS

A. Submit in accordance with the requirements of Section 260010: Basic Electrical Requirements, the following items:

1. Data/catalog cuts for each product and component specified herein, listing all physical and electrical characteristics and ratings indicating compliance with all listed standards.

2. As a minimum the following characteristics shall be indicated:

a. NEMA types.

b. Current rating.

c. Number of poles.

d. Fuse provisions.

e. Enclosure dimensions.

f. Voltage.

g. Horsepower rating (if applicable).

h. Short circuit rating.

3. Clearly mark on each data sheet the specific item(s) being submitted and the proposed application.

4. Submit Manufacturer's installation instructions.

1.04 QUALITY ASSURANCE

A. All materials, equipment and parts comprising the units specified herein shall be new, unused, and currently under production.

B. Only products and applications listed in this Section may be used on the Project unless otherwise submitted.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Products furnished by the following Manufacturers shall be acceptable if in compliance with all features specified herein and indicated on the Drawings.

1. ABB/ General Electric.
2. Eaton.
3. Siemens.
4. Square D.

B. Substitutions: Under provisions of Section 260010: Basic Electrical Requirements.

2.02 DISCONNECT SWITCHES

A. Description: Provide NEMA heavy-duty type switches with dead front construction and padlock provisions for up to three locks in the “OFF” position.

B. Switch interior: Provide switch with switchblades that are fully visible in the “OFF” position when the door is open. Provide UL listed lugs for copper conductors, lugs to be front removable. Provide plated current carrying part.

C. Switch mechanism: Provide switches with a quick-make, quick-break, position indicating, operating handle and mechanism and a dual cover interlock to prevent unauthorized opening of the switch door in the “ON” position or closing of the switch mechanism with the door open. Furnish an electrical interlock to de-energize control wiring when the disconnect switch is opened.

D. Enclosures: Provide switches with hinged cover in NEMA 1 general purpose, sheet steel enclosure for dry locations and NEMA 3R weatherproof galvanized enclosures for exterior, damp, or wet locations, unless otherwise noted on the Drawings. Provide an enclosure treated with a rust-inhibiting phosphate primer and finished in gray baked enamel.

E. Ratings: Provide switches that are horsepower rated for 240 VAC or 600volt AC as required for the circuit involved and that meet “I-SQUARED-T” requirements. Fusible switches to have provisions for the types of fuses specified in Section 262816: Overcurrent Protective Devices. UL listed short circuit rating, when equipped with fuses to be 200,000amps RMS symmetrical. Furnish with provisions for RK-1 fuses for switches up to 600amps. 800amp switches and larger to have provisions for Class L fuses.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Contractor shall thoroughly examine Project site conditions for acceptance of disconnects switch installation to verify conformance with Manufacturer and

Specification tolerances. Do not commence with installation until all conditions are made satisfactory.

3.02 PREPARATION

A. Coordinate locations of switches and equipment in the field to provide code required clearances in front of switches and to ensure that switches are insight of the controller as described in CEC Article 430.

3.03 INSTALLATION

A. Install disconnect switches where indicated on the Drawings.

B. Install fuses in fusible disconnect switches.

C. Include construction channel and mounting hardware as required to support disconnect switch.

3.04 IDENTIFICATION

A. Provide engraved, machine screw retained type 'NP' nameplate on each disconnect switch. See Section 260553: Electrical Identification.

3.05 CLEANING

A. Upon completion of Project prior to final acceptance the Contractor shall thoroughly clean both the interior and exterior of enclosure of all construction debris, scrap wire, paint splatters, dirt, etc.

END OF SECTION

SECTION 265000

LIGHTING

PART 1 - GENERAL

1.01 SUMMARY

A. Work included: Labor, materials, and equipment necessary to complete the installation required for the item specified under this Division, including but not limited to:

1. Interior luminaires (lighting fixtures.)
2. Light-emitting diode (LED) assemblies.
3. Drivers, ballasts, and transformers.
4. Optical components; including diffusers, refractors, reflectors, and louvers.
5. Unit battery equipment.

B. Related Work: Consult all other Sections, determine the extent and character of related Work, and properly coordinate Work specified herein with that specified elsewhere to produce a complete installation.

1. Division 05: Metals; for fittings, brackets, backing supports, rods, etc. as required for support and bracing of luminaires.
2. Division 09: Finishes; for ceilings, wall assemblies, acoustical treatment, and field painting of luminaires.

1.02 REFERENCES

A. Comply with the latest edition of the following applicable Specifications and Standards except as otherwise indicated or specified:

1. American National Standards Institute (ANSI):

ANSI/IEC 60529;	American National Standard for Degrees of Protection Provided by Enclosures (IP Code)
C78.54;	Electric Lamps – Specification Sheet for Tubular Fluorescent Replacement and Retrofit LED Lamps
C137.0	Lighting System Terms and Definitions.
C137.1	0-10V Dimming Interface for LED Drivers, Fluorescent Ballasts, and Controls

2. Underwriters Laboratories, Inc. (UL):

UL 66;	Fixture Wire.
UL 102.3;	Standard Method of Fire Test of Light Diffusers and Lenses.
UL 496;	Lampholders (for incandescent, fluorescent, self-ballasted CFL, integral-driver LED, and HID lamps.)
UL 924;	Emergency Lighting and Power Equipment.

UL 1598;	Luminaires.
UL 1598C;	Light-Emitting Diode Retrofit Luminaire Conversion Kits.
UL 2592;	Low Voltage LED Wire.
UL 5085-3;	Low Voltage Transformers: Class 2.
UL 8750;	Light Emitting Diode (LED) Equipment for Use in Lighting Products.
UL 8753;	Field-Replaceable Light Emitting Diode (LED) Light Engines.
UL 8754;	Holders, Bases, and Connectors for Solid-State (LED) Light Engines and Arrays.

3. National Electrical Manufacturers Associations (NEMA):

SSL-1	Electronic Drivers for LED Devices, Arrays or Systems.
SSL-4;	Retrofit Lamps—Minimum Performance Requirements.
LE-4;	Recessed Luminaires, Ceiling Compatibility

4. Illuminating Engineering Society of North America (IESNA):

TM-21;	Projecting Long Term Lumen Maintenance of LED Light Sources.
TM-30;	Method for Evaluating Light Source Color Rendition.
TM-30-Annex E	Recommendations for Specifying Light Source Color Rendition
LM-79;	Electrical and Photometric Measurements of Solid-State Lighting Products.
LM-80;	Measuring Luminous Flux and Color Maintenance of LED Packages, Arrays and Modules.
LM-84;	Measuring Luminous Flux and Color Maintenance of LED Lamps, Light Engines, and Luminaires.
LM-86;	Measuring Luminous Flux and Color Maintenance of Remote Phosphor Components

5. Restriction of Hazardous Substances (RoHS):

RoHS 3;	Directive 2015/863 - Cat 5. Lighting: lamps, luminaires, light bulbs.

1.03 SYSTEM DESCRIPTION

A. Provide and install a fully functional and operating lighting system as indicated, complete with light engines, lamps, wiring, and securely attached to support system to meet all seismic code requirements.

B. Where catalog number and narrative or pictorial descriptions are provided, the written description shall take precedence and prevail.

1.04 SUBSTITUTIONS

A. Refer to Section 260010: Basic Electrical Requirements for specific Equipment requirements.

B. Items specified under this Section and Luminaire Schedule are subject to the requirements, with the following qualifications:

1. Items solely specified by Manufacturer name and catalog number, without qualifiers: Provide as specified – No Substitutions.
2. Items specified by multiple Manufacturers, without qualifiers: Provide any listed manufacturer – No Substitutions.
3. Items specified by sole or multiple Manufacturers, followed by “Or Approved Equal” or “Or Approved Equivalent”: Conform to substitution requirements outlined for Equipment.
4. Items specified by sole or multiple Manufacturers, followed by “Or Equal” or “Or Equivalent”: Products that meet the salient requirements are acceptable to provide.
    a. Equivalency is at the sole judgement of the Architect and Engineer.
    b. Should a submitted, unspecified product fail to meet the requirements of Equivalency, provide specified products at no additional cost to the Owner.

C. Equivalency shall be determined by review of the following luminaire characteristics where applicable. Lack of pertinent data on any characteristic shall constitute justification for rejection of the submittal or substitution.

1. Performance:
    a. Distribution.
    b. Utilization.
    c. Luminance distribution (Average brightness / maximum brightness.)
    d. Spacing to mounting height ratio.
    e. Overall luminaire efficiency.
2. Construction:
    a. Engineering.
    b. Workmanship.
    c. Rigidity.
    d. Permanence of materials and finishes.
3. Installation Ease:
    a. Captive parts and captive hardware.
    b. Provision for leveling.
    c. Through-wiring ease.
4. Maintenance:
    a. Ease of relamping / replacement of LED array.
    b. Ease of replacement of driver/ballast and lamp sockets.

5. Appearance:
    a. Architectural integration.
    b. Light tightness.
    c. Styling.
    d. Conformance with design intent.
    e. Furnish a working sample complete with housing, trim, 8’ cord and plug, and specified lamp.

1.05 SUBMITTALS

A. Submit in accordance with the requirements of Section 260010: Basic Electrical Requirements, the following items:
    1. Complete bill of material listing (index) of all luminaires. Index shall be organized in the same sequence as the Luminaire Schedule (alphabetical.) Include in the index:
        a. Type per the Luminaire Schedule.
        b. Manufacturer.
        c. Complete catalog number, including all accessories and appurtenances required for the installation.
        d. Voltage.
    2. Manufacturer’s data sheets/catalog cuts for each product and component specified herein, listing all physical and electrical characteristics and ratings indicating compliance with all listed standards.
        a. Identify luminaire type on each sheet.
        b. Clearly mark on each data sheet the specific item(s) being submitted. Obfuscate or otherwise delete options on data sheets that are not provided.
    3. Manufacturer's installation instructions.
    4. Warranty.
    5. U.L. labeling information.
    6. Photometric Reports consisting of:
        a. Independent Testing Laboratories, Inc. or equal, photometric test report for each luminaire listed on the Luminaire Schedule. Test reports shall be based on Illuminating Engineering Society published test procedures and shall contain candlepower distribution curves in five lateral planes for fixtures with asymmetric distributions and fixture luminance data for vertical angles above 45 degrees from nadir.
        b. Coefficient of utilization table.
        c. Zonal lumen summary including overall luminaire efficiency.
    7. Shop Drawings:
        a. Where noted in the Luminaire Schedule, submit Shop Drawings from Manufacturer detailing modified or custom luminaires indicating dimensions,

weights, methods of field assembly, components, features, accessories, methods of support, etc.

1.06 OPERATION AND MAINTENANCE MANUAL

A. Supply operation and maintenance manuals in accordance with the requirements of Section 260010: Basic Electrical Requirements, to include the following:

1. An updated index per 1.05-A.
2. One complete set of final submittals of actual product installed, including product data and shop drawings.
3. Instructions for routine maintenance.
4. Pictorial parts list and parts number.
5. Telephone numbers for authorized parts and service distributors.

1.07 QUALITY ASSURANCE

A. All materials, equipment and parts comprising the units specified herein shall be new, unused, and currently under production.

B. Only products and applications listed in this Section may be used on the Project unless otherwise submitted.

1.08 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Delivery: Luminaires shall not be delivered to the Project site until protected storage space is available. Storage outdoors covered by rainproof material is not acceptable. Equipment damaged during shipment shall be replaced and returned to Manufacturer at no cost to Owner.

B. Storage: Store in a clean, dry, ventilated space free from temperature extremes. Maintain factory wrapping or provide a heavy canvas/plastic cover to protect units from dirt, water, construction debris and traffic. Provide heat where required to prevent condensation.

C. Handling: Handle in accordance with Manufacturer's written instructions. Be careful to prevent internal component damage, breakage, denting and scoring. Damaged units shall not be installed. Replace damaged units and return equipment to Manufacturer.

1.09 WARRANTY

A. Units and components offered under this Section shall be covered by a 1-year parts and labor warranty for malfunctions resulting from defects in materials and workmanship. Warranty shall begin upon acceptance by the Owner.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Products furnished by the following Manufacturers shall be acceptable if in compliance with all features specified herein and indicated on the Drawings.

1. Luminaires, Poles, and Exit Signs: as listed in the Luminaire Schedule.
2. Light-Emitting Diode (LED) Arrays:
   a. Cree.

b. Nichia.
c. Citizen.
d. Philips Lumileds.
e. Samsung.
f. Lumenetix Araya.
g. Xicato.
h. Bridgelux.
i. LEDs provided by Luminaire Manufacturer listed in the Luminaire Schedule: meeting the technical and warranty requirements of this Section.

3. LED replacement and integral-driver lamps:
   a. General Electric.
   b. Osram.
   c. Cree.
   d. Maxlite.
   e. Green Creative.
   f. Soraa.
4. LED drivers (DC output):
   a. eldoLED.
   b. Lutron.
   c. Philips Advance.
   d. Osram.
   e. Q-Tran.
   f. Drivers provided by Luminaire Manufacturer listed in the Luminaire Schedule: meeting the technical and warranty requirements of this Section.
5. Unit battery equipment:
   a. Philips Bodine.
   b. Iota.
   c. Unit battery equipment provided by Luminaire Manufacturers listed in the Luminaire Schedule: meeting the technical and warranty requirements of this Section.

B. Substitutions: Under provisions of Section 260010: Basic Electrical Requirements.

2.02 GENERAL

A. Luminaires new and complete with mounting accessories, junction boxes, trims, and lamps.

B. Luminaire assemblies U.L. listed appropriate to mounting conditions and application. All labels affixed to the fixture shall be in a location not visible from normal viewing angles.

C. Each luminaire family type (downlights, etc.) supplied by only one manufacturer.

D. Luminaires shall bear the IP rating appropriate for the application.

E. Luminaires shall be free of light leaks and shall be designed to provide sufficient ventilation of light engines, including ventilation holes where required.

2.03 LUMINAIRE CONSTRUCTION

A. All sheet metal Work shall be free from tool marks and dents and shall have accurate angles bent as sharp as compatible with the gauges of the required metal. 20-gauge (0.7-mm or 0.027-inch) minimum.

1. Finish: Baked white dry polyester powder, unless otherwise specified, with a minimum average reflectance of 85% on all exposed and light reflecting surfaces. Steel components shall be prepared for finishing with a 5-step zinc phosphating process prior to painting.

2. Luminaire (including all painted component parts) shall be painted after fabrication unless specifically noted in the Luminaire Schedule.

B. All surfaces shall be cleaned and dressed to eliminate all exposed sharp edges or burrs.

C. All intersections and joints shall be formed true and of adequate strength and structural rigidity to prevent any distortion after assembly.

D. End Plates: Die cast end plates shall be mechanically attached without exposed fasteners. End caps shall be minimum 0.125" thick.

E. All mitered corners or joints shall be accurately aligned with abutting intersecting members. Sheet metal Work shall be properly fabricated so that planes will not deform (i.e. become concave or convex) due to normal expected ambient and operating conditions.

F. Ferrous mounting hardware and accessories shall be finished using either a galvanic or phosphate primer/baked enamel process to prevent corrosion and discoloration of adjacent materials.

G. Fasteners shall be manufactured of galvanized steel.

H. Adjustable Lamp Mechanisms: To have aiming stops which can be permanently set to position lamp vertically and rotationally.

I. Recessed luminaires: Equip with through-wire junction box. Box, driver, and replaceable components shall be accessible from the ceiling opening of the luminaire.

J. Finish:

1. All exposed aluminum surfaces shall be treated with an acid wash and clear water rinse prior to painting. The luminaire shall then be electrostatically painted, or powder coated, and oven baked in the color indicated in the Luminaire Schedule.

2. All exposed steel surfaces shall be treated with an acid wash and clear water rinse, then prime coated. The luminaire shall then be electrostatically painted, or powder coated, and oven baked in the color indicated in the Luminaire Schedule.

2.04 SUSPENSION

A. Suspension system must permit ±13-mm (1/2”) minimum vertical adjustment after installation.

B. Supports:

1. Provide internal safety cable from fixture body to stud in outlet box.
2. Carry fixture weight to structure and provide horizontal bracing from suspension points to ceiling framing to prevent sideways shifting. Provide diagonal seismic restraint wires per code.

C. Feed Point:

1. Flat-plate canopy to cover outlet box, with holes for support cable and power cord, concealed fasteners to permit splice inspection after installation.
2. At the electrified connection provide straight cord feed.
3. Power cord: white multi-conductor cord, parallel to support cable (aircraft cable); within pendant (rigid pendant); or flexible conduit (chain hanger).

D. Non-feed Points:

1. 13-mm (½”) O.D. polished chrome end sleeve, inside threaded ¼”-20, with 50-mm (2”) diameter. Flat white plate to cover hole in ceiling. Top of cable with ball swaged on end, to fit inside sleeve.
2. Contractor to provide support above ceiling as required.

E. Suspension method shall allow adjustment to be made in hanging length to allow for variance in ceiling height.

F. All exposed paintable suspension components shall have the same finish and color as the luminaire housing.

2.05 LAMPHOLDERS

A. Of configuration and design to accept standard lamp bases.

B. Wiring channels and lampholder mountings shall be rigid and accurately constructed.

C. Integral-driver LED:

1. Medium screw base: Unglazed porcelain body or thermoplastic (PET GF) with copper-alloy screw shell. 660watt, 250volt rated.
2. Bi-Pin base: Ceramic casing with mica cover plate, copper allow contact surfaces. Pin distance designed for lamp provided.

2.06 LED ARRAYS

A. Minimum lumen maintenance per LM-80 measurements and TM-21 calculations: L90 at 60,000 hours.

B. Maximum burnout: B90 at 200,000-hours.

C. Free of mercury and toxic materials; RoHS compliant.

D. Linear LED boards: LED pitch shall be consistent throughout the luminaire and shall remain consistent from the end of one board to the start of the next. LED pitch shall be the same from the endcap of the luminaire to the last LED on the board as the LED pitch throughout the luminaire. Luminaire shall have a continuous luminous appearance – bright or dark spots are not acceptable.

E. White LEDs:

1. TIER 2 (legacy CRI 80)

a. Informational Note: For applications where color fidelity is important, such as offices, schools, general interior areas, etc.

b. Minimum efficacy: 75 lumens per watt.

c. L70 lifetime: minimum 80,000-hours (extrapolated.)

d. Correlated Color Temperature (CCT); as specified in Luminaire Schedule. Maximum 3-step MacAdam ellipse variation throughout listed life (L70).

e. Color Rendering Index (CRI); minimum 80 Ra.

f. R9 value; minimum 30.

g. TM30 values; Rf >75, 92>Rg>110.

2.07 LED REPLACEMENT AND INTEGRAL-DRIVER LAMPS:

A. CFL LED: Replacement for CFL G24Q compact fluorescent lamps

1. Refer to the Fixture Schedule for size and type of retrofit LED lamps required.

2. Retrofit Lamp shall be “plug and play” Type A, ballast driven replacement for 18watt, 26watt, 32watt, and 42watt 4-pin compact fluorescent lamp, operating off of the existing electronic ballast. Lamp shall be rated for use in enclosed fixtures.

3. System Power: 11watt

4. Beam Spread: 330-degrees

5. Color correlated temperature: 3500K

6. Lumen Output: 1445

7. Minimum CRI (Color Rendering Index): 80

8. Min. lamp life: 50,000-hours to L70

9. Total Harmonic Distortion: <20%

10. Power Factor: 90%

11. The lamp shall be free of all toxic materials to include lead, cadmium, and mercury, and shall be RoHS compliant.

12. The lamp shall be DLC compliant and UL listed.

2.08 LED DRIVERS:

A. LED drivers shall be integral to fixture housing or remotely located, when specified, within 15 feet of diode assembly.

1. Luminaires shall be provided with the UL listed or equivalent driver and low voltage power supply as recommended by Manufacturer to insure proper and consistent lamp and luminaire performance. The number of LEDs per luminaire per power supply shall not be exceeded, and LEDs shall not be wired to a high capacity driver unless recommended by Manufacturer.

2. Light Emitting Diode (LED) control gears shall operate with sustained variations of +/- 10% in voltage and frequency without damage to the driver and have a power factor not less than 90%. Regulations: +/-5% across the listed load range.
3. Driver input current shall have Total Harmonic Distortion (THD) of less than 20%. The Driver shall have a Class A sound rating unless otherwise specified.
4. Control gear shall be rated for 50-degree C ambient temperature.
5. All control gear shall facilitate smooth dimming from 100% to 1% without flicker.

2.09 LENSES

A. Acrylic:

1. Lenses shall be extruded or injection molded crystal clear 100% virgin acrylic (except as indicated otherwise). For lenses with male pattern of pyramids or cones, specified minimum thickness refers to distance from flat surface to base of pyramids (cones) or thickness of undisturbed material. For lenses with female pattern, specified minimum thickness refers to overall thickness of material.
2. Lenses shall fully eliminate lamp images when viewed from all directions within 45 to 90-degree angles from vertical, where the ratio of lamp spacing to the distance from lamp underside to top of lens does not exceed 1.50. Within the viewing angle from 0 to 45-degrees the ratio of maximum brightness (under a lamp) to minimum brightness (between lamps) shall not exceed 3 to 1.
3. Finishes (i.e. sandblasting, etching, polishing) shall be performed as described in the Fixture Schedule.
4. Plastic electrical light diffusers must meet the requirements of Section 2-5209, CAC, Flame Spread Rating.
5. Prismatic Acrylic:
    a. Extruded of clear virgin acrylic plastic, 0.125" minimum overall thickness, 0.100” nominal unpenetrated thickness, Pattern 12 with flat sided female prisms running at 45 degrees off panel axis unless otherwise specified in the luminaire schedule. Concave prisms are not acceptable.
6. Opal acrylic:
    a. Extruded or injection molded of virgin acrylic plastic, 0.080" minimum overall thickness.

2.10 UNIT BATTERY EQUIPMENT

A. LED Emergency Power Supplies

1. Standard Features:
2. Safety compliance to UL 924; CAN/CSAC22.2 No.141-10 and NFPA requirements for 90-minute egress
3. Open circuit / short circuit protection
4. Operating temperature: 32-degree F/0-degree C to 122-degree F/50-degree C
5. Test switch / charging indicator light
6. Emergency reaction time < 1-sec

7. Powder coat steel, stainless or galvan-nealed case
8. Field-replaceable NiCd battery pack (x2) with quick connect
9. Min. lead wire length: 6in UL 1452 solid / #18 AWG 1000volt / 90-degree C

PART 3 - EXECUTION

3.01 EXAMINATION

A. Contractor shall thoroughly examine Project site conditions for acceptance of luminaire installation to verify conformance with Manufacturer and Specification tolerances. Do not commence with installation until all conditions are made satisfactory.

3.02 PREPARATION

A. Architectural Plans shall govern exact ceiling construction and mounting conditions for all luminaires. Locate as shown on the architectural elevations and reflected ceiling plan.

B. Consult Architectural Drawings for details of ceiling construction, finish, and other applicable details.

C. Contractor shall be responsible for coordination of luminaire mounting and compatibility with ceiling construction.

D. Luminaires in areas where exposed or concealed pipe and ductwork prevents direct access to the structural ceiling shall be provided with appropriate support system to install luminaire below obstructions to avoid conflicts with same.

3.03 ARCHITECTURAL COORDINATION

A. Where luminaires are mounted in architectural coves, soffits, valances, or cabinets and are given an overall length, the Contractor shall verify all lengths in the field prior to releasing fixture order.

B. Where luminaires are surface mounted or suspended to match the length of walls or other architectural elements, the Contractor shall verify all lengths in the field prior to releasing fixture order.

C. Mounting heights specified on drawings:

1. Wall mounted luminaires: shall be to centerline of luminaire.
2. Pendant mounted luminaires: shall be to bottom of luminaire unless specifically identified in the Luminaire Schedule or on drawings.

3.04 INSTALLATION

A. Install luminaires in accordance with Manufacturer's written instructions, as indicated on the Drawings and as specified herein.

B. Contractor shall be responsible for all supports, hangers, and hardware necessary for a complete installation.

C. Luminaires shall be plumb, level, square, in straight lines and without distortion.

D. Remedy light leaks that may develop after installation of recessed or enclosed luminaires.

E. Adjustable luminaires shall be installed with “dead” zone of rotation away from intended aiming point.

3.05 LUMINAIRE SUPPORTS

A. Physical (gravity) supports:

1. Recessed luminaires in wood framed ceilings shall be supported by 2" x 4" hangers fastened to adjacent ceiling joists.
2. Recessed downlights in wood frame ceilings shall be supported with Manufacturers supplied bar hangers and shall be installed according to the Manufacturer’s instructions.
3. Surface mounted luminaires solely supported by recessed boxes in a gypsum board ceiling shall have a 1-1/8" steel bar screwed or welded to the back of the box. This steel bar must be long enough to span two ceiling support channels and shall be attached to the channels by twisting wire around the bar and the support channel. For luminaires weighing over 50-pounds, provide fixture studs in recessed box.
4. Support surface mounted luminaires more than 18" wide at or near each corner or edge, in addition to support from outlet box.
5. Support recessed downlights manufactured with built-in brackets by twisting wire around the bracket and two adjacent ceiling support channel runners on either side of the luminaire.
6. Support outlet boxes as specified in Section 260533: Boxes. Provide all boxes with grounding pigtail.

B. Seismic supports:

1. Recessed luminaires in suspended ceilings shall be supported by connecting two support wires to the luminaire at diagonal opposite corners for luminaires weighing 56 pounds or less. Connect four wires, one at each corner for luminaires weighing more than 56 pounds.
2. Surface mounted luminaires on suspended ceilings shall be attached to the main ceiling runner with at least two positive clamping devices and shall have an additional support wire attached to each clamping device and to the structure above.
3. Recessed downlight luminaires in suspended ceilings shall be supported by connecting one support wire to the luminaire housing.
4. All suspended luminaires shall be able to swing 45-degrees from vertical in any direction without obstruction.
    a. Furnish suspended rigid pendant luminaires with universal joint type hanger canopy and longitudinal sway adapter at each stem, to permit 45-degree swivel on 360-degree circle at canopy and 45-degree longitudinal movement at sway adapter.
    b. Submit Drawings of hanger assembly for review prior to ordering.
    c. If suspended luminaire is not free to swing 45-degrees in any direction, without obstructions, provide seismic restraint to prevent contact in

conformance with California Uniform Building Code, Section 2330, Seismic Design.

5. All recessed modular luminaires shall be furnished with earthquake clips where installed in tee bar ceiling.

3.06 IDENTIFICATION SYSTEM

A. All concealed junction box cover plates for the lighting branch circuit system shall be clearly marked with a permanent black ink felt pen identifying the branch circuit (both panel designation and circuit number) contained in the box.

3.07 FIELD QUALITY CONTROL

A. Visual and mechanical inspection:

1. Inspect for physical damage, defects, alignment and fit.
2. Perform operational test of each luminaire after installed, circuited, and energized.
3. Perform emergency operational test of all luminaires connected to emergency circuiting by simulating normal power source failure.

B. Contractor shall replace at no cost to the Owner all equipment which is found defective or do not operate within factory specified tolerances.

3.08 CLEANING

A. Clean luminaires prior to Project closeout in accordance with Manufacturer's recommended materials and methods.

B. Remove all debris, fingerprints, and packaging remnants.

END OF SECTION

SECTION 266113

FIRE ALARM SYSTEM

PART 1 - GENERAL

1.01 SUMMARY

A. Work included: Labor, materials, and equipment necessary to complete the installation required for the item specified under this Division, including but not limited to:

1. Fire alarm control panel(s) 'FACP'
2. Fire alarm annunciators
3. Fire alarm terminal cabinets 'FATC'
4. Initiating devices
5. Notification appliances
6. Auxiliary equipment control and supervision
7. Record Drawings
8. Pretesting and final testing

B. Work furnish and installed under another Section, but connected under this Section:

1. Fire sprinkler alarm system flow switches, valve monitors and post indicating valves
2. Elevator controller for recall
3. Door hold-open/closure devices
4. Fire/smoke dampers

C. Work furnished and connected to alarm system under this Section, but installed and connected to HVAC system under another Section:

1. Duct mounted smoke detectors at supply air HVAC equipment 2000 cfm and larger.

D. Work furnished and installed under another Section: HVAC shutdown wiring via dry contacts in remote mounted programmable relays.

E. Related work: Consult all other Sections, determine the extent and character of related Work, and properly coordinate Work specified herein with that specified elsewhere to produce a complete installation.

1. Division 08: Door Hardware
2. Division 14: Elevators
3. Division 23: HVAC System
4. Division 21: Fire Sprinkler System

1.02 REFERENCES

A. Comply with the latest edition of the following applicable Specifications and standards except as otherwise indicated or specified:

1. American National Standards Institute, Inc. (ANSI):

ANSI C62.41;	Guide for Surge Voltage in Low-Voltage AC Power Circuits
ANSI/ASME A17.1;	Safety Code for Elevators and Escalators

2. National Fire Protection Association (NFPA):

NFPA 13;	Standards for the Installation of Fire Sprinkler Systems
NFPA 72;	National Fire Alarm Code
NFPA 90A;	Standard for the Installation of Air Conditioning and Ventilating Systems
NFPA 101;	Life Safety Code

3. Underwriters Laboratories, Inc. (UL):

UL 38;	Manually Activated Signaling Boxes
UL 268;	Smoke Detectors for Fire Protective Signaling Systems
UL 268A;	Smoke Detectors for Duct Applications
UL 464;	Audible Signal Appliances
UL 497B;	Protectors for Data Communications and Fire Alarm Circuits
UL 521;	Heat Detectors for Fire Protective Signaling Systems
UL 864;	Control Units for Fire-Protective Signaling Systems
UL 1424;	Cables for Power-Limited Fire-Alarm Circuits
UL 1481;	Power Supplies for Fire-Protective Signaling Systems
UL 1638	Visual Signaling Appliances Standard
UL 1971	Signal Devices for the Hearing Impaired

4. Factory Mutual System (FM):

FM P7825	Approval Guide

1.03 DEFINITIONS

A. Addressable device: A fire alarm system initiating, control or monitoring device module component on a signaling line circuit (SLC) with discrete digital identification that can have its status individually identified or that is used to individually control other functions, using site-specific programming at the fire alarm control panel.

B. Alarm signal: A signal indicating an emergency that requires immediate action, such as a signal indicative of fire.

C. Annunciator: A unit containing one or more indicator lamps, alphanumeric displays, or other equivalent means in which each indication provides status information about a circuit, condition, or location.

D. Circuits and pathways:

1. Class B: Performance that does not include a redundant pathway and will not be capable of operation past a single open or ground fault condition but does include monitoring and annunciation of a trouble signal when either condition occurs. Any conditions that affect the intended operation of the path are annunciated as a trouble signal.

E. Initiating device: A system component that originates transmission of a change-of-state condition, such as in a smoke detector, manual fire alarm box or supervisory switch.

F. Initiating device circuit: A circuit to which automatic or manual initiating devices are connected where the signal received does not identify the individual device operated.

G. Notification appliances: A fire alarm system component such as a bell, horn, speaker, light, or text display that provides audible, tactile, or visible outputs or any combination thereof.

H. Notification appliance circuit: A circuit or path directly connected to a notification appliance(s).

I. Signaling line circuit: A circuit or path between any combination of circuit interfaces, control units or transmitters over which multiple system input signals or output signals or both, are carried.

J. Supervisory signal: A signal indicating the need for action in connection with the supervision of guard tours, the fire suppression systems or equipment or the maintenance features of related systems.

K. Trouble signal: A signal initiated by the fire alarm system or device indicative of a fault in a monitoring circuit or component.

1.04 SYSTEM DESCRIPTION

A. The fire alarm system shall be a microprocessor-based direct wired, multi-priority, peer-to-peer networked system. The system shall utilize independently addressed, microprocessor-based smoke detectors, heat detectors, and modules as described in this Specification. It shall be complete with all necessary hardware, software and memory specifically tailored for this installation. It shall be possible to permanently modify the software on site by using a plug-in programmer.

B. It shall be 24Vdc closed circuit, electronically supervised, common signaling, device indicating, and automatic alarm type. The system shall include all wiring, raceways, pullboxes, terminal cabinets, outlet and mounting boxes, control equipment, alarm and supervisory signal initiating devices, alarm notification appliances and all other accessories required for a complete operating system.

C. Provide system with the following circuit and pathway performance:

1. Initiating devices circuits (IDCs): Class B.

2. Signaling line circuits (SLCs): Class B.

3. Notification appliance circuits (NACs): Class B.

D. Standby power: The standby power supply shall be an electrical battery with capacity to operate the system under maximum supervisory load for twenty 24-hours and capable of operating the system for 5-minutes of evacuation alarm on all devices, operating at maximum load. The system shall include a charging circuit to

automatically maintain the electrical charge of the battery. The system shall automatically adjust the charging of the battery to compensate for temperature.

E. Voltage drop:

1. Under all operating conditions, the voltage on the NAC must be sufficient to operate all the notification appliances so that they deliver the proper signal intensity. The worst-case operating condition shall be calculated from when the control unit primary power supply has failed and the battery capacity is at its lowest point. An end of useful battery life starting value of 20.4volts shall be used at the starting voltage unless the manufacturer's instructions indicate that a higher or lower value should be used. The current draw of an appliance at the minimum listed operating voltage (16volts) should be used.
2. The point-to-point Ohm's Law voltage drop calculations of all alarm system circuits shall not exceed 10%.

F. Auxiliary equipment requiring control and monitoring:

1. Flow switches, tamper switches and PIV monitoring
2. Elevator recall and monitoring
3. Interface and provide fan shutdown control for all supply fans over 2000cfm
4. Interface and provide fire/smoke damper (FSD) control and monitoring
5. Door hold/open release device power and control

1.05 SEQUENCE OF OPERATION

A. For system description of output controls and monitoring, based on input signals, refer to Sequence of Operation Matrix on the Drawings.

B. General alarm operation: Upon alarm activation of any area smoke detector, duct smoke detector, heat detector, manual pull station, sprinkler waterflow, etc., the following functions shall automatically occur:

1. The internal audible device shall sound at the control panel and annunciator.
2. The LCD Display shall indicate all applicable information associated with the alarm condition including zone, device type, device location and time/date.
3. Any remote or local annunciator LCD/LED's associated with the alarm zone shall be illuminated.
4. The following notification signals and actions shall occur simultaneously:
   a. Horns shall sound throughout the building.
   b. Activate visual strobes throughout the building.
5. All self-closing fire/smoke doors held open shall be released.
6. All automatic events programmed to the alarm point shall be executed and the associated outputs activated.

C. Elevator lobby/equipment room detectors: Upon alarm activation of any elevator lobby smoke detector or equipment/control room detectors, the following functions shall automatically occur:

1. Perform general alarm sequence above.

2. Activation of elevator lobby smoke detectors (other than primary floor) shall recall the elevators to primary floor.
3. Activation of elevator lobby smoke detectors located on the primary recall floor shall recall the elevator the alternate floor.
4. Activation of equipment/control room smoke detectors shall recall the elevator to the primary floor.
5. Activation of the equipment room heat detector shall initiate the shunt-trip of service power to the associated elevator equipment.

D. Supervisory operation: Upon supervisory activation of any sprinkler valve supervisory switch, fire pump off-normal, etc., the following functions shall automatically occur:
   1. The internal audible device shall sound at the control panel and annunciator.
   2. The LCD display shall indicate all applicable information associated with the supervisory condition including zone, device type, device location and time/date.
   3. Any remote or local annunciator LCD/LED's associated with the supervisory zone shall be illuminated.
   4. Transmit signal to the central station with point identification.

E. Trouble operation: Upon activation of a trouble condition or signal from any device on the system, the following functions shall automatically occur:
   1. The internal audible device shall sound at the control panel and annunciator.
   2. The LCD keypad display shall indicate all applicable information associated with the trouble condition including zone, device type, device location and time/date.
   3. Any remote or local annunciator LCD/LED's associated with the trouble zone shall be illuminated.
   4. Transmit signal to the central station with point identification.

F. Monitor activation: Upon activation of any device connected to a monitor circuit (fire pump, emergency generator status, etc.), the following functions shall automatically occur:
   1. The LCD display shall indicate all applicable information associated with the status condition including zone, device type, device location and time/date.
   2. Any remote or local annunciator LCD/LED's associated with the status zone shall be illuminated.

G. In addition to the above sequence of operation, the FACP shall perform the following functions:
   1. Identify every addressable device by location, priority, and device type.
   2. Read and display at FACP the sensitivity of addressable smoke and heat detection devices.
   3. Remain 100% operational and capable of responding to an alarm condition while in the routine maintenance mode.
   4. Be capable of supporting non-addressable as well as addressable devices.

5. Allow individual programmable control of each connected remote or panel-mounted relay.
6. Provide the user with the field programmability to add or change addressable device types and custom messages on-site.
7. Display up to 127 alarms and/or up to 127 trouble indications, one at a time, as a list on the system printer/terminal.
8. Change the status of configured circuits (arming or disarming) and change status of relays.
9. Generate an addressable detector sensitivity report providing a chamber voltage listing (device testing) for each detector.

1.06 SUBMITTALS

A. Submit in accordance with the requirements of Section 260010: Basic Electrical Requirements, the following items:

1. Data/catalog cuts for each product and component specified herein, listing all physical and electrical characteristics and ratings indicating compliance with all listed standards.
2. Describe system operation, equipment and dimensions and indicate features of each component.
3. Clearly mark on each data sheet the specific item(s) being submitted and the proposed application.
4. Shop Drawings. A complete set of shop drawings shall be supplied. The shop drawings shall be reproduced electronically in digital format. This package shall include but not be limited to:

a. All drawings and diagrams shall include the contractor's title block, complete with drawing title, contractor's name, address, date including revisions, and preparer's and reviewer's initials.

b. Detailed system operational description. Any Specification differences and deviations shall be clearly noted and marked.

c. A riser diagram that individually depicts all control panels, annunciators, addressable devices, and notification appliances. Field addressable devices and notification appliances may be grouped together by specific type per loop or circuit.

d. Complete 1/8" = 1'-0 scale floor plan drawing locating all system devices and elevation of all equipment. Floor plans shall indicate accurate locations for all control and peripheral devices as well as raceway size and routing, junction boxes, and conductor size, and quantity in each raceway. All notification appliances shall be provided with a candela rating and circuit address that corresponds to that depicted on the Riser Diagram. If individual floors need to be segmented to accommodate the 1/8” scale requirements, KEY PLANS and BREAK-LINES shall be provided on the plans in an orderly and professional manner. End-of-line resistors (and values) shall be depicted.

e. Control panel wiring and interconnection schematics. The drawing(s) shall depict internal component placement and all internal and field termination

points. Drawing shall provide a detail indicating where conduit penetrations shall be made, so as to avoid conflicts with internally mounted batteries. For each additional data-gathering panel, a separate control panel drawing shall be provided, which clearly indicated the designation, service, and location of the control enclosure.

f. Complete calculations shall clearly indicate the quantity of devices, the device part numbers, the supervisory current draw, the alarm current draw, totals for all categories, and the calculated battery requirements. Battery calculations shall also reflect all control panel component, remote annunciator, and auxiliary relay current draws.

g. System (Load & Battery) calculations shall be provided for each system power supply, each notification appliance circuit and each auxiliary control circuit that draws power from any system power supply.

h. Additionally, Drawings shall include:

1) Symbols legend.

2) Equipment list showing quantity, make, model and CSFM listing number for each device.

3) Wire and cable schedule.

4) Scope of Work with overall system description.

5) Sequence of operation matrix with system inputs signals and output functions.

6) Code summary and Building type.

7) Assignment of Class and/or Style designation for device circuits.

8) Elevation indicating mounting heights for manual pull stations, audible and visual devices, and combination audible/visual devices.

9) Rated penetration details.

10) Typical wiring diagram details of field devices.

11) Detector mounting details at HVAC ducts.

12) Voltage drop calculations for system wiring circuits.

5. Furnish structural calculations for equipment anchorage as described in Section 260010: Basic Electrical Requirements.

6. Submit Manufacturer's installation instructions.

7. Complete bill of materials listing all components.

8. Warranty.

B. Contractor shall submit approved Shop Drawings for review by Local Fire Marshal prior to the purchase and installation of equipment. Provide quantities of Drawing sets as required by jurisdiction. Drawings shall be wet stamped and signed by a registered professional Engineer.

C. Record Drawings:

1. Furnish Record Drawings as described in Section 260010: Basic Electrical Requirements, utilizing Shop-Drawing submissions with updated field conditions. These Drawings shall include but not be limited to the following:
    a. Plot plans and building floor plans, showing point-to-point wiring location of and conduit routing to all devices.
    b. Block Diagram/Riser Diagram showing the FACP, system components and all conduit and wire type/sizes between each.
2. Drawings shall be incorporated into the Record Drawing submission.
3. Final acceptance will not be made until the Engineer has approved the Record Drawings.

1.07 OPERATION AND MAINTENANCE MANUAL

A. Supply operation and maintenance manuals in accordance with the requirements of Section 260010: Basic Electrical Requirements, to include the following:
    1. A detailed explanation of the operation of the system.
    2. Instructions for routine maintenance.
    3. Pictorial parts list and part numbers.
    4. Schematic Drawings of wiring system, including all initiation and annunciation devices, control panel, annunciators, etc.
    5. Telephone numbers for the authorized parts and service distributors.
    6. Final testing reports.

1.08 QUALITY ASSURANCE

A. All materials, equipment and parts comprising the units specified herein shall be new, unused, and currently under production.

B. Only products and applications listed in this Section may be used on the Project unless otherwise submitted.

1.09 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Delivery: Fire alarm system components shall not be delivered to the Project site until protected storage space is available. Storage outdoors covered by rainproof material is not acceptable. Equipment damaged during shipment shall be replaced and returned to Manufacturer at no cost to Owner.

B. Storage: Store in a clean, dry, ventilated space free from temperature extremes. Maintain factory wrapping or provide a heavy canvas/plastic cover to protect units from dirt, water, construction debris and traffic. Provide heat where required to prevent condensation.

C. Handling: Handle in accordance with Manufacturer's written instructions. Be careful to prevent internal component damage, breakage, denting and scoring. Damaged units shall not be installed. Replace damaged units and return equipment to Manufacturer.

1.10 WARRANTY

A. Units and components offered under this Section shall be covered by a 1-year parts and labor warranty for malfunctions resulting from defects in materials and workmanship. Warranty shall begin upon acceptance by the Owner.

B. The warranty package shall include, but not be limited to the following:

1. Emergency maintenance service.
2. Service by factory trained service representative of system Manufacturer.
3. Replacement of any defective components.

1.11 SYSTEM START-UP

A. Upon completion of installation, a factory trained dealer service representative shall perform initial start-up of the fire alarm system. Sufficient time shall be allowed to properly check the system out and perform required minor adjustments before the Engineer's witnessed test shall begin.

1.12 MAINTENANCE

A. Maintenance Service:

1. For a period of one year following acceptance the equipment Supplier shall have a person(s) familiar with this Project attend four quarterly meetings with the Owner's Representative to review system performance, operation, and any system problems. That person shall provide a written summary of the items discussed in each meeting and a schedule of when the system problems will be corrected. The report is due within 7 working days after each meeting.
2. During the eleventh month following system acceptance, on a weekend day, the equipment Supplier shall perform a complete test of the system, in a manner similar to the acceptance test. A written report shall be submitted to the Owner certifying that each initiating device has been tested. A copy of these test forms shall be submitted to the Engineer for review and acceptance.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Products furnished by the following Manufacturers shall be acceptable if in compliance with all features specified herein and indicated on the Drawings.

1. EST.
2. Gamewell/FCI (Fire Control Instruments).
3. Notifier.
4. Siemens.

B. Substitutions: Under provisions of Section 260010: Basic Electrical Requirements.

2.02 CONTROL PANEL ‘FACP’

A. General:

1. The control panel shall comply with applicable requirements of UL864 and shall provide power, annunciation, supervision, and control for the complete fire alarm system. The panel shall be installed in a surface mounted steel cabinet, containing all modules necessary to operate as indicated herein. The operating

controls shall be located behind hinged, locked door with viewing window. All control modules shall be labeled, and all zone locations shall be identified.

2. The panel shall be supervised, site programmable, and of modular design supporting up to 64 network nodes. The peer-to-peer network shall contain multiple nodes consisting of the command center, main controller, remote control panels, and annunciation nodes. Each node is an equal, active functional node of the network, which is capable of making all local decisions and generating network tasks to other nodes in the event of node failure or communications failure between nodes. When utilizing a network and multiple wiring faults occur, the network shall re-configure into many sub-networks and continue to respond to alarm events from every panel that can transmit and receive network messages.
3. The panel module shall control and monitor all local or remote peripherals. It shall support a large 168-character LCD, power supply, remote LCD and zone display annunciators, printers, etc.
4. The programmer shall be able to download all network applications from the configuration computer to all the network panels from a single location on the system.
5. The panels shall have the ability to add an operator interface control/display at each node that shall annunciate, command and control system functions.
6. The system shall store all basic system functionality and job specific data in non-volatile memory. All site specific and operating data shall survive a complete power failure intact.
7. The control panel shall contain a standby power supply that automatically supplies electrical energy to the system upon primary power supply failure. The system shall include a charging circuit to automatically maintain the electrical charge of the battery.
8. All addressable devices shall be individually identified by the system and any quantity of addressable devices may be in alarm at any time up to the total number connected to the system.
9. Dynamic supervision of system electronics, wiring, initiating devices and software shall be provided by the control system. Failure of system hardware or wiring shall be indicated by type and location on the alphanumeric annunciator. Software and processor operation shall be monitored by an independent hardware watchdog, which will indicate their failure. The panel shall provide failsafe operation, i.e. all incoming alarms shall override all other modes of operation.
10. Provide a service mode to permit the arming and disarming of individual initiating or output devices as well as manually operating output devices. Status of these devices shall be displayed upon command from the control panel. The panel shall automatically return to the normal mode in the event the panel remains unattended in the service mode.
11. The panel shall be capable of measuring and adjusting the sensitivity of addressable detectors upon request. An alphanumeric display shall be provided to display custom messages and give readings of detector sensitivity detector by

detector. Each device on an addressable initiating circuit shall be checked continuously to include the following:

a. Sensitivity.

b. Response.

c. Opens.

d. Shorts.

e. Ground faults.

f. Functionality.

g. Status.

12. The panel shall monitor the addressable smoke detectors in such a manner that if the detectors become dirty and reach and maintain 80% of alarm threshold for 5-consecutive hours, a trouble condition indicating exactly which device needs service shall be automatically annunciated. If the device becomes too insensitive for a period of 10-seconds, the trouble indication will read: "Input device response too low".

13. The panel shall report, by specific device number, any device removed from an addressable initiating circuit and all other devices shall continue to function.

14. The panel shall automatically indicate the total quantity of alarms and troubles, which have occurred prior to reset at the control unit.

15. No alarm or trouble indication shall be resettable until it has been acknowledged. It shall not be possible to reset the system until all alarms have been acknowledged.

16. The panel shall be capable of:

    a. Counting the number of addressable devices within a designated area or "zone" which are in alarm.

    b. Counting "zones" which are in alarm.

    c. Counting the number of addressable devices, which are in alarm on the system.

    d. Differentiating among types of addressable devices such as smoke detectors, manual stations, waterflow switches, heat detectors, etc.

    e. Assigning priorities to types of devices, zones, or groups of devices.

    f. Cross-Zoning.

17. Each addressable device shall report its condition to the panel control unit every 3-seconds in a manner such that failure of the connections to or internal electronics of the device will result in a trouble signal that identifies the specific device involved.

B. Signaling line circuits (SLC):

1. The control panel shall be supervised, site programmable, and of modular design supporting up to 125-detectors and 125-remote modules per addressable SLC. The panel shall support up to 10-SLC's per panel for a total system capacity of

2500-intelligent addressable points. The system shall be designed with peer-to-peer networking capability for enhanced survivability, with support for up to 64 nodes, each with up to 2500-points and an overall capacity of 160,000-points.

2. The system shall provide electronic addressing of analog/addressable devices.
3. The system shall have built-in automatic system programming to automatically address and map all system devices attached to the main controller.
4. The system shall use full digital communications to supervise all addressable loop devices for placement, correct location, and operation. It shall allow swapping of “same type” devices without the need of addressing and impose the “location” parameters on replacement device. It shall initiate and maintain a trouble if a device is added to a loop and clear the trouble when the new device is mapped and defined into the system.
5. The system shall have a UL Listed detector sensitivity test feature, which will be a function of the smoke detectors and performed automatically every 4-hours.

C. Digital alarm communicator transmitter (DACT):

1. The system shall provide DACT for off premise communications capability, transmitting system events to single or multiple Central Monitoring Station (CMS) receivers.
2. The system shall be capable of providing the CMS with point identification of system events using Contact ID or SIA DCS protocols.
3. In the event of a panel CPU failure during a fire alarm condition, the DACT degrade mode shall transmit a general fire alarm signal to the CMS.

D. Internal Modular Power Supply:

1. System power supply(s) shall provide multiple power limited 24volt DC output circuits as required by the panel.
2. Upon failure of normal (AC) power, the affected portion(s) of the system shall automatically switch over to secondary power without losing any system functions.
3. Each system power supply shall be individually supervised. Power supply trouble signals shall identify the specific supply and the nature of the trouble condition.
4. All standby batteries shall be continuously monitored by the power supply. Low battery and disconnection of battery power supply conditions shall immediately annunciate as battery trouble and identify the specific power supply affected.
5. All system power supplies shall be capable of recharging up to 260AH batteries, from a fully discharged condition to a capacity sufficient to allow the system to perform consistent with the requirements of this section, in 48 hours maximum.
6. Power supply shall be adequate to supply all system components of the fire alarm system, including FACP modules, initiating devices, notification appliances, remote control and monitoring devices, annunciators, etc. All power connections whether AC or DC shall be separately fused within panel.

E. Storage batteries: Shall be provided and shall be the sealed, lead-acid types. The batteries shall have ample capacity, with primary power disconnected, to operate the

fire alarm system for a period of 24-hours. Following this period of operation via batteries, the batteries shall have ample capacity to operate all components of the system, including all alarm annunciating devices in the total alarm mode for a period of 5-minutes. Battery cabinet shall be a separate cabinet.

F. Battery charger: Shall be completely automatic, with high/low charging rate, capable of restoring the batteries from full discharge to full charge within 8-hours. A separate ammeter shall be provided for indicating rate of charge. A separate voltmeter shall be provided to indicate the state of the battery charge. Pilot light shall indicate when batteries are manually placed on a high rate of charge as part of the unit assembly if a high rate switch is provided. Charger shall be located in battery cabinet.

G. Reports:

1. The system shall provide the operator with system reports that give detailed description of the status of system parameters for corrective action, or for preventative maintenance programs. The system shall provide these reports via the main LCD and shall be capable of being printed on any system printer.
2. The system shall provide a report that gives a sensitivity listing of all detectors that have less than 75% environmental compensation remaining. The system shall provide a report that provides a sensitivity (% Obscuration per foot) listing of any detector.
3. The system shall provide a report that gives a listing of the sensitivity of all the detectors on any given panel in the system, or any given analog/addressable device loop within any given panel.
4. The system shall provide a report to determine the carbon monoxide detectors end-of-life.
5. The system shall provide a report that gives a chronological listing of up to the last 1740 system events.
6. The system shall provide a listing of all the firmware revision listings for all of the installed network components in the system.

2.03 ANNUNCIATORS

A. Main control and annunciator panel:

1. Main annunciator shall be located with the FACP.
2. The main display shall be a large 168-character LCD with normal, alarm, trouble, supervisory, disabled point, and ground fault indicators.
3. The main display shall show the first and most recent highest priority system events without any operator intervention. All system events shall be directed to one of four message queues. Messages of different types shall never inter-mixed to eliminate operator confusion. A "Details" switch shall provide additional information about any device highlighted by the operator.
4. Receipt of alarm, trouble, and supervisory signals shall activate integral audible devices at the control panel(s) and at each remote annunciation device. The integral audible devices shall produce a sound output upon activation of not less than 85-dBA at 10-feet.

5. The internal audible signal shall have different programmable patterns to distinguish between alarm, supervisory, trouble and monitor conditions.
6. The annunciator shall contain the following controls:
    a. System reset switch with indicator
    b. System alarm silence switch with indicator
    c. System panel silence switch with indicator
    d. Programmable switch with indicator
    e. Details switch
    f. System message queue scroll switches.
    g. 10-Digit keypad to enable/disable system and functions.
7. An authorized operator shall have the ability to operate or modify system functions like system time, date, passwords, holiday dates, restart the system and clear control panel event history file.
8. An authorized operator shall be capable of performing test functions within the installed system.

B. Fireman's remote annunciator panel (FRAP):
1. Remote LCD network alphanumeric annunciators shall display each point in the system.
2. Network alphanumeric annunciators shall be located as indicated on the plans. This annunciator shall be an integral part of the peer to peer network for survivability.
3. Annunciator shall contain a supervised, back-lit, liquid crystal display with a minimum of 8-lines and 21-characters per line. The annunciator shall support full ability to serve as the operating interface to the system and shall include the following features:
    a. Matched appearance with other system displays
    b. LCD display shall be configurable to show the status of any or all the following functions anywhere in the system:
        1) Alarm
        2) Supervisory
        3) Trouble
        4) Monitor
4. Annunciator must be capable of supporting custom messages as well as system event annunciation. It must be possible to filter unwanted annunciation of trouble, alarm, or supervisory functions on a by point or by geographic area. The annunciators shall be mounted in stand-alone enclosures at location as indicated on the plans.

2.04 INTELLIGENT ADDRESSABLE DETECTORS

A. General:

1. Each detector device shall have a microprocessor with non-volatile memory to support its functionality and serviceability. Devices shall store as required for its functionality the following data: device serial number, device address, device type, personality code, date of manufacture, hours in use, time and date of last alarm, amount of environmental compensation left/used, last maintenance date, job/project number, current detector sensitivity values, diagnostic information (trouble codes) and algorithms required to process sensor data and perform communications with the loop controller.
2. Each device shall be capable of electronic addressing, either automatically or application programmed assigned, to support physical/electrical mapping and supervision by location. Setting a device's address by physical means shall not be necessary.
3. The intelligent detectors shall be capable of full digital communications using both broadcast and polling protocol. Each detector shall be capable of performing independent fire detection algorithms. The fire detection algorithm shall measure sensor signal dimensions, time patterns, and combine different fire parameters to increase reliability and distinguish real fire conditions from unwanted deceptive nuisance alarms. Signal patterns that are not typical of fires shall be eliminated by digital filters. Devices not capable of combining different fire parameters or employing digital filters shall not be acceptable.
4. Each detector shall be capable of making alarm decisions based on fire parameter information stored in the detector head. Distributed intelligence shall improve response time by decreasing the data flow between detector and analog loop controller. Maximum total analog loop response time for detectors changing state shall be 0.75-seconds. The integral microprocessor shall dynamically examine values from the sensor and initiate an alarm based on the analysis of data.
5. The detector shall continually monitor any changes in sensitivity due to the environmental effects of dirt, smoke, temperature, aging, and humidity.
6. Each detector shall have a separate means of displaying communication and alarm status. A green/red LED shall flash to confirm communication with the analog loop controller and display alarm status.
7. The detector shall be capable of identifying up to 32-diagnostic codes. This information shall be available for system maintenance. The diagnostic code shall be stored at the detector.
8. Each smoke detector shall be capable of transmitting pre-alarm and alarm signals in addition to the normal, trouble and need cleaning information. It shall be possible to program control panel activity to each level. Each smoke detector may be individually programmed to operate at any one of 5-sensitivity settings.
9. Each device microprocessor shall contain an environmental compensation algorithm, which identifies and sets ambient "Environmental Thresholds" approximately six times an hour. The microprocessor shall continually monitor the environmental impact of temperature, humidity, other contaminates as well as detector aging. The process shall employ digital compensation to adapt the detector to both 24-hour long-term and 4-hour short-term environmental changes. The microprocessor shall monitor the environmental compensation value and alert the system operator when the detector approaches 80% and

100% of the allowable environmental compensation value. Differential sensing algorithms shall maintain a constant differential between selected detector sensitivity and the “learned” base line sensitivity. The base line sensitivity information shall be updated and permanently stored at the detector approximately once every hour.

B. Ionization smoke detector:

1. The intelligent ionization detector shall be rated for ceiling installation at a minimum of 30-foot centers and be suitable for wall mount applications.
2. The percent smoke obscuration per foot alarm set point shall be field selectable to any of five sensitivity settings ranging from 0.61% to 1.91%. The ionization detector shall be suitable for operation in the following environment:
   a. Temperature: 32-degree F to 120-degree F (0-degree C to 49-degree C)
   b. Humidity: 0-93% RH, non-condensing
   c. Installation attitude: 6000-feet
   d. Air velocity: 0 to 75-feet/minimum

C. Photoelectric smoke detector:

1. Provide intelligent analog photoelectric detector shall utilize a light scattering type photoelectric smoke sensor to sense changes in air samples from its surroundings.
2. Each unit shall have a field-replaceable smoke chamber.
3. The photo detector shall be rated for ceiling installation at a minimum of 30-foot centers and be suitable for wall mount applications.
4. The photoelectric smoke detector shall be suitable for direct insertion into air ducts up to 3-feet high and 3-feet wide with air velocities up to 5,000-feet/minimum.
5. The percent smoke obscuration per foot alarm set point shall be field selectable to any of five sensitivity settings ranging from 1.0% to 3.5%. The photoelectric detector shall be suitable for operation in the following environment:
   a. Temperature: 32-degree F to 120-degree F (0-degree C to 49-degree C)
   b. Humidity: 0-93% RH, non-condensing
   c. Installation attitude: no limit

D. Fixed temperature/rate-of-rise heat detector:

1. Provide intelligent combination fixed temperature/rate-of-rise heat detectors with low mass thermistor heat sensor and operate at a fixed temperature and at a temperature rate-of-rise. It shall continually monitor the temperature of the air in its surroundings to minimize thermal lag to the time required to process an alarm.
2. The integral microprocessor shall determine if an alarm condition exists and initiate an alarm based on the analysis of the data.
3. The intelligent heat detector shall have a nominal fixed temperature alarm point rating of 135-degree F (57-degree C) and a rate-of-rise alarm point of 15-degree F (9-degree C) per minute.

4. The heat detector shall be rated for ceiling installation at a minimum of 50-foot centers and be suitable for wall mount applications.

E. Standard detector bases:

1. Provide standard detector mounting bases suitable for mounting on a standard 4” octagon or square box. The base shall contain no electronics and support all intelligent detector types.
2. Removal of the respective detector shall not affect communications with other detectors.
3. Terminal connections shall be made on the room side of the base.

F. Relay detector bases:

1. Provide standard detector mounting bases suitable for mounting on a standard 4” octagon or square box. The base shall support all intelligent detector types.
2. Removal of the respective detector shall not affect communications with other detectors.
3. Terminal connections shall be made on the room side of the base. Bases, which must be removed to gain access to the terminals, shall not be acceptable.
4. The relay shall be a bi-stable type and selectable for normally open or normally closed operation.
5. The position of the contact shall be supervised.
6. The relay shall automatically de-energize when a detector is removed.
7. The operation of the relay base shall be controlled by its respective detector processor. Detectors operating standalone mode shall operate the relay upon changing to alarm state. Relay bases not controlled by the detector microprocessor shall not be acceptable.
8. Form "C" relay contacts shall have a minimum rating of 1amp at 30volt DC and be listed for pilot duty.

G. Duct detector:

1. Provide intelligent addressable analog photoelectric duct smoke detectors that utilize a light scattering type photoelectric smoke sensor to sense changes in air samples from its surroundings. The integral microprocessor shall dynamically examine values from the sensor and initiate an alarm based on the analysis of data. Systems using central intelligence for alarm decisions shall not be acceptable. The detector shall continually monitor any changes in sensitivity due to the environmental effects of dirt, smoke, temperature, aging, and humidity.
2. The percent smoke obscuration per foot alarm set point shall be field selectable to any of five sensitivity settings ranging from 0.79% to 2.46%. The duct detector shall be suitable for operation in the following environment:
    a. Temperature: -20-degree F to 158-degree F (-29-degree C to 70-degree C)
    b. Humidity: 0% to 93% RH, non-condensing
    c. Air velocity: 100 to 4000-feet/minimum

3. Provide an air exhaust tube and an air sampling inlet tube, which extends into the duct air stream up to ten feet. The sampling tube can be installed with or without the cover in place and can be rotated in 45-degree increments to ensure proper alignment with the duct airflow.
4. Status LEDs shall remain visible through a clear assembly cover.
5. The unit shall contain a magnet-activated test switch.
6. One integral Form C auxiliary alarm relay shall be provided. The relay contact shall be capable of being individually programmed from the control panel. The contact shall be rated for 2.0amp at 30volt DC.

2.05 INTELLIGENT ADDRESSABLE MODULES

A. General:

1. Each remote device shall have a microprocessor with non-volatile memory to support its functionality and serviceability. Devices shall store as required for its functionality the following data: device serial number, device address, device type, personality code, date of manufacture, hours in use, time and date of last alarm, amount of environmental compensation left/used, last maintenance date, job/project number, current detector sensitivity values, diagnostic information (trouble codes) and algorithms required to process sensor data and perform communications with the loop controller.
2. Each device shall be capable of electronic addressing, either automatically or application programmed assigned, to support physical/electrical mapping and supervision by location.
3. The module shall be suitable for operation in the following environment:
   a. Temperature: 32°F to 120°F (0°C to 49°C)
   b. Humidity: 0-93% RH, non-condensing

B. Single input module:

1. Provide intelligent signal input modules for monitoring of PIV's, tamper switches, flow switches, fan & damper status or any other sets of dry contacts required to be monitored.
2. The single input module shall provide one (1) supervised Class B input circuit capable of a minimum of 4 personalities, each with a distinct operation.
3. The module shall be suitable for mounting on a standard 4" square box with 1-gang ring.
4. The single input module shall support the following circuit types:
   a. Normally Open Alarm Latching (Manual Stations, Heat Detectors, etc.)
   b. Normally Open Alarm Delayed Latching (Waterflow Switches)
   c. Normally Open Active Non-Latching (Monitor, Fans, Dampers, Doors, etc.)
   d. Normally Open Active Latching (Supervisory, Tamper Switches)

C. Dual input module:

1. Provide intelligent dual input modules for monitoring of sets of PIV's, tamper switches, flow switches, fan & damper status or any other sets of dry contacts required to be monitored.
2. The dual input module shall provide two (2) supervised Class B input circuits each capable of a minimum of 4 personalities, each with a distinct operation.
3. The module shall be suitable for mounting on a standard 4" square box with 1-gang ring.
4. The dual input module shall support the following circuit types:
    a. Normally open alarm latching
    b. Normally open alarm delayed latching
    c. Normally open active non-latching
    d. Normally open active latching

D. Signal module:

1. Provide intelligent single input signal modules for activation of booster power supplies, audible/visual circuits.
2. The single input signal module shall provide 1-supervised Class B output circuit capable of a minimum of 2-personalities, each with a distinct operation.
3. The module shall be suitable for mounting on a standard 4" square box with 2-gang ring.
4. The single input signal module shall support audible/visible signal power selector (polarized 24volt DC at 2amps, 25Vrms at 50watt or 70Vrms at 35watt of audio)

E. Synchronized signal module:

1. Provide intelligent single input signal modules for activation of booster power supplies and/or audible/visual circuits that require synchronization.
2. The single input signal module shall provide one (1) supervised Class B output circuit capable of a minimum of 2 personalities, each with a distinct operation.
3. The module shall be suitable for mounting on a standard 4" square box with 2-gang ring.
4. The single input signal module shall support audible/visible signal power selector (polarized 24volt DC at 2amp, 25Vrms at 50watt or 70Vrms at 35watt of audio)
5. Provides UL1971 auto-sync output for synchronizing multiple notification appliance circuits

F. Control relay module:

1. Provide intelligent control relay modules for activation and/or shutdown of fans, dampers, door holder circuits, door locks, shunt trip, elevator recall or any other fail-safe system requiring control or activation.
2. The control relay module shall provide one Form R dry relay contact rated at 2amps at 24volt DC to control external appliances or equipment shutdown.
3. The control relay shall be rated for pilot duty and releasing systems.

4. The control relay module shall be suitable for mounting on a standard 4” square box with 1-gang ring.

G. Manual pull station:

1. Provide intelligent single action, single stage fire alarm pull stations. The fire alarm pull station shall be of metal construction with an internal toggle switch. Provide a locked test feature. Finish the station in red with silver “PULL IN CASE OF FIRE” lettering.
2. The manual station shall be suitable for mounting on a standard 4” square box with 1-gang ring.
3. Provide compatible surface mount red box at all surface mount locations.

2.06 NOTIFICATION APPLIANCES

A. Horns:

1. Horns shall be a low-profile design, finished in red with white lettering and shall not protrude more than 1” off the finished wall surface. In-out screw terminals shall be provided for wiring.
2. Horns shall be provided with a switch selectable audible output of at least two decibel levels. Maximum 84-dBA output at 10-feet when measured in reverberation room per UL 464.
3. Horns shall have two selectable tone options of temporal or non-temporal continuous pattern.
4. Horns shall be suitable for wall mounting and shall mount in a standard 4" square x 2 1/8" deep electrical box. All mounting hardware shall be captive and there shall be no mounting screws visible after the device is installed.
5. Horns shall also be suitable for ceiling mounting and shall mount in a standard 4" square x 2-1/8" deep electrical box. All mounting hardware shall be captive and there shall be no mounting screws visible after the device is installed.
6. Where surface mounted horns are installed a skirt enclosure or manufacturer’s color-matched surface mount box, shall be installed to conceal the electrical box to which the strobe lights are mounted. The correct surface box shall be used to ensure the skirt fits properly and is flush with the wall or ceiling.

B. Strobe lights:

1. Strobes shall be a low-profile design, finished in white with red lettering and shall not protrude more than 1” off the finished wall surface. In-out screw terminals shall be provided for wiring.
2. Strobes shall provide synchronized flash outputs at maximum pulse duration of 0.2-seconds. The light output shall be an even pattern with no hot spots. Strobes appliances shall be comprised of a Xenon flashtube with a clear lens and be entirely solid state.
3. The strobe shall have selectable 15, 30, 75 or 110 cd settings for wall or standard ceiling height mounting.
4. The strobe shall have selectable 95, 115, 150 or 177 cd settings for high ceilings.

5. It shall be possible to change the strobe setting without removing the device from the wall or ceiling.
6. Strobes shall be suitable for wall mounting and shall mount in a standard 4" square x 1-½" deep electrical box. All mounting hardware shall be captive and there shall be no mounting screws visible after the device is installed.
7. Strobes shall also be suitable for ceiling mounting and shall mount in a standard 4" square x 1-½" deep electrical box. All mounting hardware shall be captive and there shall be no mounting screws visible after the device is installed.
8. Where surface mounted strobe lights are installed a skirt enclosure or manufacturer's color-matched surface mount box, shall be installed to conceal the electrical box to which the strobe lights are mounted. The correct surface box shall be used to ensure the skirt fits properly and is flush with the wall or ceiling.

C. Combination horn/strobe lights:

1. Horns shall be a low-profile design, finished in red with white lettering and shall not protrude more than 1" off the finished wall surface. In-out screw terminals shall be provided for wiring.
2. Horns shall be provided with a switch selectable audible output of at least two decibel levels.
3. Horns shall have two selectable tone options of temporal or non-temporal continuous pattern.
4. Strobes shall provide synchronized flash outputs at maximum pulse duration of 0.2-seconds. The light output shall be an even pattern with no hot spots. Strobes appliances shall be comprised of a Xenon flashtube with a clear lens and be entirely solid state.
5. It shall be possible to flash the strobe at a temporal flash rate to match the horn.
6. The strobe shall have selectable 15, 30, 75 or 110 cd settings for wall or standard ceiling height mounting.
7. The strobe shall have selectable 95, 115, 150 or 177 cd settings for high ceilings.
8. It shall be possible to change the strobe setting without removing the device from the wall or ceiling.
9. Horn/strobes shall be suitable for wall mounting and shall mount in a standard 4" square x 1-½" deep electrical box. All mounting hardware shall be captive and there shall be no mounting screws visible after the device is installed.
10. Horn/strobes shall also be suitable for ceiling mounting and shall mount in a standard 4" square x 1-½" deep electrical box. All mounting hardware shall be captive and there shall be no mounting screws visible after the device is installed.
11. Where surface mounted horn/strobe lights are installed a skirt enclosure or manufacturer's color-matched surface mount box, shall be installed to conceal the electrical box to which the strobe lights are mounted. The correct surface box shall be used to ensure the skirt fits properly and is flush with the wall or ceiling.

D. Weatherproof horns and strobes and/or combination appliances:

1. Appliances shall be a semi-flush design, finished in red with white lettering. In-out screw terminals shall be provided for wiring.
2. Horns shall be provided with a switch selectable audible output of at least three decibel levels of 99, 95, and 90-dBA.
3. Horns shall have two selectable tone options of temporal or non-temporal continuous pattern.
4. Strobes shall provide synchronized flash outputs at maximum pulse duration of 0.2 seconds. The light output shall be an even pattern with no hot spots. Strobes appliances shall be comprised of a Xenon flashtube with a clear lens and be entirely solid state.
5. The strobe shall have a 75 cd setting for wall mounting.
6. Strobe shall operate over an extended temperature range of -31-degree F to 150-degree F. All inputs shall be polarized for compatibility with standard reverse polarity supervision of circuit wiring.
7. Appliance backbox shall be weatherproof and vandal resistant.

E. Remote booster power supplies:

1. Unit shall be a self-contained with 24volt DC power supply and batteries housed in its own locked enclosure. Keys provided shall be identical to the keys provided for all other fire alarm equipment provided.
2. Power supply shall be available in both 10amp or 6.5amp models and 120volt AC.
3. On board LED indicators for each NAC, battery supervision, ground fault and AC power.
4. The power supply shall provide four (4) independent 3amp NACs. Each circuit can be configurable as an auxiliary output.
5. Configurable for any one of three signaling rates: 120SPM; 3-3-3 temporal; or, continuous.
6. Two independent and configurable inputs switch selectable to allow correlation of the two (2) inputs and the four (4) outputs.
7. NACs shall be configurable for either four Class B or two Class A circuits.
8. The unit shall be compatible with SIGA-CC1S for synchronization of multiple power supplies without inter-connect wiring.
9. Brackets shall be provided inside the enclosure to allow mounting the signaling modules. All signaling modules shall be listed to be located inside the booster power supply enclosure.
10. A selectable dip switch shall enable built in synchronization for horns and strobes which may be used to synchronize downstream devices, as well as other boosters and their connected devices.

2.07 AUXILIARY EQUIPMENT CONTROL AND SUPERVISION

A. Fire sprinkler system components: Include single or dual input modules at waterflow and/or tamper switch on each floor of building, fire pump room, etc., for monitoring status:
   1. Each waterflow switch will initiate an alarm signal.
   2. Each tamper switch will initiate a trouble signal.
   3. Each post indicating valve (PIV) will initiate a trouble signal.

B. Elevator interface: Include the following in each elevator machine/control room or electrical room for interface with the elevator system:
   1. Addressable control relay in each machine/control room for elevator recall purposes to ground floor.
   2. Addressable control relay in each machine/control room for elevator recall purposes to an alternate floor, designated by fire marshal. Alternate floor will activate if ground floor lobby smoke detector is in alarm.
   3. Single or dual input modules in machine/control rooms to monitor auxiliary contacts of elevator disconnect switches for power availability.
   4. Addressable control relay at electrical room where circuit breaker with shunt trip feeding elevator equipment is located. Relay shall interface with shunt trip to open circuit breaker upon heat detection in elevator machine/control room. Also, if heat detector is located in elevator shaft, then this shall open circuit breaker as well.
   5. Single input module in the electrical room where shunt trip is located to monitor available power of shunt trip circuit.

C. Supply fan/air handler shutdown: All supply air fan, 2000cfm and greater, shall be furnished with a duct-mounted smoke detector and addressable control relay for shutdown purposes. Upon smoke detection, the fan shall be automatically controlled to the “OFF” position.

D. Fire/smoke dampers (FSDs):
   1. FSDs for return air systems: Include spot smoke detector(s) over the openings of all return air FSDs for “OPEN/CLOSE” control upon detection of smoke. Provide one detector if open is 36” wide or less, two if opening is 72” wide or less and three if opening is 108” wide or less.
   2. FSDs for supply air systems: Include in-duct smoke detector(s) within ducts adjacent to supply air FSDs for “OPEN/CLOSE” control upon detection of smoke. Provide one detector if open is 36” wide or less, two if opening is 72” wide or less and three if opening is 108” wide or less.

E. Door hold-open/closure devices: Provide an addressable control relay for doors with magnetic hold-open/closure devices as well as a 24volt DC power circuit from fire alarm system to release doors when system is in alarm.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Contractor shall thoroughly examine Project site conditions for acceptance of fire alarm system installation to verify conformance with Manufacturer and Specification

tolerances. Do not commence with installation until all conditions are made satisfactory.

3.02 INSTALLATION

A. General:

1. Install fire alarm system in accordance with Manufacturer's written instructions, as indicated on the Drawings and as specified herein.
2. The 120volt, 2-wire, 60-cycles AC two-20amp circuits supply required to power the system shall be connected as indicated on the Drawings. Connect to red colored circuit breaker(s) in panelboard. Identify circuit as "Fire Alarm Circuit Control."

B. Conductors:

1. Refer to Section 260519: Building Wire and Cable.
2. All circuits shall be rated power limited in accordance with CEC Article 760.
3. All system conductors shall be of the type(s) specified herein.
   a. All initiating circuit, signaling line circuit, AC power conductors, shield drain conductors and grounding conductors, shall be solid copper, stranded or bunch tinned (bonded) stranded copper.
   b. All wiring shall be color-coded throughout.
   c. Signaling line circuits: Shall be #18 AWG minimum multi-conductor jacketed twisted cable or as per manufacturer's requirements.
   d. Initiating device circuits: 24volt DC circuits shall be #18 AWG minimum or per manufacturer's requirements.
   e. Notification appliance circuits:
      1) Horn-strobe or strobe: Non-twisted pair, not less than #14 AWG or as recommended by the manufacturer.
   f. 120Vac circuits:
      1) Minimum #10 AWG for panel power circuits.
      2) Minimum #12 AWG for all other circuits.
      3) Each circuit shall have its own dedicated neutral conductor.

C. Conduit raceway:

1. All system components listed to UL864 Control Units for Fire Protective Signaling Systems shall be installed within a common conduit raceway system, in accordance with the manufacture's recommendations. System components not listed to the UL864 standard shall utilize a separate conduit raceway system for each of the sub-systems.
2. All system conduits shall be EMT, 1/2-inch minimum, except for flexible metallic conduit used for whips to devices only, maximum length 6 feet, 1/2-inch diameter, minimum.
3. Conduits shall be sized according to the conductors contained therein. Cross sectional area percentage fill for system conduits shall not exceed 40%.

4. All fire alarm conduit systems shall be routed and installed to minimize the potential for physical, mechanical or by fire damage, and so as not to interfere with other building systems, facilities or equipment, and to facilitate service and minimize maintenance.
5. All system conduits, junction boxes, pull boxes, terminal cabinets, electrical enclosures, and device back boxes shall be readily accessible for inspection, testing, service and maintenance.
6. All penetration of floor slabs and firewalls shall be sleeved (1” conduit minimum) fire stopped in accordance with all local fire codes.
7. All junction box covers shall be painted red.

D. Equipment:

1. All devices and appliances shall be mounted to flush mounted boxes where areas are finished. Exceptions being above suspended ceiling, exposed ceiling areas, or equipment rooms to facilitate connections to other equipment.
2. All pull stations shall be mounted 48-inches above the finished floor, as measured on handle.
3. All audio/visual devices shall be mounted at a minimum of 80-inches and no more than 96-inches above the finished floor, as measured on strobe center. Devices shall be mounted no less than 6-inches from the ceiling.
4. No area smoke detectors shall be mounted within 36-inches of any HVAC supply, return air register or luminaire.
5. No area smoke or heat detector shall be mounted within 12-inches of any wall.
6. All fire alarm devices shall be accessible for periodic maintenance.
7. End-of-line resistors shall be furnished as required for mounting as directed by the manufacturer. Devices containing end-of-line resistors shall be appropriately labeled. Devices should be labeled so removal of the device is not required to identify the EOL device.
8. All addressable modules shall be mounted within 36-inches of the monitored or controlled point of termination. This shall include, but is not necessarily limited to, fan shutdown, elevator recall, shunt trip, sprinkler status points, or door release. Label all addressable modules as to their function.
9. Power-limited/non-power-limited CEC wiring standards shall be observed.
10. Relays shall be appropriately labeled on the exterior to indicate “FIRE ALARM SYSTEM” and their specific function (i.e. FAN SHUTDOWN).

3.03 FIELD QUALITY CONTROL

A. Manufacturer's field service: Contractor shall arrange and pay for the services of a factory-authorized service representative to supervise the initial start-up, pretesting, and adjustment of the fire alarm system.

B. Independent testing: Contractor shall arrange and pay for the services of an independent Testing Agency to perform all quality control electrical testing, calibration and inspection required herein. Testing Agencies objectives shall be to:

1. Assure fire alarm system installation conforms to specified requirements and operates within specified tolerances.
2. Field test and inspect to ensure operation in accordance with Manufacturer's recommendations and Specifications.
3. Prepare final test report including results, observations, failures, adjustments, and remedies.
4. Apply label on fire alarm system control panel upon satisfactory completion of tests and results.
5. Verify settings and make final adjustments.

C. At least three weeks prior to any testing, notify the Engineer so that arrangement can be made for witnessing test, if deemed necessary. All pretesting shall have been tested satisfactorily prior to the Engineer's witnessed test.

D. Prefunctional testing:

1. Provide Testing Agency with Contract Documents and Manufacturer instructions for installation and testing.
2. Visual and mechanical inspection:
   a. Inspect for physical damage, defects alignment and fit.
   b. Perform mechanical operational tests in accordance with Manufacturer's instructions.
   c. Compare nameplate information and connections to Contract Documents.
   d. Check tightness of all control and power connections.
   e. Check that all covers, barriers, and doors are secure.
3. Electrical tests:
   a. The system shall be completely tested prior to final acceptance testing. All points shall be tested from point of initiation to the final point or points of annunciation. All circuits shall be tested for continuity and ability to transmit the required signal correctly to the FACP. Any problem due to wrong wire type, wire twist, impedance, mismatches, noise filtering or shielding shall be completely corrected during pretesting and prior to any final acceptance tests.
   b. Testing shall include each device in the system. Coordinate with other trades as necessary for testing.
      1) Sprinkler flow switches: Record time delay from water flow to alarm and adjust as necessary for a 30 to 50-second delay.
      2) Tamper switches: Verify "trouble "signal is received and alarmed on closing of each valve.
      3) Smoke detectors, in-duct smoke detectors and duct mounted smoke detectors: Test with actual or approved artificial smoke. Verify that reset does not occur when devices are cleared of smoke. Verify supervisory circuit function. Perform pressure differential test on all duct mounted smoke detectors.

4) Door release: Verify that proper alarm activates every held-open door, roll-down doors, and shutters, that doors close completely to the closed position.

5) Elevator recall: Verify that elevators recall to designated floor by testing elevator lobby detectors with smoke. This is necessary on the ground floor and one other only.

6) Audible/visual notification: Activate by means of an alarm-initiating device that audible and visual devices are clearly audible and/or visual throughout.

7) Central station notification: Verify that one set of conductors in the terminal cabinet becomes a short circuit on any "trouble" condition and that the other set becomes a short circuit on any "alarm" condition. Verify that the conductor groups are labeled properly.

c. Test report:

1) Provide a complete report listing every device, the date it was tested, the results and the date retested (if failure occurred during the previous test). The test report shall indicate that every device tested successfully.

2) Submit two typed copies of the test report in a neatly bound folder for review and approval. Failure to comply with this will result in a delay of final testing and acceptance.

E. Functional performance testing:

1. After the approval of the test report, provide a schedule of final testing to be done in the presence of the Fire Marshal and Owner's Representative. The schedule must be received by the Engineer a minimum of 2 weeks prior to the Final Test Date and must list the dates and time slots in which the various systems can be tested.

2. Coordination of the Final Test dates with all parties (General Contractor, Mechanical Contractor, Elevator Contractor, Engineer, Owner, and others) shall be the sole responsibility of the Contractor. If a party is required to be present during any phase of testing to activate a device, ensure that the party or a qualified representative of the party is present throughout that phase of the testing.

F. In the event that the system fails to function properly during the testing, as a result of inadequate pretesting or preparation, the Contractor shall bear all costs incurred by the necessity for retesting including test equipment, transportation, subsistence and the Engineer's hourly rate.

G. Contractor shall replace at no costs to the Owner all devices which are found defective or do not operate within factory specified tolerances.

H. Contractor shall submit the Testing Agency's final report for review prior to Project closeout and final acceptance by the Owner. Test report shall indicate test dates, devices tested, results, observation, deficiencies, and remedies. Test report shall be included in the operation and maintenance manuals.

3.04 TRAINING

A. Factory authorized service representative shall conduct a 8-hour training seminar for Owner's Representatives upon completion and acceptance of system. Instructions shall include safe operation, maintenance, and testing of equipment with both classroom training and hands-on instruction.

B. Contractor shall schedule training with a minimum of 7-days advance notice.

END OF SECTION

APPENDIX

Appendix A Special Inspections & Testing Agreement
Appendix B Hazardous Material Report

SPECIAL INSPECTION & TESTING AGREEMENT

PROJECT TYPE: ☐RESIDENTIAL ☒COMMERCIAL

Permit Number(s):_____ Project Address: 2415 UNIVERSITY AVENUE, EAST PALO ALTO, CA 94303

The owner and his general contractor, where applicable, shall also acknowledge the following conditions applicable to Special Inspection and/or Testing.

1. The special inspection agency shall be employed by the owner, or, the engineer or architect of record acting as the owner's agent.
2. Contractor is responsible for proper notification to the special inspection agency for the items listed.
3. Only special inspection & testing agency personnel are to take samples and transport them to their laboratory.
4. Copies of all laboratory reports and inspections are to be sent directly to the City by the special inspection agency.
5. The special inspection agency is to submit the names and qualifications of on-site special inspectors to the Building Department for approval.
6. The Special Inspector is under the authority and is responsible to the Building Official. All concerns and/or problems encountered are to be brought to his attention immediately.
7. Special Inspectors shall provide weekly reports to this Department of all inspection activity.
8. It is the responsibility of the contractor to review City approved plans for additional inspection or testing requirements that may be noted.
9. BEFORE AN OCCUPANCY PERMIT CAN BE ISSUED: The Inspection agency shall submit a statement that all items requiring testing and inspection were fulfilled and reported. Those items not tested and/or inspected shall be noted in this statement. Copies of statements to be maintained at the job site for City's Building Inspector's review prior to final inspections.
10. NO WORK SHALL BE COVERED PRIOR TO CITY INSPECTION APPROVAL. PLEASE SCHEDULE AN INSPECTION WITH THE BUILDING DIVISION AT 650-853-3189.

ACKNOWLEDGEMENT (SIGN BELOW) I have reviewed the enclosed "Special Inspection Schedule" and the information above.

Owner (or)	Special Inspection Agency (Company Name Only)
Project Architect (or)	Contractor (Name Only)
Project Engineer	Building Official

STRUCTURAL TESTS AND INSPECTIONS SCHEDULE

Prior to issuance of a building permit, the Owner, on the advice of the Architect or Engineer, shall complete, sign and submit this form to the Building Official.

EAST PALO ALTO GOVERNMENT CENTER	
Project Name	Permit Number
2415 UNIVERSITY AVENUE, EAST PALO ALTO, CA 94303	APPLIED MATERIALS & ENGINEERING, INC
Project Address	Special Inspection Agency (Company Name Only)
Owner's Name	Contractor (Name Only)

I hereby certify that the Special Inspection & Testing Agency named above has been engaged to perform structural tests and inspection during construction, as checked below, to satisfy all applicable portions of the Building Code.

Prior to issuance of an occupancy permit, the special inspection agency shall submit a statement that all items of designated work performed were reported. Any items checked but not tested or inspected will be noted and explained.

Whenever any designated items on this list are ready for sampling, testing or inspection, it shall be the responsibility of the Contractor to give timely notice to the Special Inspection Agency so that the required services may be performed.

REINFORCING STEEL

	Tensile & Bond
	Inspection of Placement
	Inspection of Welding

MASONRY

	Preliminary Acceptance Test (Masonry Units, Wall Prism)
	Subsequent Tests (Mortar, Grout, Field Wall Prisms)
	Inspection of Grouting
	Inspection of Placement and Grouting

CONCRETE, GUNITE/SHOTCRETE, GROUT & MORTAR

Conc.	Shotcrete	Grout	Mortar	
				Agg. Tests for Designs
				Suitability of Agg.
				Mix Designs
				Batch Plant Insp.
				Compression Tests
				Cast Specimens
				Pick-Up Samples
				Shrinkage Bars
				Yield Check
				Air Check
				Dry Unit Weight

PRECAST CONCRETE

	Reinforcing Tests
	Inspection of Reinforcing Placement
	Tendon Tests
	Inspection of Tendon Placement
	Inspection of Concrete Placement
	Inspection of Concrete Batching
	Inspection of Panel Attach & Inserts
	Inspection of Panel Installation
	Compression Tests
	Inspection of Stressing/Transfer

PILING, CAISSONS, CAPS, TIES

	Inspection of Reinforcing Placement
	Inspection of Concrete Placement
	Inspection of Concrete Batching

UNDERPINNING

	Inspection of Steel Fabrication
	Inspection of Reinforcing & Forms
	Inspection of Concrete Placement
	Inspection of Tiebacks

STRUCTURAL STEEL

	Sample & Test
X	Shop Indent. & Welding Inspection
X	Shop Ultrasonic Inspection
	Shop Radiography
X	Field Welding Inspection
X	Field Bolting
	Field Ultrasonic Inspection
	Field Radiography
	Metal Deck Welding Inspection

STRUCTURAL HARDWARE

	Holdown Installation
	Tiedown System Installation
	Epoxied Anchors & Bolts

INSULATING CONCRETE

	Sample & Test
	Unit Weights

FIREPROOFING

	Inspection of Placement
	Density Tests
	Thickness Tests
	Inspection Batching

GEOTECHNICAL (Inspections & Testing by Geotechnical Engineer)

	Fill Material Acceptance Tests
	Moisture-Density Determination
	Field Density/Compaction
	Pier Drilling
	Observation & Testing by Geotechnical Engineer

ROOFING & WATERPROOFING

	Inspection of Placement
	Sample & Tests
	Basement Waterproofing

STRUCTURAL WOOD

	Inspection of Fabrication
	Inspection of Truss Joist Fabrication
	Sample & Test Components
	Inspection of Glulam Fabrication
	Shearwall Construction & Nailing

OTHER TESTS OR INSPECTIONS: - INSPECTION OF CJP WELDS

SUMMARY REPORT:
LIMITED HAZARDOUS MATERIALS SURVEY
2415 UNIVERSITY AVENUE
EAST PALO ALTO, CA 94303

PREPARED BY:

SCA

ENVIRONMENTAL, INC.

320 JUSTIN DRIVE
SAN FRANCISCO, CA 94112
TEL: (415) 882-1675
FAX: (415) 962-0736

SUMMARY REPORT:
LIMITED HAZARDOUS MATERIALS SURVEY
2415 UNIVERSITY AVENUE
EAST PALO ALTO, CA 94303

CONDUCTED FOR:

COUNTY OF SAN MATEO
DEPARTMENT OF PUBLIC WORKS
555 COUNTY CENTER, 5TH FLOOR
REDWOOD CITY, CA 94063

SCA PROJECT NO.: F13225

REVIEWED & APPROVED BY:

TUCKER KALMAN, QSD/P, CAC, CDPH
SENIOR PROJECT MANAGER

DANIEL LEUNG, CIH, CSP, CAC, CDPH
CERTIFIED INDUSTRIAL HYGIENIST

SCA ENVIRONMENTAL, INC.
320 JUSTIN DRIVE
SAN FRANCISCO, CA 94112
TEL: (415) 882-1675
FAX: (415) 962-0736

Table of Contents

Attachments

1. Sample Location Diagrams
2. Asbestos Laboratory Reports
3. Lead and PCB Laboratory Reports

1.0 Executive Summary

This report summarizes the results of a limited non-destructive survey and limited destructive supplemental sampling for asbestos-containing construction materials, lead-based paint, and associated environmental building material hazards, for the planned renovations at 2415 University Avenue, East Palo Alto, CA 94303. The limited non-destructive survey was conducted on November 19-20 and December 10, 2015. The limited destructive supplemental sampling was conducted on June 19, 2020. Both sampling events were conducted by Dan Leung, CIH, CSP, CDPH, CAC of SCA Environmental, Inc. (SCA).

The building is 3-stories and comprises approximately 45,000 square feet. The County wished to obtain a limited hazardous building materials survey to identify potential hazardous materials that may be present in the building prior to possible renovation and/or alteration work on all 3 floors of the facility.

The survey included limited non-destructive testing inside of the structure and included sampling of suspect asbestos- and lead-containing materials, as well as visual identification of PCB and mercury-containing items. In addition, exterior surface asphalts and concretes were tested for asbestos. Limited destructive sampling was completed in the restrooms, roofs and limited interior spaces, at the direction of The County. Other materials that could not be sampled without destructive means (e.g., underlying baserock, multi-layered asphalts and tars except for surface components, etc.) were assumed asbestos-containing. In addition, sampling of both native and surface surcharged soils for naturally occurring asbestos (NOA) content was not included in the survey. The following summarizes the results.

Asbestos

Various materials were identified as **asbestos-containing (>1%)** as part of this investigation. A summary of asbestos-containing materials is tabulated in the **Table 1: Materials Matrix Report (MMR).**

Materials that were identified as asbestos-containing are included below:

1. Wall drywall (-) w/tape (-) and joint compound (+)
2. Black gasket between flanges of hot water supply and return pipes
3. Off-white/brown caulking between exterior metal wall panels
4. Gray concrete floor with compound in locations (2% CH)
5. Wall drywall (-) w/tape (-) and joint compound (-)
6. Ceiling drywall (-) w/tape (-) and joint compound (+)
7. brown mastic (-) under 4" Brown vinyl baseboard -asbestos found in underlying joint compound (+) associated with drywall only
8. 12"x12" Light blue w/white streaks vinyl floor tile (-) w/black mastic (+)
9. brown mastic (-) under 4"/6" Brown vinyl baseboard -asbestos found in underlying joint compound (+) associated with drywall only
10. Ceiling drywall w/tape and joint compound
11. Wall drywall (-) w/tape (-), joint compound (+) and texture (+)
12. 12"x12" Tan w/white streaks and black fissures vinyl floor tile (+) w/black mastic (+)

13. White painted (-) off-white canvas covering (-) w/yellow glue (-) over white compound (+)

In addition, the following trace **(Trace <1%)** asbestos-containing materials were identified:

1. Beige sprayed-on structural fireproofing on metal roof truss and decking (<0.09% Tremolite/Actinolite, <1% CH).
2. Older ceiling tiles reported as <1% in 1987. Although not replicated in this 2015 and 2020 survey, assume any older ceiling tile encountered as asbestos-containing as many may have been painted, etc.

Items assumed asbestos-containing **(Assumed >1%)**, pending "destructive testing" if impacted as part of the proposed renovations, include the following:

1. Fire-rated core in fire doors.
2. Off-white/gray Formica counter top w/associated glues.
3. Engineered fill and/or surcharged soils (6" per as-built plans) and gravel (4") below concrete slab.
4. Insulation on domestic hot water (DHW) pipes and fittings concealed behind walls or above ceilings.
5. 12"x12" Brown ceramic floor tile w/associated grout and mortar.
6. Transite associated with underground utilities.
7. Additional layers of asphalt paving below surface asphalts. Coring and multilayers analysis is required to determine asbestos content before disturbance.

Prior to any renovations or demolition, the National Emission Standard for Hazardous Air Pollutants (NESHAP) mandated by the Environmental Protection Agency (EPA) and locally enforced by the Bay Area Air Quality Management District (BAAQMD) require:

1. A building be inspected for asbestos-containing materials prior to building demolition; and
2. Asbestos containing materials subject to damage or which will be made friable be removed.

Naturally-Occurring Asbestos in Soils

Sampling for soils under the building for naturally-occurring asbestos and sampling of fill/surcharged soils placed prior to building construction as indicated on the as-built drawings was not included in the scope of services as impacts to the subsurface are not anticipated for this project.

Polychlorinated Biphenyls (PCBs)

Suspect caulking between exterior metal wall panels was also sampled for polychlorinated biphenyl (PCB) content. No PCBs exceeding 50 parts per million (ppm) were identified in the material.

Ballasts associated with fluorescent light fixtures were identified. These items are assumed to contain PCBs, the fixtures will need to be disassembled during renovation/demolition for visual determination for proper disposal.

Lead

Many paint samples collected in the Building were found to contain measurable concentrations of lead. Dust control procedures are required throughout the demolition/renovation of painted elements to comply with the Cal/OSHA regulations under 8 CCR 1532.1. In addition, many glazed ceramic tiles and lead sleeves were found to contain lead or are assumed lead-containing as destructive sampling was not performed. As a result, paints and ceramic tiles may require segregation from the

waste stream based on lead content and characterized to determine leachability prior to disposal. Disposal of these materials may be as RCRA or California hazardous waste pending receipt of analytical waste characterization data.

Mold

No visual evidence of mold was identified in the buildings.

Other Hazardous Materials

Miscellaneous items that have some minor cost impact to the Project include:

- Mercury containing fluorescent light tubes and thermostats

2.0 Introduction

This report summarizes the results of a limited non-destructive hazardous materials survey for lead-based paint, asbestos-containing materials, and associated environmental building material hazards at 2415 University Avenue, East Palo Alto, CA 94303. The non-destructive sampling was conducted on November 19-20 and December 10, 2015. Limited supplemental destructive sampling was conducted on June 19, 2020.

The purpose of the survey was to determine the presence of regulated and/or potentially hazardous building materials that are required to be addressed in future planned renovations of the building. Materials addressed in the survey include:

- Asbestos-containing materials (ACM);
- Lead in paint and building materials;
- Polychlorinated Biphenyls (PCB) in building materials;
- lead in coatings, ceramic tiles and vinyl flooring;
- mercury-containing fluorescent tubes; and
- visual assessment for evidence of mold growth.

Individuals involved in the project, and their technical certifications, included:

SCA Staff	Role	Certifications
Christina Codemo, CHMM, CAC, REPA	Senior Project Consultant	Certified Hazardous Materials Manager (CHMM #9761) Certified Asbestos Consultant (CAC #99-2649); Certified Environmental and Safety Compliance Officer (CESCO #729032); and Registered Environmental Property Assessor (REPA #953197) OSHA 40-hr HAZWOPER Training per 29 CFR 1910.120(e).
Dan Leung, CIH, CSP, CAC, CDPH	Certified Industrial Hygienist	Certified Industrial Hygienist (CIH #10893) Certified Safety Professional (CSP#22424) Certified Asbestos Consultant (CAC #07-4175); and Certified Lead Inspector/Assessor & Project Monitor (CDPH #I/A-7329) OSHA 40-hr HAZWOPER Training per 29 CFR 1910.120(e).
Tucker Kalman, QSP/D, REPA, CAC, CDPH	Sr. Project Manager	Qualified SWPPP Developer/ Practitioner (QSP/D #26807) Cal/OSHA Certified Asbestos Consultant (CAC #15-5384) CDPH Certified Inspector/Assessor (CDPH #I/A-25870) Registered Environmental Property Assessor (REPA #12980020348200513) OSHA 40-hr HAZWOPER Training per 29 CFR 1910.120(e).

The following contract laboratories provided analytical services for the project:

Laboratory	Analysis Type	Accreditation
Reservoirs Environmental, Inc., Denver, CO	Polarized Light Microscopy (PLM) Asbestos Analysis Inductively Coupled Plasma Mass Spectrometry (ICP-MS) for Lead	National Voluntary Laboratory Accreditation Program (NVLAP) AIHA Laboratory Accreditation Programs (AIHA-LAP)
Analytical Labs San Francisco, San Francisco, CA	Polarized Light Microscopy (PLM) Asbestos Analysis	National Voluntary Laboratory Accreditation Program (NVLAP) AIHA Laboratory Accreditation Programs (AIHA-LAP)
McCampbell Analytical Pittsburgh, CA	Gas Chromatography-Electron Capture Detector (GC-ECD) Polychlorinated Biphenyls Analysis Inductively Coupled Plasma Mass Spectrometry (ICP-MS) for Lead	National Voluntary Laboratory Accreditation Program (NVLAP); and California Environmental Laboratory Accreditation Program (ELAP).

3.0 Methodology

3.1 Asbestos-Containing Materials

Asbestos sampling was performed in a fashion designed to minimize exposure of the surveyor or Subject Property occupants to airborne asbestos fibers. Samples were typically removed from the substrate utilizing a knife, the sample material was then placed into an airtight plastic vial. The vial's exterior was labeled with a unique sample I.D. The vial was then stored in a plastic bag.

Samples of suspect materials were collected generally using triplicate sampling procedures. Under these procedures, the first sample is analyzed. If it tests positive for asbestos (>1%), the analysis is suspended for further samples of that material. If the first sample tests only trace positive (between 0.1 to 1%), or negative, then the second and third samples are analyzed sequentially, in order to determine the possible presence of asbestos. If all three samples test negative, the material is considered as non-asbestos. If one or more samples test "trace" positive (<1%), the material is considered to be trace positive. If one or more samples are positive for asbestos, the material is considered positive.

Certain materials, such as gypsum board systems, are frequently non-homogeneous in content. For such materials, multiple samples were gathered at various points in the building, with all samples analyzed to determine the possible presence of asbestos.

All asbestos samples collected were submitted to Reservoirs Environmental, Inc., (REI) in Denver, Colorado for analysis by polarized light microscopy (PLM) with dispersion staining (DS/PLM). Quality assurance/quality control (QA/QC) were submitted to Analytical Labs San Francisco (ALSF) in San Francisco, CA for analysis by PLM. All results were comparable to REI's findings. The Bay Area Air Quality Management District's (BAAQMD), the Federal Environmental Protection Agency's (EPA), and California Environmental Protection Agency's (Cal/EPA) regulations all specify the DS/PLM method.

3.2 Lead-Containing Paints and Building Materials

Lead contents were measured by collection and analysis of bulk samples. Samples were analyzed by EPA Method 6020 (ICP/MS) by McCampbell Analytical, Inc.

For the purpose of complying with the Cal/OSHA lead in construction regulation (8 CCR 1532.1), SCA recommends that all coated surfaces be considered to contain >600 ppm of lead. The aforementioned regulation contains requirements for lead air monitoring, work practices, respiratory protection, etc., that are triggered by the presence of even very low levels of lead.

In addition, various ceramic tiles and lead sleeves were identified with measurable lead content. The loose and peeling paints and ceramic flooring should be segregated from the waste stream and characterized to determine leachability prior to disposal. Disposal of these materials may be as RCRA or California hazardous waste pending receipt of analytical waste characterization data. Additional sampling and analysis for leachable lead content by the Consultant during demolition will be required for waste characterization.

3.3 Polychlorinated Biphenyls

PCB-containing ballasts in fluorescent light fixtures can be identified by visually examining the ballasts in a representative number of light fixtures in the building. The ballast manufacturing industry has taken the active step of labeling new non-PCB containing ballasts, so that any ballast not

labeled as non-PCB can reasonably be assumed to contain PCB (and required to be disposed as such). For the purposes of survey, SCA quantified all ballasts associated with lighting fixtures.

Bulk samples of possible PCB-containing materials were also collected and analyzed by McCampbell Analytical in Pittsburg, California by EPA Method 8082. All samples showed PCB content <50 ppm and would not require disposal at a TSCA-permitted facility.

3.4 Mercury-Containing Items

Fluorescent lamps, which contain mercury vapors, and mercury-containing thermostats were visually observed by SCA during the survey of the building in several areas. Mercury is a neurotoxin and a hazardous waste, and Cal/EPA currently regulates its disposal. Recycling is a viable alternative to disposal.

3.5 Mold

No areas with visual evidence of mold were noted during the investigation.

4.0 Applicable Standards

4.1 Asbestos-Containing Materials

ACM is defined by EPA regulations as those substances containing greater than 1% asbestos. The BAAQMD and the Cal/EPA provide local enforcement of these regulations. Friable ACM with greater than 1% asbestos needs to be disposed of as asbestos waste.

Prior to renovation of a Building, the BAAQMD requires abatement of friable ACM, as well as non-friable ACM that may become friable during renovation (practically, this means all non-friable ACM).

Federal Occupational Safety and Health Administrations (OSHA) regulations, locally enforced by CAL/OSHA, define ACM as substances that contain greater than 1% asbestos. Cal/OSHA also mandates special training, medical exams, personal protective equipment and record keeping for employees working with ACM. If a material contains less than 1% asbestos but more than 0.1% asbestos, the material may be disposed of as non-ACM, but the Cal/OSHA requirements would still have to be followed regarding workers' protection and Contractor licensing.

"Trace" materials are currently regulated in California and require the following:

- Removal using wet methods;
- Prohibition of removal using abrasive saws or methods which would aerosolize the material;
- Prompt clean-up of the impacted zone, using HEPA-filtered vacuums, as applicable;
- Employer registration by Cal/OSHA for removal quantities exceeding 100 sq. ft. per year; and
- Cal/OSHA Carcinogen Registration by the Demolition or Abatement Contractor impacting such materials.

4.2 Naturally-Occurring Asbestos

Naturally occurring asbestos (NOA) has been identified in at least 44 of California's 58 counties. The Asbestos Airborne Toxic Control Measure (ATCM) for Construction, Grading, Quarrying and Surface Mining Operations was signed into State law on July 22, 2002, and became effective in the Bay Area Air Quality Management District (District) on November 19, 2002. The purpose of the regulation is to reduce public exposure to NOA from construction and mining activities that emit dust which may contain NOA. The ATCM requires regulated operations engaged in road construction and maintenance activities, construction and grading operations, and quarrying and surface mining operations in areas where NOA is likely to be found. If identified, the regulation includes requirements for the Contractor to employ dust mitigation measures in order to reduce and control dust emissions. Depending on the proposed use of the site and future construction activities, sampling at depth may be required to verify if NOA is present at the site.

In addition, if asbestos concentrations exceed 1% asbestos, all work must be performed utilizing Class II work procedures with AHERA-trained personnel. Workers involved with removal of soil are required to adhere to all CalOSHA requirements (e.g., training, notifications to CalOSHA prior to work, personal monitoring, etc.).

4.3 Lead-Containing Paints and Building Materials

Since elemental lead is a suspect carcinogen and known teratogen and neurotoxic in high doses, lead-containing materials need to be identified prior to the on-set of demolition activities. Using combinations of engineering controls and personal protective equipment, lead-containing materials can be removed safely. Several sources of applicable standards are listed as follows:

1. Lead exposures in the workplace are regulated by Cal/OSHA, which has certain regulatory requirements for identifying and controlling potential lead exposures. Currently applicable regulations for the construction industry have been adopted by Cal/OSHA (8 CCR 1532.1) from the Federal OSHA regulations. The current OSHA 8-hour Permissible Exposure Level (PEL) for lead is 50 $\mu g/m^3$.

2. Current EPA and Cal/EPA regulations do not require LBP to be removed prior to demolition, unless loose and peeling. Provided that the paint coatings are securely adhered to the substrates (i.e., non-flaking or non-peeling), disposal of intact demolition debris can generally be handled in California as non-hazardous and non-RCRA waste, pending receipt of waste characterization testing following demolition.

   In California, loose and peeling LBP or other wastes require characterization and testing for leachability. Disposal requirements are outlined as follows:

Classification and Disposal of Inorganic Lead Wastes in California

Standards	TTLC	Leachable Lead		Classifications				
Concentations	1000 mg/kg	5 mg/L						
	Test Methods & Results							
Condition	Total Pb (mg/kg)	STLC Pb (mg/L)	TCLP Pb (mg/L)	Non-haz waste	CalHaz	Fed Haz (RCRA)	Stabilization Required	Landfill Class
1a	<50 (a1)	NA		Yes	no	no	no	III
1b	<100 (a2)		NA	Yes	no	no	no	III
2a	50 to <1000	<5	<5	Yes (c)	no	no	no	III or II (d)
2b		>5	<5	no	Yes	no	no	I
2c		>5	>5	no	Yes	Yes	Yes	I
2d (b)		<5	>5	no	no	Yes	Yes	I
3a	>1000	<5	<5	No	Yes	No	no	I
3b		>5	<5	no	Yes	no	no	I
3c		>5	>5	no	Yes	Yes	Yes	I
3d (b)		<5	>5	no	no	Yes	Yes	I
4	any	any	>5	no	no	Yes	Yes	I

(a1) 50 = 10 x 5 (STLC for Pb). Per WET method, impossible to exceed STLC even if 100% soluble.
(a2) 100 = 20 x 5 (TCLP for Pb). Per TCLP method, impossible to exceed STLC even if 100% soluble.
(b) Physically impossible due to the stronger acid used in WET than TCLP.
(c) Landfills will likely require documentation that TCLP is <5, even though TCLP is almost always less than WET.
(d) Landfill dependent, function of permit, landfill liner, or landfill policy

3. The major definitions of LBP or lead-coated surfaces are listed as follows:

   a. HUD defines LBP as paint that contains either ≥0.5% by weight of lead, or ≥1 mg/cm^2.
   b. Consumer Product Safety Commission (CPSC) prohibits the manufacturing of paint that contains more than 90 ppm of lead.

Note that adherence to Cal/OSHA's Construction Lead Standard is required for all paint with any measurable lead content.

4. Lead is on the "Proposition 65" list, given its toxic potential in causing reproductive hazards.

5. The California Department of Public Health (CDPH) requires the use of Certified Lead Workers and Supervisors for lead abatement projects at public Buildings with a greater than 20 years expected life or whenever work is completed specifically to abate Lead-Based Paint as defined by HUD. The CDPH certification requirements do not apply to industrial sites; however, dust controls and personnel protection are still required under 17 CCR Sections 35001 through 36100.

4.4 Polychlorinated Biphenyls and Mercury-Containing Items

Cal/EPA regulates disposal of all these materials.

To reduce liability concerns, many building owners opt to have PCB ballasts incinerated, with a record of destruction generated. A slightly less expensive approach involves recycling of the components (and incineration of the small amount of PCBs separately); however, this method may pose liability concerns for building owners.

Mercury lamps and thermostats are best treated by bundling and recycling. Limited disposal is allowed by Cal/EPA, but not in the quantities typically generated during a major renovation or demolition project.

4.5 Mold

Several attempts have been made to identify surface and airborne concentrations of biological materials that indicate unhealthy conditions. No currently available guidelines have been generally accepted due to the large variability in surface sampling results and poor correlations with inhaled exposures according to the American Conference of Governmental Industrial Hygienists' "Bioaerosols Assessment and Control," Chapter 12. This position by the ACGIH exemplifies the need to use surface sampling data as a tool in conjunction with other aspects of the investigation to help support or disprove a hypothesis of an investigation.

While there are no airborne microbiological standards, ASHRAE recommends that indoor concentrations be less than outdoor concentrations based on filtrations of the outdoor air by the HVAC system, where applicable. Therefore, indoor concentrations exceeding 2 times the outdoor level is considered excessive and corrective actions should be taken.

5.0 Results and Conclusions

5.1 Asbestos in Building Materials

The detailed results (including quantities found in each location) are shown in the attached Table 1: Materials Matrix Report. Asbestos-sample locations are shown on drawings included as Attachment 1, and all analytical reports are included in Attachment 2.

Materials that were identified as asbestos-containing are included below:

1. Wall drywall (-) w/tape (-) and joint compound (+)
2. Black gasket between flanges of hot water supply and return pipes
3. Off-white/brown caulking between exterior metal wall panels
4. Gray concrete floor with compound in locations (2% CH)
5. Wall drywall (-) w/tape (-) and joint compound (-)
6. Ceiling drywall (-) w/tape (-) and joint compound (+)
7. brown mastic (-) under 4" Brown vinyl baseboard -asbestos found in underlying joint compound (+) associated with drywall only
8. 12"x12" Light blue w/white streaks vinyl floor tile (-) w/black mastic (+)
9. brown mastic (-) under 4"/6" Brown vinyl baseboard -asbestos found in underlying joint compound (+) associated with drywall only
10. Ceiling drywall w/tape and joint compound
11. Wall drywall (-) w/tape (-), joint compound (+) and texture (+)
12. 12"x12" Tan w/white streaks and black fissures vinyl floor tile (+) w/black mastic (+)
13. White painted (-) off-white canvas covering (-) w/yellow glue (-) over white compound (+)

In addition, the following trace **(Trace <1%)** asbestos-containing materials were identified:

1. Beige sprayed-on structural fireproofing on metal roof truss and decking (<0.09% Tremolite/ Actinolite, <1% CH).
2. Older ceiling tiles reported as <1% in 1987. Although not replicated in this 2015 and 2020 survey, assume any older ceiling tile encountered as asbestos-containing as many may have been painted, etc.

Regarding the structural fireproofing, <1% CH was reported in 3rd floor and <1% CH and <1% Amosite asbestos was reported in boiler room samples collected in 1987. SCA collected samples in these areas and throughout the building and could not replicate these results. We speculate the Amosite was most likely present as contamination from insulation previously present in the boiler room. We recommend that prior to abatement in the boiler room, additional testing by Transmission Electron Microscopy (TEM) be performed due to the difficulty wetting and elevated fiber levels associated with Amosite. As asbestos content can vary in surfacing materials, we recommend all fireproofing be treated as asbestos-containing, with impacts following Class I removal activities with a negative pressure enclosure unless additional TEM analysis confirms asbestos content <1% in areas subject to abatement and/or disturbance.

Although not identified in this 2015 survey, older ceiling tiles previously reported to contain asbestos may be present in the building but painted for aesthetics. If any older ceiling tiles are encountered, they should be treated as asbestos-containing until sampling is performed to verify asbestos content.

Items assumed asbestos-containing **(Assumed >1%)**, pending "destructive testing" if impacted as part of the proposed renovations, include the following:

1. Fire-rated core in fire doors.
2. Off-white/gray Formica counter top w/associated glues.
3. Engineered fill and/or surcharged soils (6" per as-built plans) and gravel (4") below concrete slab.
4. Insulation on domestic hot water (DHW) pipes and fittings concealed behind walls or above ceilings.
5. 12"x12" Brown ceramic floor tile w/associated grout and mortar.
6. Transite associated with underground utilities.
7. Additional layers of asphalt paving below surface asphalts. Coring and multilayers analysis is required to determine asbestos content before disturbance.

Prior to any renovations or demolition, the National Emission Standard for Hazardous Air Pollutants (NESHAP) mandated by the Environmental Protection Agency (EPA) and locally enforced by the Bay Area Air Quality Management District (BAAQMD) require:

1. A building be inspected for asbestos-containing materials prior to building demolition; and
2. Asbestos containing materials subject to damage or which will be made friable be removed.

Identified or Assumed asbestos-containing materials to be disturbed by the proposed renovations should be abated by a Registered Asbestos Abatement Contractor.

5.2 Naturally-Occurring Asbestos in Soils

Sampling for soils under the building for naturally-occurring asbestos and sampling of fill/surcharged soils placed prior to building construction as indicated on the as-built drawings was not included in the scope of services as impacts to the subsurface are not anticipated for this project. These items are assumed asbestos-containing and should be sampled prior to any subsurface disturbance.

5.3 Lead-Containing Paints & Coatings

Results of the bulk samples collected are included in Table 1: Materials Matrix Report. In addition, suspect building materials such as ceramic tiles, vinyl flooring, piping sleeves, etc. were tested for lead and are summarized in Table 1: Materials Matrix Report, and laboratory reports are included in Attachment 3.

Many paint samples collected were found to contain measurable concentrations of lead. In addition, glazed ceramic tiles, lead sleeves, and vinyl flooring were found to contain lead or have been assumed lead-containing pending destructive sampling.

As lead was identified in some paints and a detailed inventory of paints was not performed for the project, for the purpose of complying with the Cal/OSHA lead in construction regulation (8 CCR

1532.1), all coated surfaces shall be considered to contain some lead and require demolition dust control procedures for compliance with Cal/OSHA's Construction Lead Standard under 8 CCR 1532.1. The aforementioned regulation contains requirements for lead air monitoring, work practices, respiratory protection, etc., that are triggered by the presence of even very low levels of lead.

In addition, based on the California Total Threshold Level Concentration (TTLC) hazardous waste standard, the paints and ceramic tiles (assumed to be lead-containing) may be classified as hazardous wastes. These materials should be segregated from the general demolition debris and characterized separately to identify the waste stream. Additional sampling and analysis for leachable lead content by the Contractor during demolition will be required for waste characterization. Disposal of these materials may be as RCRA or California hazardous waste pending receipt of analytical waste characterization data.

None of the applicable regulations require removal of lead paints prior to renovation if the paints are securely adhered to the substrates (i.e., non-flaking or non-peeling). Disposal of the demolition debris in this case can be handled as non-hazardous and non-RCRA waste after the loose and flaking paint have been removed, as long as demolition practices do not compromise worker safety.

Conventional demolition techniques should be employed for all painted surfaces with the Contractor complying with applicable OSHA and Cal/OSHA statutes regarding:

- Worker awareness training;
- Exposure monitoring, as needed;
- Medical examinations, which may include blood lead level testing; and
- Establishing a written respiratory protection program.

5.4 Polychlorinated Biphenyls

Lighting ballasts were observed in conjunction with fluorescent lighting fixtures throughout the space. The contractor shall examine the lighting ballasts during the demolition process. If a “No PCBs” stamp is absent, the ballast should be assumed to contain polychlorinated biphenyls (PCBs).

No suspect materials containing more than 50 parts per million (ppm) of PCB were identified, beyond the assumed PCB in lighting ballasts.

Laboratory reports are included in Attachment 3.

Wastes containing >50 ppm PCB must be disposed of as PCB bulk product waste according to 40 CFR § 761.62 which involves disposal in a TSCA incinerator, a TSCA chemical waste landfill, a RCRA hazardous waste landfill, under a TSCA approved alternate disposal method, under the TSCA regulated decontamination procedures; or in a facility with a coordinated approval issued under TSCA. Waste with detected levels of PCB <50 ppm may be disposed of in non-TSCA approval landfill facilities, including municipal solid waste landfills subject to state and local regulations regarding such disposal.

5.5 Mercury-Containing Items

Fluorescent light tubes and mercury thermostats were observed throughout the space. Fluorescent light tubes and thermostats are required to be either disposed of as hazardous material, or recycled for their mercury contents.

5.6 Mold

No areas with visual evidence of mold were noted during the investigation.

6.0 Limitations and Exclusions

SCA warrants that this survey was performed using due care and state of the art techniques. Beyond this, SCA does not warrant or guarantee the survey. Despite the care exercised, some materials may not have been identified, or may have been incompletely identified. This condition may occur due to renovations or original construction practices that concealed older materials, and/or visually similar materials with different compositions.

This document is not a stand-alone document; abatement of materials is recommended to be completed under the oversight and design of an AHERA-accredited Project Designer and Certified Asbestos Consultant. Although due care is exercised in the course of the survey, concealed materials may be found in the course of performing the abatement or demolition; a contingency budget should be included in any cost estimates prepared to cover unexpected conditions.

Table 1: Materials Matrix Report County of SM East Palo Alto Government Center

Material ID	Material Description	Previous Sample Results	Sub-sample # A	B	C	D	E	F	G	H	I	J	K	L	Asbestos Positive? Yes. No. Trace. Assumed	UNITS (LF, SF, EA)
ASBESTOS																
WLSH-3	Wall drywall (-) w/tape (-) and joint compound (+)		2% CH	3% CH	3% CH	2% CH	3% CH	2% CH	3% CH							SF
GASKET-7	Black gasket between flanges of hot water supply and return pipes		60% CH													EA
CAULK-13	Off-white/brown caulking between exterior metal wall panels		10% CH	10% CH	10% CH											LF
CONC-14	Gray concrete floor with compound in locations (2% CH)		ND	2% CH	ND											SF
WLSH-16	Wall drywall (-) w/tape (-) and joint compound (+)		3% CH	3% CH	3% CH											SF
BBMAS-17	Brown mastic (-) under 4" Brown vinyl baseboard -asbestos found in underlying joint compound (+) associated with drywall only		ND	4% CH	3% CH											LF
CLSH-18	Ceiling drywall (-) w/tape (-) and joint compound (+)		2% CH	2% CH	2% CH											SF
12FLVCT/M-20	12"x12" Light blue w/white streaks vinyl floor tile (-) w/black mastic (+)		8% CH												YES	SF
BBMAS-22	Brown mastic (-) under 4"/6" Brown vinyl baseboard -asbestos found in underlying joint compound (+) associated with drywall only		ND	ND	2% CH											LF
CLSH-25	Ceiling drywall (-) w/tape (-) and joint compound (+)		ND	2% CH	ND	2% CH	3% CH	3% CH								SF
WLSH-29	Wall drywall (-) w/tape (-), joint compound (+) and texture (+)		ND	3% CH	ND											SF
12FLVCT/M-37	12"x12" Tan w/white streaks and black fissures vinyl floor tile (+) w/black mastic (+)		6-15% CH	6-15% CH	6-15% CH											SF
WL-54	White painted (-) off-white canvas covering (-) w/yellow glue (-) and white compound (+)		3% CH	NA	NA											SF
CLTL-AAA	Older ceiling tiles reported as <1% in 1987. Although not identified in 2015 and 2020 surveys, assume any older ceiling tile encountered as asbestos-containing as many may have been painted, etc.	<1% CH													TRACE	SF
STSFP-4	Beige sprayed-on structural fireproofing on metal roof truss and decking (<0.09% Tremolite/Actinolite) [SEE NOTE 1 BELOW]	<1% CH, <1% AM	ND	ND	ND	<0.09% AC/TR	<0.09% AC/TR	ND	ND	ND	ND	ND		ND		SF
ASSUMED ASBESTOS (Destructive Testing Required to Confirm)																
FIREDOOR-AAA	Fire-rated core in fire doors															EA
FORMICA-AAA	Off-white/gray Formica counter top w/assoc glue															SF
FILL-AAA	Engineered fill and/or surcharged soils (6" per as-built plans) and gravel (4") below concrete slab															CY
PIDHW-AAA	Insulation on domestic hot water (DHW) pipes and fittings concealed behind walls or above ceilings														ASSUMED	LF
FLCER-AAA	12"x12" Brown ceramic floor tile w/assoc grout and mortar															SF
TRANSITE-AAA	Transite associated with underground utilities															LF
ASPHALT-45	Surface asphalt (-) in parking lot and driveways with underlying asphalt layers (Assumed) and baserock (Assumed). Note that only surface was sampled. Coring and multilayered analysis is required to determine asbestos content before disturbance.		ND	ND	ND											SF
NON-ASBESTOS																
CONC-1	Gray concrete floor		ND	ND	ND											SF
CONC-2	Gray concrete wall		ND	ND	ND											SF
PICW-5	Yellow fiberglass insulation (-) w/off-white canvas jacket (-) on chilled water return and supply pipes and fittings		ND	ND												LF
PIHW-6	Yellow fiberglass insulation (-) w/off-white canvas jacket (-) on hot water return and supply pipes and fittings		ND	ND												LF
RFROLL-8	Off-white membrane roofing over off-white backing on parapet walls		ND	ND	ND											SF
PENMAS-9	Off-white painted black roofing penetration tars/mastic		ND	ND	ND											LF
RFPAD-10	Gray roof stepping pads		ND	ND	ND											SF
RFPTCH-11	Black roofing patch		ND	ND												SF
RFMAS-12	Black roofing mastic on black rubber pads supports for pipes		ND	ND	ND											SF
CONC-15	Gray concrete wall		ND	ND	ND											SF
CARMAS-19	Yellow carpet glue under various colored carpets		ND	ND	ND											SF
12FLVCT/M-21	12"x12" Purple w/tan specks vinyl floor tile (-) w/gray glue (-) and leveling compound (-)		ND													SF
CLLI-23	2'x4' Fiberglass laid-in ceiling tile w/off-white covering and fissures		ND	ND	ND											SF
CLSP-24	12"x12" Off-white splined ceiling tiles w/fissures		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND		SF
SINK-26	Stainless steel sink w/gray undercoating		ND													EA
12FLVCT/M-27	12"x12" Beige w/red and white specks vinyl floor tile (-) w/yellow glue (-)		ND	ND												SF
DEBRIS-28	Debris in walker ducts		ND	ND												SF
BBMAS-30	4"/6" Red/tan/ivory/black vinyl baseboard w/off-white glue		ND	ND	ND											LF
CLLI-31	2'x4' Off-white laid-in ceiling tile w/2'x2' pattern, fissures and pinholes		ND	ND	ND											SF
FLVCS-32	Tan/brown wood-look vinyl floor sheeting (-) w/yellow glue (-)		ND	ND	ND											SF
12FLVCT/M-33	12"x12" Beige/green/blue vinyl floor tiles (-) in checkerboard pattern w/yellow glue (-)		ND	ND	ND										NO	SF
SINK-34	Stainless steel sink w/off-white undercoating		ND													EA
FLVCS-35	Light blue w/gray and white specks vinyl floor sheeting (-) w/yellow glue (-)		ND													SF
HDUTP-36	Off-white canvas tape around seams of VAV boxes		ND	ND												LF
9FLVCT/M-38	9"x9" Red brick pattern vinyl floor tile (-) w/yellow glue (-) over 12FLVCT/M-37		ND													SF
12FLVCT/M-39	12"x12" Purple w/gray and blue streaks vinyl floor tile (-) w/yellow glue (-)		ND	ND	ND											SF
FLCER-40	1"x1" Beige ceramic floor tile (-) w/black grout (-) and yellow glue (-)		ND													SF
12FLVCT/M-41	12"x12" Off-white w/black specks vinyl floor tile (-) w/yellow glue (-)		ND	ND												SF
12FLVCT/M-42	12"x12" Light gray w/white streaks and 12"x12" blue w/gray streaks vinyl floor tiles (-) w/yellow glue (-)		ND	ND												SF
CLLI-43	2'x2' Off-white laid-in ceiling tile w/fissures		ND	ND	ND											SF
CONC-44	Gray concrete sidewalk around perimeter of building		ND	ND	ND											SF
FL-50	Core of: 2"x2" Gray/blue/green ceramic floor tile (-) w/gray grout (-) and mortar (-), black felt vapor barrier (-) and gray concrete slab (-) (3.5 inches thick)		ND	ND	ND											SF
WLCER-51	6"x6" Off-white/blue/green ceramic wall tile (-) w/off-white grout (-) and off-white/gray mortar (-)		ND	ND	ND											SF
RFAG-52	Tar and gravel roofing felts w/silver foil (-) w/black tars/mastic (-) over off-white/tan lightweight concrete (-)		ND	ND	ND											SF
RFINS-53	Off-white/tan zonolite roofing insulation (-) below roofing felts (-)		ND	ND	ND											SF
WLMAS-55	Off-white fiberglass-reinforced panels (FRP) w/tan glue (-)		ND	ND	ND											SF
WL-NNN	Brown painted exterior metal panels															SF
WLSH-NNN	Drywall wall partitions (No tape or joint compound)															SF
HVAC-NNN	Fiberglass insulation around HVAC ducts															LF
CL-NNN	Off-white fiberglass ceiling light panels in honeycomb pattern														NOT SUSPECT	SF
WL-NNN	Moveable partition wall w/vinyl and faux wood															SF
VAPBAR-NNN	No vapor barrier or waterproofing membrane below floor finishes/topping slab															SF
PCBs															PPM	
CAULK-13	Off-white/brown caulking between exterior metal wall panels														<0.50	LF
PCBs	Possible PCB-containing Ballasts, assumed >50 ppm														>50	EA
LEAD															PPM	
OW-1	Off-white paint on drywall walls														9.2	SF
BR-2	Brown paint on exterior metal panels														30	SF
RD-3	Red paint on metal base of chiller														150	SF
VENT-4	Lead sleeve on vent pipes														62000	SF
OE-5	Orange paint on hand rails														3100	SF
12FLVCT/M-20	12"x12" Light blue w/white streaks vinyl floor tile w/black mastic														<5.0	SF
12FLVCT/M-21	12"x12" Purple w/tan specks vinyl floor tile w/gray glue														6.9	SF
12FLVCT/M-27	12"x12" Beige w/red and white specks vinyl floor tile w/yellow glue														<5.0	SF
FLVCS-32	Tan/brown wood-look vinyl floor sheeting w/yellow glue														<5.0	SF
12FLVCT/M-33	12"x12" Beige/green/blue vinyl floor tiles in checkerboard pattern w/yellow glue														<5.0	SF
FLVCS-35	Light blue w/gray and white specks vinyl floor sheeting w/yellow glue														<5.0	SF
12FLVCT/M-37	12"x12" Tan w/white streaks and black fissures vinyl floor tile w/black mastic														<5.0	SF
9FLVCT/M-38	9"x9" Red brick pattern vinyl floor tile w/yellow glue over 12FLVCT/M-37														<5.0	SF
12FLVCT/M-39	12"x12" Purple w/gray and blue streaks vinyl floor tile w/yellow glue														<5.0	SF
FLCER-40	1"x1" Beige ceramic floor tile w/black grout and yellow glue														<5.0	SF
12FLVCT/M-41	12"x12" Off-white w/black specks vinyl floor tile w/yellow glue														6.7	SF
12FLVCT/M-42	12"x12" Light gray w/white streaks and 12"x12" blue w/gray streaks vinyl floor tiles w/yellow glue (assumed >600ppm)														5.5	SF
WLCER-51	6"x6" Off-white/blue/green ceramic wall tile w/assoc grout and mortar														9.8	SF
FLCER-AAA	12"x12" Brown ceramic floor tile w/assoc grout and mortar														>600	SF
Lead in paints	Lead Containing Paints / Coatings (assumed >600ppm)														>600	SF
Lead on steel	Lead Containing Coatings on Structural Steel (assumed >600ppm)														>600	SF
Other Hazardous Materials																
Mercury	Fluorescent Light Tubes														PRESENT	EA
Mold	Potentially Moldy Conditions														NOT PRESENT	---

Material ID	First Floor						Second Floor												Third Floor											Stairs			Elev	Roof					Ext	
	Police Dept	RR	Elev Rm	Lobby	Library	Community Rm	Probation	City Hall	Elect Rm	Stor1	Stor2	Hallway	Jan	RR	American Water	Rent Control	Break Rm	Community Learning	Family Health Nursing	Community Health Center	Stor	Conf Rm	Human Services Agency	Telecom	Lounge	Elect Rm	Jan	RR	Hallway	W Stairs	E Stairs	Ctr Stairs	Elev	Roof	Mech Rm Roof	E Stairs Roof	W Stairs Roof	Mech Rm	Exterior	TOTAL (+/-15%)
ASBESTOS																																								
WLSH-3	6270	1280	320	2650	4100	3000	4500	3050	560	400	280	3040	320	1280	900	520	760	760	3000		280	800	10620	280	520	560	320	1280	3040			2160						3540		60390
GASKET-7																																						5		5
CAULK-13																																		1560					9550	11110
CONC-14																														1200										1200
WLSH-16																														3360										3360
BBMAS-17																														280										280
CLSH-18																														250										250
12FLVCT/M-20																			45																					45
BBMAS-22	200								70	50	35						110	110	430							70														1075
CLSH-25	625		100						300	150				435					45				930			300	100	435												3420
WLSH-29																				5360																				5360
12FLVCT/M-37	425									150	60	2300			540	235	730	730															50							5220
WL-54								300											120													2160								2580
CLTL-AAA																																								PNQ
STSFP-4	1800	435	100	1400	1000	600	1000	1500	300	150	60	2100	100	435	250			250	400	500		250	3200	60	145	300	100	435	2100	250	250	625						300		20395
ASSUMED ASBESTOS																																								
FIREDOOR-AAA	7	2	1	1	1	2		4	2	1	1	3	1		1	1	1	3	1	2	1	2	4	1	1		1	4									5	5		59
FORMICA-AAA					30		30												30	50					20															160
FILL-AAA	875	165	40	520	2950	1100																																		5650
PIDHW-AAA	250	100			250	250	250						100	100			100	200	200	250			100		100		100	100												2450
FLCER-AAA				1220																																				1220
TRANSITE-AAA																																							PNQ	PNQ
ASPHALT-45																																							20285	20285
NON-ASBESTOS																																								
CONC-1	2360	435	100	1400	7940	2960	7940	3600	300	150	60	2300	100	435	540	235	730	730	1870	2115	85	600	10940	60	145	300	100	435	2300		900	750						1375		54290
CONC-2																																						325		325
PICW-5																																						150		150
PIHW-6																																						150		150
RFROLL-8																																		1050						1050
PENMAS-9																																		200	100					300
RFPAD-10																																		500						500
RFPTCH-11																																		50						50
RFMAS-12																																		1000						1000
CONC-15																														500										500
CARMAS-19					7760	1480	7790	3600							540	235	550		1725	1970		600	7480						2300											36030
12FLVCT/M-21																			100																					100
CLLI-23	1735			180	7940												730	730	1450	2115																				14880
CLSP-24				1220				1000				2300							375																					4895
SINK-26																			1						1															2
12FLVCT/M-27																				145	85																			230
DEBRIS-28																				650																				650
BBMAS-30	405				590	250		450							100	65				700	35	100	1410	35	65		40		380											4625
CLLI-31								2600			60				540	235					85	600	10010	60	145				1140											15475
FLVCS-32																							3500						1140											4640
12FLVCT/M-33																								60	145				2300											2505
SINK-34					1																				1															2
FLVCS-35							150																																	150
HDUTP-36	200	50		200	500	200	500	350		50	50	200	50	50	150	150	150	150	200	200	50	75	200	50	50		50	50	200											4125
9FLVCT/M-38																	80																							80
12FLVCT/M-39	1735																																							1735
FLCER-40	200																																							200
12FLVCT/M-41				180	180																																			360
12FLVCT/M-42						1480																																		1480
CLLI-43						2960																																		2960
CONC-44																																							2865	2865
FL-50		435												435														400												1270
WLCER-51		1280												1280														1280												3840
RFAG-52																																		15090	1375	250	250			16965
RFINS-53																																		15090	1375	250	250			16965
WLMAS-55	400																															1800								2200
WL-NNN																																		3150					19080	22230
WLSH-NNN	2450				2760		2900	320											1480	240																				10150
HVAC-NNN	350	50		200	500	350	500	350				200		50	150	75	100	100	250	250	50	75	250	50	50			50	200											4200
CL-NNN												735																												735
WL-NNN						620																																		620
VAPBAR-NNN	200	435																																						635
PCBs																																								
CAULK-13																																		1560					9550	11110
PCBs	47	2	2	28	124	48	143	56	3	1	2	53	1		9	6	12	12	35	41	2	10	104	2	4	3	1	4	18	16	12	12	3					17		833
LEAD																																								
OW-1	PNQ	PNQ	PNQ	PNQ	PNQ	PNQ	PNQ	PNQ	PNQ	PNQ	PNQ	PNQ	PNQ	PNQ	PNQ	PNQ	PNQ	PNQ	PNQ	PNQ	PNQ	PNQ	PNQ	PNQ	PNQ	PNQ	PNQ	PNQ	PNQ	PNQ	PNQ	PNQ	PNQ	PNQ	PNQ	PNQ	PNQ	PNQ		PNQ
BR-2																																		PNQ					PNQ	PNQ
RD-3																																							PNQ	PNQ
VENT-4																																		10						10
OE-5																														PNQ	PNQ									PNQ
12FLVCT/M-20																			45																					45
12FLVCT/M-21																			100																					100
12FLVCT/M-27																				145	85																			230
FLVCS-32																							3500						1140											4640
12FLVCT/M-33																								60	145				2300											2505
FLVCS-35							150																																	150
12FLVCT/M-37	425									150	60	2300			540	235	730	730																						5170
9FLVCT/M-38																	80																							80
12FLVCT/M-39	1735																																							1735
FLCER-40	200																																							200
12FLVCT/M-41				180	180																																			360
12FLVCT/M-42						1480																																		1480
WLCER-51		1280												1280														1280												3840
FLCER-AAA				1220																																				1220
Lead in paints																																						PNQ		PNQ
Lead on steel																																						PNQ		PNQ
Other Hazardous Materials																																								
Mercury	94	4	4	56	248	96	286	112	6	2	4	106	2		18	12	24	24	70	82	4	20	208	4	8	6	2	8	36	32	24	24	6					34		1666
Mold																																								NA

Notes:

NOTE 1: <1% CH reported in 3rd floor and <1% CH/<1% AM reported in boiler room samples collected in 1987. SCA collected samples in these areas and throughout the building and could not reproduce these results.

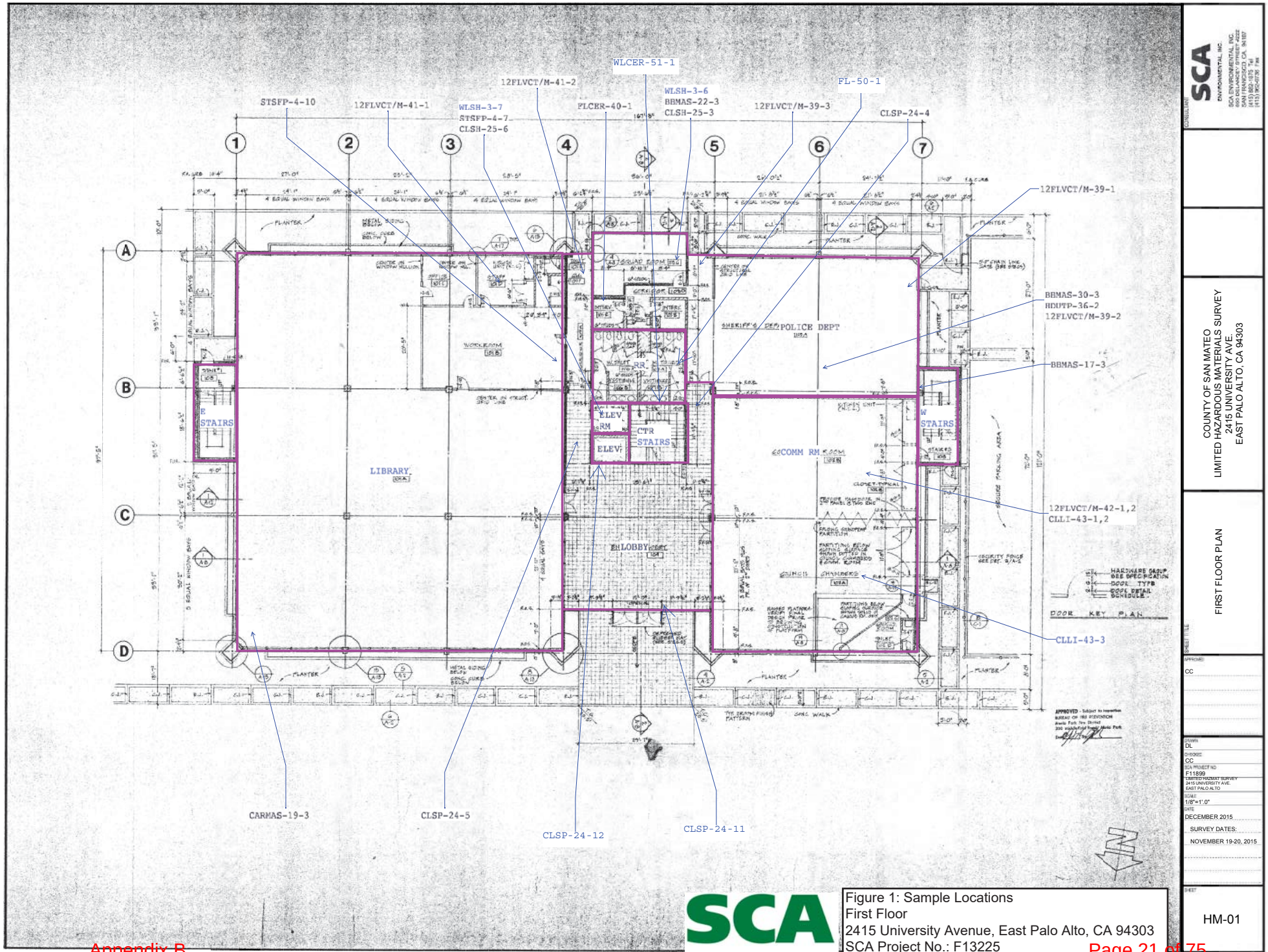
We speculate the Amosite was most likely present as contamination from insulation previously present in the area. We recommend that prior to abatement in the boiler room, add't testing by TEM be performed due to the difficulty wetting and elevated fiber levels associated with Amosite.

As asbestos content can vary in surfacing materials, we recommend all fireproofing be treated as asbestos-containing, with impacts following Class I removal activities with a neg pressure enclosure.

PNQ = Present, not quantified; CH = Chrysotile; ND = Not detected; NA = Not analyzed; TR=Tremolite; AC=Actinolite; AM=Amosite

Attachment 1

Sample Location Diagrams



SCA ENVIRONMENTAL, INC.
SCA ENVIRONMENTAL, INC.
660 DELANCEY STREET, #222
SAN FRANCISCO, CA 94107
(415) 957-1676 TEL
(415) 957-0778 FAX

COUNTY OF SAN MATEO
LIMITED HAZARDOUS MATERIALS SURVEY
2415 UNIVERSITY AVE.
EAST PALO ALTO, CA 94303

SHEET TITLE: FIRST FLOOR PLAN

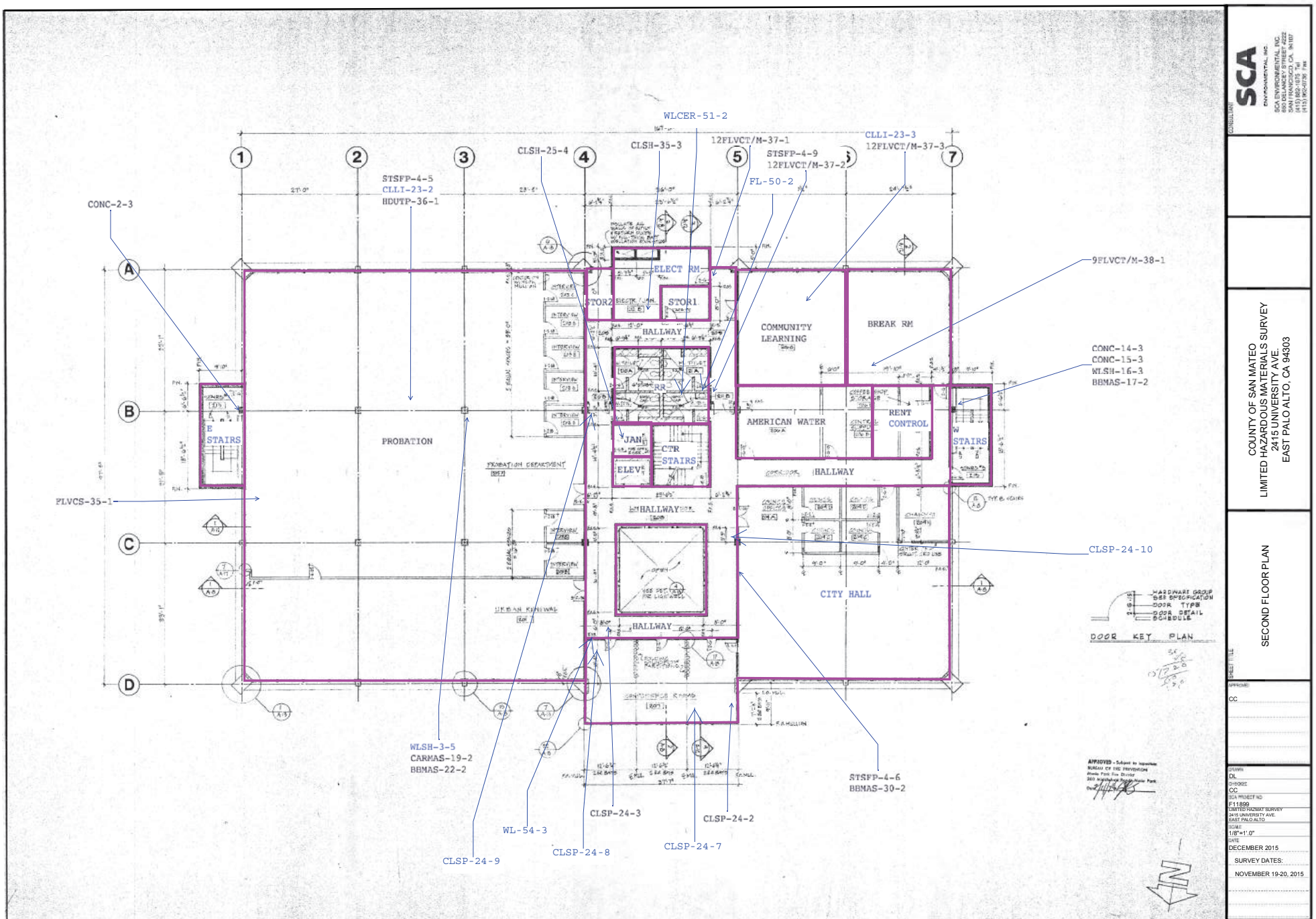
APPROVED: CC

DRAWN: DL
CHECKED: CC
SCA PROJECT NO: F11899
LIMITED HAZMAT SURVEY
2415 UNIVERSITY AVE.
EAST PALO ALTO
SCALE: 1/8"=1'-0"
DATE: DECEMBER 2015
SURVEY DATES: NOVEMBER 19-20, 2015

SHEET: HM-01

Figure 1: Sample Locations
First Floor
2415 University Avenue, East Palo Alto, CA 94303
SCA Project No.: F13225
Sampled December 2015 and June 2020

SCA ENVIRONMENTAL, INC.



SCA ENVIRONMENTAL, INC.
SCA ENVIRONMENTAL, INC.
1250 HOWARD STREET, SUITE 1222
SAN FRANCISCO, CA. 94103
(415) 882-1875 Tel
(415) 882-0736 Fax

COUNTY OF SAN MATEO
LIMITED HAZARDOUS MATERIALS SURVEY
2415 UNIVERSITY AVE.
EAST PALO ALTO, CA 94303

SHEET TITLE
SECOND FLOOR PLAN

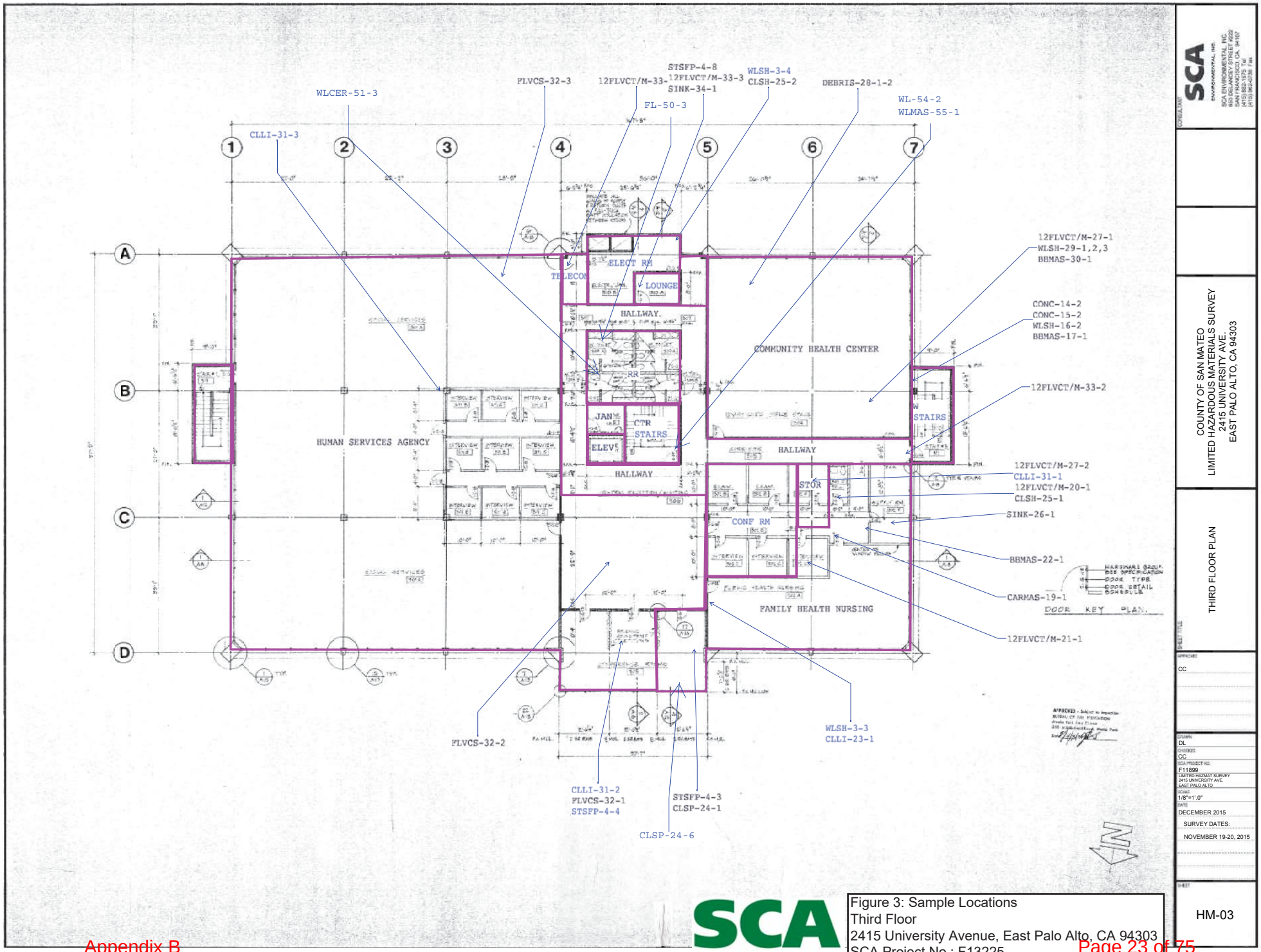
APPROVED
CC

DRAWN
DL
CHECKED
CC
SCA PROJECT NO
F11899
LIMITED HAZMAT SURVEY
2415 UNIVERSITY AVE.
EAST PALO ALTO
SCALE
1/8"=1'-0"
DATE
DECEMBER 2015
SURVEY DATES:
NOVEMBER 19-20, 2015

SHEET
HM-02

Figure 2: Sample Locations
Second Floor
2415 University Avenue, East Palo Alto, CA 94303
SCA Project No.: F13225
Sampled December 2015 and June 2020

SCA ENVIRONMENTAL, INC.



SCA ENVIRONMENTAL, INC.
SAN FRANCISCO, CA 94107
(415) 882-1975 Tel
(415) 882-0736 Fax

COUNTY OF SAN MATEO
LIMITED HAZARDOUS MATERIALS SURVEY
2415 UNIVERSITY AVE.
EAST PALO ALTO, CA 94303

THIRD FLOOR PLAN

CC

DL
CC
F11899
LIMITED HAZMAT SURVEY
2415 UNIVERSITY AVE.
EAST PALO ALTO
1/8"=1'-0"
DECEMBER 2015
SURVEY DATES:
NOVEMBER 19-20, 2015

HM-03

Figure 3: Sample Locations
Third Floor
2415 University Avenue, East Palo Alto, CA 94303
SCA Project No.: F13225
Sampled December 2015 and June 2020

SCA ENVIRONMENTAL, INC.

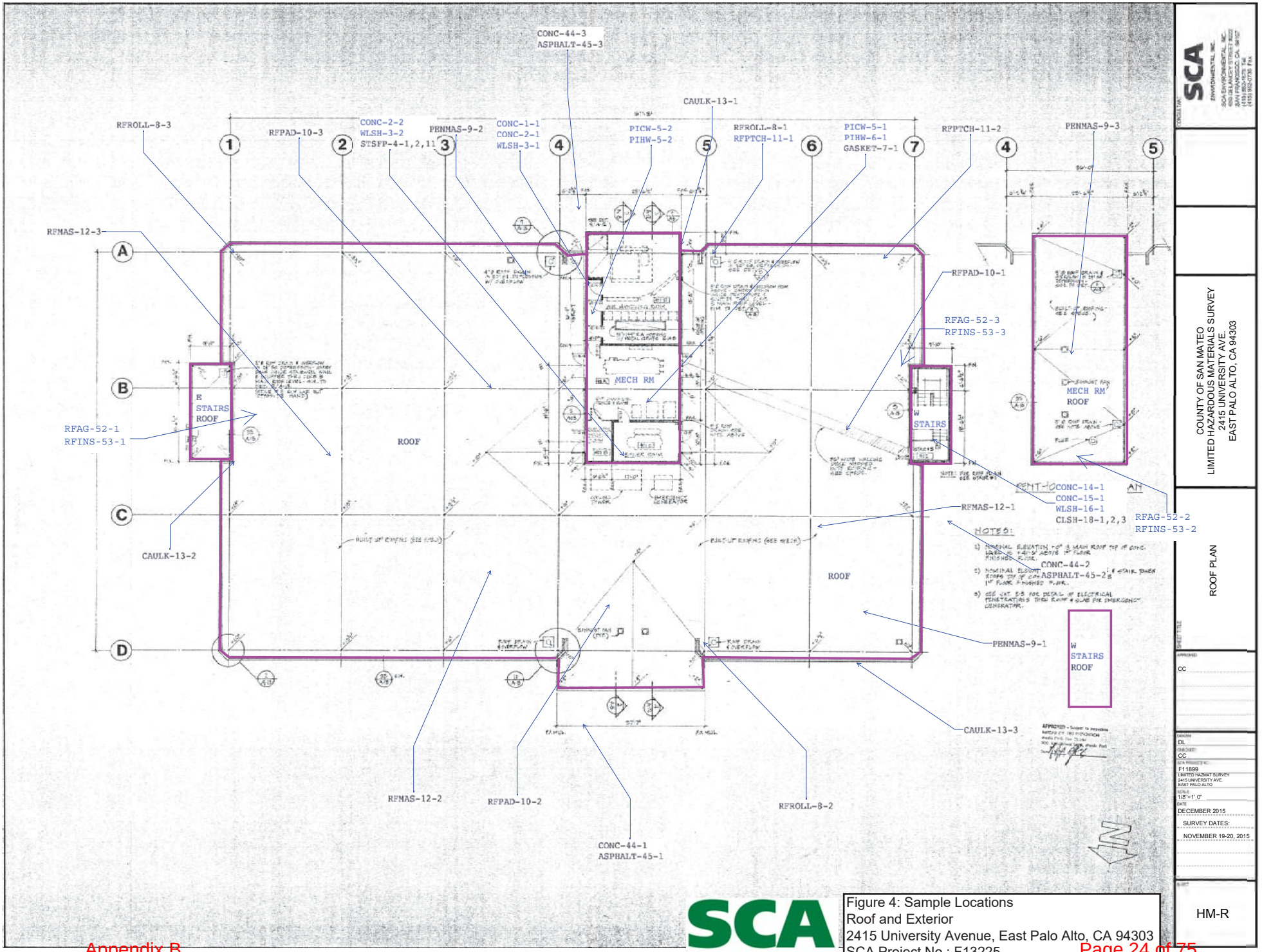


Figure 4: Sample Locations
Roof and Exterior
2415 University Avenue, East Palo Alto, CA 94303
SCA Project No.: F13225
Sampled December 2015 and June 2020

SCA ENVIRONMENTAL, INC.

Attachment 2

Asbestos Laboratory Reports

REI LAB **Reservoirs Environmental, Inc.**

June 27, 2020

Subcontractor Number:
Laboratory Report: **RES 466164-1**
Project #/P.O. #: **F13225**
Project Description: **County of San Mateo 2415 University Ave Destructive Sampling**

Tucker Kalman
SCA Environmental, Inc.
320 Justin Drive
San Francisco CA 94112

Dear Tucker,

Reservoirs Environmental, Inc. is an analytical laboratory accredited for the analysis of Industrial Hygiene and Environmental matrices by the National Voluntary Laboratory Accreditation Program (NVLAP), Lab Code 101896-0 for Transmission Electron Microscopy (TEM) and Polarized Light Microscopy (PLM) analysis and the American Industrial Hygiene Association (AIHA), Lab ID 101533 - Accreditation Certificate #480 for Phase Contrast Microscopy (PCM) analysis. This laboratory is currently proficient in both Proficiency Testing and PAT programs respectively.

Reservoirs Environmental, Inc. has analyzed the following samples for asbestos content as per your request. The analysis has been completed in general accordance with the appropriate methodology as stated in the attached analysis table. The results have been submitted to your office.

RES 466164-1 is the job number assigned to this study. This report is considered highly confidential and the sole property of the customer. Reservoirs Environmental, Inc. will not discuss any part of this study with personnel other than those of the client. The results described in this report only apply to the samples analyzed. This report must not be used to claim endorsement of products or analytical results by NVLAP or any agency of the U.S. Government. This report shall not be reproduced except in full, without written approval from Reservoirs Environmental, Inc. Samples will be disposed of after sixty days unless longer storage is requested. If you have any questions about this report, please feel free to call 303-964-1986.

Sincerely,

Jeanne Spencer
President

RESERVOIRS ENVIRONMENTAL INC.

NVLAP Lab Code 101896-0

TABLE: PLM BULK ANALYSIS, PERCENTAGE COMPOSITION BY VOLUME

RES Job Number: **RES 466164-1**
Client: **SCA Environmental, Inc.**
Client Project Number / P.O.: **F13225**
Client Project Description: **County of San Mateo 2415 University Ave Destructive Sampling**
Date Samples Received: **June 24, 2020**
Method: **EPA 600/R-93/116 - Short Report, Bulk**
Turnaround: **Standard 3**
Date Samples Analyzed: **June 27, 2020**

ND=None Detected
TR=Trace, <1% Visual Estimate
Trem/Act=Tremolite/Actinolite

Client Sample Number	LAYER	Physical Description	Sub Part (%)	Asbestos Content: Mineral	Asbestos Content: Visual Estimate (%)	Non Asbestos Fibrous Components (%)	Non-Fibrous Components (%)
CLSP-24-1-6 (Labeled as CLSP-24-6)	A	Gray/off white ceiling tile	100		**ND**	70	30
CLSP-24-7	A	Gray/off white ceiling tile	100		**ND**	70	30
CLSP-24-8	A	Gray/off white ceiling tile	100		**ND**	70	30
CLSP-24-9	A	Gray/off white ceiling tile	100		**ND**	65	35
CLSP-24-10	A	Gray/off white ceiling tile	100		**ND**	70	30
CLSP-24-11	A	Gray/off white ceiling tile	100		**ND**	70	30
CLSP-24-12	A	Gray/off white ceiling tile	100		**ND**	70	30
FL-50-1	A	Off white resinous material	2		**ND**	0	100
	B	Green ceramic tile	8		**ND**	0	100
	C	Grayish-tan grout	10		**ND**	0	100
	D	Off white granular adhesive	15		**ND**	5	95
	E	Gray granular cementitious material	20		**ND**	0	100
	F	Gray/white speckled ceramic tile	45		**ND**	0	100

TEM Analysis recommended for organically bound material (i.e. floor tile) if PLM results are <1%.

RESERVOIRS ENVIRONMENTAL INC.

NVLAP Lab Code 101896-0

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ND=None Detected
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Trem/Act=Tremolite/Actinolite

Client Sample Number	LAYER	Physical Description	Sub Part (%)	Asbestos Content: Mineral	Asbestos Content: Visual Estimate (%)	Non Asbestos Fibrous Components (%)	Non-Fibrous Components (%)
FL-50-2	A	Off white resinous material	3		ND	0	100
	B	Off white granular adhesive	8		ND	4	96
	C	Tan grout	9		ND	0	100
	D	Black resinous material	10		ND	0	100
	E	Black fibrous resinous material	11		ND	70	30
	F	Off white ceramic tile	18		ND	0	100
	G	Gray granular material	20		ND	0	100
	H	Gray granular cementitious material	21		ND	0	100

TEM Analysis recommended for organically bound material (i.e. floor tile) if PLM results are <1%.

RESERVOIRS ENVIRONMENTAL INC.

NVLAP Lab Code 101896-0

TABLE: PLM BULK ANALYSIS, PERCENTAGE COMPOSITION BY VOLUME

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ND=None Detected
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Trem/Act=Tremolite/Actinolite

Client Sample Number	LAYER	Physical Description	Sub Part (%)	Asbestos Content: Mineral	Asbestos Content: Visual Estimate (%)	Non Asbestos Fibrous Components (%)	Non-Fibrous Components (%)
FL-50-3	A	Tan adhesive	3		ND	0	100
	B	Off white resinous material	5		ND	0	100
	C	Tan grout	5		ND	0	100
	D	Black resinous material	6		ND	0	100
	E	Off white granular adhesive	7		ND	3	97
	F	Black fibrous material	9		ND	60	40
	G	Gray granular cementitious material	10		ND	0	100
	H	Gray granular material	25		ND	0	100
	I	Off white ceramic tile	30		ND	0	100
WLCER-51-1	A	Gray/black granular material	3		ND	0	100
	B	Off white granular material	5		ND	0	100
	C	White ceramic tile	92		ND	0	100

TEM Analysis recommended for organically bound material (i.e. floor tile) if PLM results are <1%.

RESERVOIRS ENVIRONMENTAL INC.

NVLAP Lab Code 101896-0

TABLE: PLM BULK ANALYSIS, PERCENTAGE COMPOSITION BY VOLUME

RES Job Number: **RES 466164-1**
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Client Sample Number	LAYER	Physical Description	Sub Part (%)	Asbestos Content: Mineral	Asbestos Content: Visual Estimate (%)	Non Asbestos Fibrous Components (%)	Non-Fibrous Components (%)
WLCER-51-2	A	White grout	8		**ND**	0	100
	B	Gray/black granular material	30		**ND**	0	100
	C	White ceramic tile	62		**ND**	0	100
WLCER-51-3	A	Gray granular material	1		**ND**	0	100
	B	White grout	3		**ND**	0	100
	C	Off white resinous material	8		**ND**	0	100
	D	White ceramic tile	88		**ND**	0	100
RFAG-52-1	A	Brown fibrous material w/ silver foil	10		**ND**	60	40
	B	Black tar w/ tan granular material	30		**ND**	0	100
	C	Black fibrous tar	60		**ND**	15	85

TEM Analysis recommended for organically bound material (i.e. floor tile) if PLM results are <1%.

RESERVOIRS ENVIRONMENTAL INC.

NVLAP Lab Code 101896-0

TABLE: PLM BULK ANALYSIS, PERCENTAGE COMPOSITION BY VOLUME

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Client Sample Number	LAYER	Physical Description	Sub Part (%)	Asbestos Content: Mineral	Asbestos Content: Visual Estimate (%)	Non Asbestos Fibrous Components (%)	Non-Fibrous Components (%)
RFAG-52-2	A	Brown fibrous material w/ silver foil & colorless resinous material	8		**ND**	60	40
	B	Black tar w/ tan/multi-colored granular material	20		**ND**	5	95
	C	Black fibrous tar	72		**ND**	15	85
RFAG-52-3	A	Brown fibrous material w/ silver foil & colorless resinous material	9		**ND**	0	100
	B	Black tar w/ gray/multi-colored granular material	21		**ND**	4	96
	C	Black fibrous tar	70		**ND**	20	80
RFINS-53-1	A	Black fibrous tar	4		**ND**	10	90
	B	Off white plaster w/ gray granular material	96		**ND**	0	100
RFINS-53-2	A	Off white/tan plaster w/ black tar	100		**ND**	0	100
RFINS-53-3	A	Off white plaster w/ black tar	100		**ND**	0	100

TEM Analysis recommended for organically bound material (i.e. floor tile) if PLM results are <1%.

RESERVOIRS ENVIRONMENTAL INC.

NVLAP Lab Code 101896-0

TABLE: PLM BULK ANALYSIS, PERCENTAGE COMPOSITION BY VOLUME

RES Job Number: **RES 466164-1**
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Date Samples Analyzed: **June 27, 2020**

ND=None Detected
TR=Trace, <1% Visual Estimate
Trem/Act=Tremolite/Actinolite

Client Sample Number	LAYER	Physical Description	Sub Part (%)	Asbestos Content: Mineral	Asbestos Content: Visual Estimate (%)	Non Asbestos Fibrous Components (%)	Non-Fibrous Components (%)
WL-54-1	A	White compound	2	**Chrysotile**	**3**	0	97
	B	White paint	5		**ND**	0	100
	C	Off white wall covering w/ white paint & colorless adhesive	93		**ND**	50	50
WL-54-2		Not Analyzed per Client Request.					
WL-54-3		Not Analyzed per Client Request.					
WLMAS-55-1	A	Black mastic	1		**ND**	0	100
	B	Tan adhesive	99		**ND**	0	100
WLMAS-55-2	A	Tan adhesive	100		**ND**	0	100
WLMAS-55-3	A	Tan adhesive	100		**ND**	0	100

TEM Analysis recommended for organically bound material (i.e. floor tile) if PLM results are <1%.

Tyler Hutchinson
Analyst

John C. McIntyre
Analyst / Data QA

Reservoirs Environmental, Inc.

RES Job #: 466164

SUBMITTED BY	INVOICE TO	CONTACT INFORMATION	SERIES
Company: SCA ENVIRONMENTAL, INC.	Company: SCA ENVIRONMENTAL, INC.	Contact: TUCKER KALMAN	-1 PLM STANDARD 3
Address: 320 JUSTIN DRIVE	Address: 320 JUSTIN DRIVE	Phone: (415) 723-0962	
		Fax:	
SAN FRANCISCO, CA 94112	SAN FRANCISCO, CA 94112	Cell:	
Project Number and/or P.O. #: F13225		Final Data Deliverable Email Address:	
Project Description/Location: COUNTY OF SAN MATEO 2415 UNIVERSITY AVE DESTRUCTIVE SAMPLING		TKALMAN@SCA-ENVIRO.COM (+ 2 ADDNL. CONTACTS)	

ASBESTOS LABORATORY HOURS: Weekdays: 7am - 7pm & Sat. 8am - 5pm

PLM / PCM / TEM DTL RUSH PRIORITY STANDARD

CHEMISTRY LABORATORY HOURS: Weekdays: 8am - 5pm

Dust RUSH PRIORITY STANDARD

Metals RUSH PRIORITY STANDARD *PRIOR NOTICE REQUIRED FOR SAME DAY TAT

Organics* SAME DAY RUSH PRIORITY STANDARD

MICROBIOLOGY LABORATORY HOURS: Weekdays: 8am - 5pm

Viable Analysis** PRIORITY STANDARD **TAT DEPENDENT ON SPEED OF MICROBIAL GROWTH

Medical Device Analysis RUSH STANDARD

Mold Analysis RUSH PRIORITY STANDARD

****Turnaround times establish a laboratory priority, subject to laboratory volume and are not guaranteed. Additional fees apply for afterhours, weekends and holidays.****

Special Instructions:

REQUESTED ANALYSIS

ASBESTOS

- **PLM** - Short Report, Long Report, CARB 435
- **TEM** - AHERA (+/- or Quantified), Microvac (+/- or Quantified), Wipe (+/- or Quantified), NIOSH 7402, Yamate Level II, ISO 10312, ISO 13794, Chatfield, Waste Water, Drinking Water, Bulk +/-, CARB Modified Ahera
- **PCM** - 7400A, 7400B, OSHA

CHEMISTRY

- **DUST** - Total, Respirable
- **METALS** - Analyte(s) Lead Only (7082, 7420, Waste Water, Foodware), Multi Metal (7303, 6020A, 200.8, Waste Water, Foodware, OSHA ID-125G), pH (Liquid, Non-Liquid), TCLP, RCRA 8 Scan, Welding Fume Scan, Full Metals Scan
- **ORGANICS** - Methamphetamine, TSS

MICROBIOLOGY

- **Viables**: Campylobacter, Bacillus, Salmonella (Culturable, 1-2), Listeria, E.coli O157:H7, E.coli/Coliforms - Plated, S. aureus, Yeast & Mold, Areobic Plate Count, Coliforms/E.coli (State Water, Drinking Water, Non-Drinking Water, +/-, Quantification), Lactic Acid, Viable Microbioal Count (wo/ID, w/ID), Enterococcus (+/- or Quantification)
- **MEDICAL** - Bioburden, LAL
- **MOLD** - Spore Trap, Bulk Mold, Particulate Identification

VALID MATRIX CODES

Air = A	Bulk = B
Dust = D	Food = F
Paint = P	Soil = S
Surface = SU	Swab = SW
Tape = T	Wipe = W
Drinking Water = DW	
Waste Water = WW	
ASTM E1792 approved wipe media only	

Client Sample ID Number (Sample ID's must be unique)	ASBESTOS	CHEMISTRY	MICROBIOLOGY	Sample Volume (L) / Area	Length(or Aliquots) x Width(or Area per Aliquot)	Matrix Code	# of Containers	Date Collected mm/dd/yy	Time Collected hh:mm	LAB NOTES: Laboratory Analysis Instructions
1 CLSP-24-1-6	X					B				PROG(A)
2 CLSP-24-7	X					B				PROG(A)
3 CLSP-24-8	X					B				PROG(A)
4 CLSP-24-9	X					B				PROG(A)
5 CLSP-24-10	X					B				PROG(A)
6 CLSP-24-11	X					B				PROG(A)
7 CLSP-24-12	X					B				PROG(A)
8 FL-50-1	X					B				PROG(B)
9 FL-50-2	X					B				PROG(B)
10 FL-50-3	X					B				PROG(B)
11 WLCER-51-1	X					B				PROG(C)
12 WLCER-51-2	X					B				PROG(C)
13 WLCER-51-3	X					B				PROG(C)

REI will analyze incoming samples based on information received and will not be responsible for errors or omissions in calculations resulting from the inaccuracy of original data. By signing, client/company representative agrees that submission of the following samples for requested analysis as indicated on this Chain of Custody shall consitute an analytical services agreement with payment terms of NET 30 days. Failure to comply with payment terms may result in a 1.5% monthly interest surcharge.

Relinquished By:	DAN LEUNG	Date/Time: 06/24/2020 11:24:06	Sample Condition: ACCEPTABLE - INTACT
Received By:	HANNA MARTI	Date/Time: 06/24/2020 11:24:06	Carrier: UPS

Reservoirs Environmental, Inc.

Res Job#: **466164**

Submitted By: **SCA ENVIRONMENTAL, INC.**

REQUESTED ANALYSIS											VALID MATRIX CODES		LAB NOTES
											Air = A	Bulk = B	
											Dust = D	Food = F	
											Paint = P	Soil = S	
											Surface = SU	Swab = SW	
											Tape = T	Wipe = W	
											Drinking Water = DW		
											Waste Water = WW		
											ASTM E1792 approved wipe media only		
PLM - Short Report, Long Report, CARB 435	**TEM** - AHERA, (+/- or Quantified), Microvac (+/- or Quantified), Wipe (+/- or Quantified), NIOSH 7402, Yamate Level II, ISO 10312, ISO 13794, Chatfield, Waste Water, Drinking Water, Bulk +/-, CARB Modified Ahlera	**PCM** - 7400A, 7400B, OSHA	**DUST** - Total, Respirable	**METALS** - Analyte(s) Lead Only (7082, 7420), Waste Water, Foodware), Multi Metal (7303, 6020A, 200.8, Waste Water, Foodware, OSHA ID-125G), pH (Liquid, Non-Liquid) TCLP, RCRA 8 Scan, Welding Fume Scan, Full Metals Scan	**ORGANICS** - Methamphetamine, TSS	Campylobacter, Bacillus, Salmonella (Culturable, 1-2), Listeria, E.coli O157:H7, E.coli/Coliforms - Plated, S. aureus, Yeast & Mold, Areobic Plate Count, Coliforms/E.coli (State Water, Drinking Water, Non-Drinking Water, +/-, Quantification), Lactic Acid, Viable Microbioal Count (wo/ID, w/ID), Enterococcus (+/- or Quantification)	**MEDICAL** - Bioburden, LAL	**MOLD** - Spore Trap, Bulk Mold, Particulate Identification	Sample Volume (L) / Area	Length(or Aliquots) x Width(or Area per Aliquo	Matrix Code	# of Containers	Date Collected mm/dd/yy	Time Collected hh:mm	Laboratory Analysis Instructions
						Viables							
Client Sample ID Number (Sample ID's must be unique)	**ASBESTOS**			**CHEMISTRY**			**MICROBIOLOGY**						
14 **RFAG-52-1**	X										B		**PROG(D)**
15 **RFAG-52-2**	X										B		**PROG(D)**
16 **RFAG-52-3**	X										B		**PROG(D)**
17 **RFINS-53-1**	X										B		**PROG(E)**
18 **RFINS-53-2**	X										B		**PROG(E)**
19 **RFINS-53-3**	X										B		**PROG(E)**
20 **WL-54-1**	X										B		**PROG(F)**
21 **WL-54-2**	X										B		**PROG(F)**
22 **WL-54-3**	X										B		**PROG(F)**
23 **WLMAS-55-1**	X										B		**PROG(G)**
24 **WLMAS-55-2**	X										B		**PROG(G)**
25 **WLMAS-55-3**	X										B		**PROG(G)**

Attachment 3

Lead and PCB Laboratory Reports

REI LAB **Reservoirs Environmental, Inc.**

June 26, 2020

Subcontractor Number:
Laboratory Report: **RES 466163-1**
Project #/P.O. #: **F13225**
Project Description: **County of San Mateo 2415 University Ave Destructive Sampling**

Tucker Kalman
SCA Environmental, Inc.
320 Justin Drive
San Francisco CA 94112

Dear Tucker,

Reservoirs Environmental, Inc. is an analytical laboratory accredited for the analysis of Industrial Hygiene and Environmental matrices by the American Industrial Hygiene Association, Lab ID 101533 - Accreditation Certificate #480. The laboratory is currently proficient in both IHPAT & ELPAT programs respectively.

Reservoirs has analyzed the following sample(s) using Atomic Absorption Spectroscopy (AAS) / Inductively Coupled Plasma - Mass Spectrometry (ICP-MS) per your request. Reported sample results were not blank corrected. The analysis has been completed in general accordance with the appropriate methodology as stated in the analysis table. Results have been sent to your office.

RES 466163-1 is the job number assigned to this study. This report is considered highly confidential and the sole property of the customer. Reservoirs Environmental, Inc. will not discuss any part of this study with personnel other than those of the client. The results described in this report only apply to the samples analyzed. This report must not be used to claim endorsement of products or analytical results by NVLAP or any agency of the U.S. Government. This report shall not be reproduced except in full, without written approval from Reservoirs Environmental, Inc. Samples will be disposed of after sixty days unless longer storage is requested. If you have any questions about this report, please feel free to call 303-964-1986.

Sincerely,

Robin S Klover
by Ryan Ellerby

Robin Klover
Vice President

Forensic Analytical Specialties, Inc.

Consulting and Laboratory Services in the Forensic and Environmental Health Sciences

Bulk Asbestos Analysis

DATE RECEIVED
2/25/87

CLIENT NO.
115

CLIENT NAME AND ADDRESS
ASBESTOS ADVISORY ASSOCIATION
2352 Bates
Attn: Mr. Don Henderson
CONCORD, CALIFORNIA 94520

DATE EXAMINED
3/2/87

REPORT NO.
1721

SITE OR LOCATION
East Palo Alto-Community Service Building
Floor tile, through building.

LAB NUMBER
8701962

GROSS DESCRIPTION
Hard, white tile associated with black tar adhesive.

SAMPLE NUMBER

MICROSCOPIC DESCRIPTION

TOTAL ASBESTOS PRESENT:			1-5 %
Chrysotile	1-5	%	
Amosite	< 1	%	
TOTAL NON-ASBESTOS FIBROUS MATERIAL PRESENT			1-5 %
Cellulose	1-5	%	
Mineral Wool	< 1	%	
Other Fibers	< 1	%	
TOTAL NON-ASBESTOS NON FIBROUS MATERIAL PRESENT			90-95 %
Unspecified Binding Material	90-95	%	

Comments: Analysis employs Polarized Light Microscopy with Dispersion Staining, and is performed by an analyst qualified under the EPA bulk asbestos proficiency testing program. Samples with no observable asbestiform minerals are designated as containing less than one percent (<1%) asbestos. Samples in which asbestiform minerals have been observed, but exist in concentrations of less than one percent (<1%) are designated as present in trace amounts.

Analyst **Dave Kahane and Michelle Fox** DK

3777 Depot Road, Suite 408, Hayward, CA 94545 • (415) 887-8828

Forensic Analytical Specialties, Inc.

Consulting and Laboratory Services in the Forensic and Environmental Health Sciences

Bulk Asbestos Analysis

DATE RECEIVED	CLIENT NO.	CLIENT NAME AND ADDRESS
2/25/87	115	ASBESTOS ADVISORY ASSOCIATION 2352 Bates
DATE EXAMINED	**REPORT NO.**	Attn: Mr. Don Henderson
3/2/87	1723	CONCORD, CALIFORNIA 94520

SITE OR LOCATION

East Palo Alto-Community Service Building
Ceiling tile, through building.

LAB NUMBER

8701964

GROSS DESCRIPTION

Hard, white fibrous material

SAMPLE NUMBER

MICROSCOPIC DESCRIPTION

TOTAL ASBESTOS PRESENT:			**< 1 %**
Chrysotile	< 1	%	
Amosite	< 1	%	
TOTAL NON-ASBESTOS FIBROUS MATERIAL PRESENT			**85-90 %**
Cellulose	Trace	%	
Mineral Wool	85-90	%	
Other Fibers	< 1	%	
TOTAL NON-ASBESTOS NON FIBROUS MATERIAL PRESENT			**10-15 %**
Unspecified Binding Material	10-15	%	

Comments: Analysis employs Polarized Light Microscopy with Dispersion Staining, and is performed by an analyst qualified under the EPA bulk asbestos proficiency testing program. Samples with no observable asbestiform minerals are designated as containing less than one percent (<1%) asbestos. Samples in which asbestiform minerals have been observed, but exist in concentrations of less than one percent (<1%) are designated as present in trace amounts.

Analyst **Dave Kahane and Michelle Fox** DK

3777 Depot Road, Suite 408, Hayward, CA 94545 • (415) 887-8828

Forensic Analytical Specialties, Inc.

Consulting and Laboratory Services in the Forensic and Environmental Health Sciences

Bulk Asbestos Analysis

DATE RECEIVED	CLIENT NO.	CLIENT NAME AND ADDRESS
2/25/87	115	ASBESTOS ADVISORY ASSOCIATION 2352 Bates
DATE EXAMINED	**REPORT NO.**	Attn: Mr. Don Henderson
3/1/87	1711	CONCORD, CALIFORNIA 94520

SITE OR LOCATION

East Palo Alto-Community Service Building.
Fireproofing above ceiling, on third floor. Sample taken: 2/25/87

LAB NUMBER

8701952

GROSS DESCRIPTION

Off-White, semi-fibrous material.

SAMPLE NUMBER

MICROSCOPIC DESCRIPTION

TOTAL ASBESTOS PRESENT:			**< 1 %**
Chrysotile	< 1	%	
TOTAL NON-ASBESTOS FIBROUS MATERIAL PRESENT			**30-40 %**
Cellulose	20-25	%	
Mineral/Glass Wool	10-15	%	
Other Fibers	< 1	%	
TOTAL NON-ASBESTOS NON FIBROUS MATERIAL PRESENT			**60-70 %**
Unspecified Binding Material	60-70	%	

Comments: Analysis employs Polarized Light Microscopy with Dispersion Staining, and is performed by an analyst qualified under the EPA bulk asbestos proficiency testing program. Samples with no observable asbestiform minerals are designated as containing less than one percent (<1%) asbestos. Samples in which asbestiform minerals have been observed, but exist in concentrations of less than one percent (<1%) are designated as present in trace amounts.

Analyst **Dave Kahane and Michelle Fox** DK

3777 Depot Road. Suite 408. Hayward. CA 94545 • (415) 887-8828

Forensic Analytical Specialties, Inc.

Consulting and Laboratory Services in the Forensic and Environmental Health Sciences

Bulk Asbestos Analysis

DATE RECEIVED	CLIENT NO.	CLIENT NAME AND ADDRESS
2/25/87	115	ASBESTOS ADVISORY ASSOCIATION 2352 Bates
DATE EXAMINED	**REPORT NO.**	Attn: Mr. Don Henderson
3/2/87	1727	CONCORD, CALIFORNIA 94520

SITE OR LOCATION

East Palo Alto-Community Service Building
Fireproofing in Boiler room. Sample taken: 2/25/87

LAB NUMBER

8701968

GROSS DESCRIPTION

Soft, white (dirty) fibrous material.

SAMPLE NUMBER

MICROSCOPIC DESCRIPTION

TOTAL ASBESTOS PRESENT:			**< 1 %**
Chrysotile	< 1	%	
Amosite	< 1	%	
TOTAL NON-ASBESTOS FIBROUS MATERIAL PRESENT			**25-35 %**
Cellulose	15-20	%	
Mineral Wool	10-15	%	
Other Fibers	< 1	%	
TOTAL NON-ASBESTOS NON FIBROUS MATERIAL PRESENT			**65-75 %**
Unspecified Binding Material	65-75	%	

Comments: Analysis employs Polarized Light Microscopy with Dispersion Staining, and is performed by an analyst qualified under the EPA bulk asbestos proficiency testing program. Samples with no observable asbestiform minerals are designated as containing less than one percent (<1%) asbestos. Samples in which asbestiform minerals have been observed, but exist in concentrations of less than one percent (<1%) are designated as present in trace amounts.

Analyst **Dave Kahane and Michelle Fox** DK

3777 Depot Road, Suite 408, Hayward, CA 94545 • (415) 887-8828

Reservoirs Environmental, Inc.

December 4, 2015

Subcontract Number: NA
Laboratory Report: RES 337279-2
Project # / P.O. # F11899
Project Description: E. Palo Alto Govt Center, 2415 University

SCA Environmental, Inc.
650 Delancey St. Ste. 222
San Fransisco CA 94107

Dear Customer,

Reservoirs Environmental, Inc. is an analytical laboratory accredited for the analysis of Industrial Hygiene and Environmental matrices by the National Voluntary Laboratory Accreditation Program (NVLAP), Lab Code 101896-0 for Transmission Electron Microscopy (TEM) and Polarized Light Microscopy (PLM) analysis and the American Industrial Hygiene Association (AIHA), Lab ID 101533 - Accreditation Certificate #480 for Phase Contrast Microscopy (PCM) analysis. This laboratory is currently proficient in both Proficiency Testing and PAT programs respectively.

Reservoirs Environmental, Inc. has analyzed the following samples for asbestos content as per your request. The analysis has been completed in general accordance with the appropriate methodology as stated in the attached analysis table. The results have been submitted to your office.

RES 337279-2 is the job number assigned to this study. This report is considered highly confidential and the sole property of the customer. Reservoirs Environmental, Inc. will not discuss any part of this study with personnel other than those of the client. The results described in this report only apply to the samples analyzed. This report must not be used to claim endorsement of products or analytical results by NVLAP or any agency of the U.S. Government. This report shall not be reproduced except in full, without written approval from Reservoirs Environmental, Inc. Samples will be disposed of after sixty days unless longer storage is requested. If you have any questions about this report, please feel free to call 303-964-1986.

Sincerely,

Gina Vettraino for

Jeanne Spencer
President

RESERVOIRS ENVIRONMENTAL INC.

NVLAP Lab Code 101896-0

TABLE: PLM BULK ANALYSIS, PERCENTAGE COMPOSITION BY VOLUME

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Client Sample Number	Lab ID Number	LAYER	Physical Description	Sub Part (%)	Asbestos Content: Mineral	Asbestos Content: Visual Estimate (%)	Non Asbestos Fibrous Components (%)	Non-Fibrous Components (%)
2415-CONC-1-1	EM 1533248	A	Gray cementitious material	100		**ND**	0	100
2415-CONC-1-2	EM 1533249	A	Gray cementitious material	100		**ND**	0	100
2415-CONC-1-3	EM 1533250	A	Gray cementitious material	100		**ND**	0	100
2415-CONC-2-1	EM 1533251	A	Gray cementitious material	100		**ND**	0	100
2415-CONC-2-2	EM 1533252	A	Gray cementitious material	15		**ND**	0	100
		B	Dark gray - green rock fragments	85		**ND**	0	100
2415-CONC-2-3	EM 1533253	A	Gray cementitious material	100		**ND**	0	100
2415-WLSH-3-1	EM 1533254	A	White paint w/ white compound	5		**ND**	0	100
		B	White paint w/ white compound	5		**ND**	0	100
		C	Off white compound	10	**Chrysotile**	**2**	0	98
		D	White paint w/ white compound	30		**ND**	0	100
		E	Pink/brown drywall	50		**ND**	50	50

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2415-WLSH-3-2	EM 1533255	A	White paint w/ white paper	5		**ND**	75	25
		B	Off white compound	15	**Chrysotile**	**3**	0	97
		C	Gray/brown drywall	80		**ND**	15	85
2415-WLSH-3-3	EM 1533256	A	White tape	2		**ND**	95	5
		B	White compound	3	**Chrysotile**	**3**	0	97
		C	White joint compound	3	**Chrysotile**	**3**	0	97
		D	Pink/brown drywall	92		**ND**	15	85
2415-WLSH-3-4	EM 1533257	A	White paint	1		**ND**	0	100
		B	White compound	2	**Chrysotile**	**2**	0	98
		C	White tape	2		**ND**	95	5
		D	White joint compound	2	**Chrysotile**	**3**	0	97
		E	White/brown drywall	93		**ND**	15	85

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2415-WLSH-3-5	EM 1533258	A	White paint	5		**ND**	0	100
		B	White compound	35	**Chrysotile**	**2**	0	98
		C	White/brown drywall	60		**ND**	50	50
2415-WLSH-3-6	EM 1533259	A	White paint	1		**ND**	0	100
		B	White compound	2	**Chrysotile**	**2**	0	98
		C	White tape	2		**ND**	95	5
		D	White joint compound	2	**Chrysotile**	**2**	0	98
		E	White/brown drywall	93		**ND**	15	85
2415-WLSH-3-7	EM 1533260	A	White paint	1		**ND**	0	100
		B	White compound	2	**Chrysotile**	**3**	0	97
		C	White tape	2		**ND**	95	5
		D	White joint compound	3	**Chrysotile**	**3**	0	97
		E	Gray/brown drywall	92		**ND**	15	85

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2415-STSFP-4-1	EM 1533261	A	Gray fibrous micaceous plaster w/ white paint	100		**ND**	35	65
2415-STSFP-4-2	EM 1533262	A	Gray fibrous micaceous plaster w/ white paint	100		**ND**	35	65
2415-STSFP-4-3	EM 1533263	A	Gray fibrous micaceous plaster	100		**ND**	30	70
2415-STSFP-4-4	EM 1533264	A	Gray fibrous micaceous plaster	100	**Trem/Act**	**TR**	35	65
					1,100 Pt. Pt. Ct.	< 0.09		
2415-STSFP-4-5	EM 1533265	A	Gray fibrous micaceous plaster	100	**Trem/Act**	**TR**	35	65
					1,100 Pt. Pt. Ct.	<0.09		
2415-STSFP-4-6	EM 1533266	A	Gray fibrous micaceous plaster	100		**ND**	35	65
2415-STSFP-4-7	EM 1533267	A	Gray fibrous micaceous plaster	100		**ND**	35	65
2415-PICW-5-1	EM 1533268	A	Tan/silver wrap	25		**ND**	30	70
		B	Yellow fibrous material	35		**ND**	95	5
		C	White fibrous resinous wrap	40		**ND**	35	65

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2415-PICW-5-2	EM 1533269	A	Tan/silver wrap	20		**ND**	50	50
		B	Yellow fibrous material	20		**ND**	95	5
		C	White fibrous resinous multi-layered wrap	60		**ND**	35	65
2415-PIHW-6-1	EM 1533270	A	Tan/silver wrap	15		**ND**	50	50
		B	White fibrous resinous wrap	30		**ND**	35	65
		C	Tan fibrous material	55		**ND**	95	5
2415-PIHW-6-2	EM 1533271	A	Tan/silver wrap	10		**ND**	50	50
		B	White fibrous resinous wrap	20		**ND**	35	65
		C	Tan fibrous material	70		**ND**	95	5
2415-GASKET-7-1	EM 1533272	A	Gray gasket	100	**Chrysotile**	**60**	0	40
2415-RFROLL-8-1	EM 1533273	A	White resinous material	5		**ND**	0	100
		B	White/black resinous material w/ white fibrous material	15		**ND**	20	80
		C	Pink/white drywall	80		**ND**	20	80

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2415-RFROLL-8-2	EM 1533274	A	White resinous	5		ND	0	100
		B	White/black resinous material w/ white fibrous material	25		ND	20	80
		C	Pink/white drywall	70		ND	20	80
2415-RFROLL-8-3	EM 1533275	A	White resinous material	5		ND	0	100
		B	White resinous material	15		ND	0	100
		C	White/black resinous material w/ white fibrous material	25		ND	20	80
		D	Pink/white drywall	55		ND	20	80
2415-PENMAS-9-1	EM 1533276	A	Gray rock fragments black tar	15		ND	0	100
		B	White resinous material	25		ND	0	100
		C	Black fibrous tar	60		ND	25	75
2415-PENMAS-9-2	EM 1533277	A	White resinous material	50		ND	0	100
		B	Black fibrous tar	50		ND	20	80
2415-PENMAS-9-3	EM 1533278	A	Black fibrous tar	30		ND	25	75
		B	White resinous material	70		ND	0	100

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2415-RFPAD-10-1	EM 1533279	A	Black roofing material w/ gray granular material	100		**ND**	40	60
2415-RFPAD-10-2	EM 1533280	A	Black roofing material w/ gray granular material	100		**ND**	40	60
2415-RFPAD-10-3	EM 1533281	A	Black roofing material w/ gray granular material	100		**ND**	40	60
2415-RFPTCH-11-1	EM 1533282	A	Green woven tape	35		**ND**	95	5
		B	Black fibrous tar	65		**ND**	40	60
2415-RFPTCH-11-2	EM 1533283	A	Black/gray fibrous tar	100		**ND**	40	60
2415-RFMAS-12-1	EM 1533284	A	Black fibrous tar w/ rock fragments	100		**ND**	40	60
2415-RFMAS-12-2	EM 1533285	A	Black/gray fibrous tar	100		**ND**	40	60
2415-RFMAS-12-3	EM 1533286	A	Black/gray fibrous tar w/ rock fragments	100		**ND**	40	60
2415-CAULK-13-1	EM 1533287	A	Brown/multi-colored paint w/ white resinous material	5		**ND**	0	100
		B	Brown resinous material	95	**Chrysotile**	**10**	0	90
2415-CAULK-13-2	EM 1533288		Not Analyzed per Client Request.					
2415-CAULK-13-3	EM 1533289		Not Analyzed per Client Request.					
2415-CONC-14-1	EM 1533290	A	Gray cementitious material	100		**ND**	0	100

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2415-CONC-14-2	EM 1533291	A	White paint	1		**ND**	0	100
		B	Off white compound	4	**Chrysotile**	**2**	0	98
		C	Gray cementitious material	95		**ND**	0	100
2415-CONC-14-3	EM 1533292	A	Green/white rock fragments	100		**ND**	0	100
2415-CONC-15-1	EM 1533293	A	Green/white rock fragments	100		**ND**	0	100
2415-CONC-15-2	EM 1533294	A	Gray cementitious material	100		**ND**	0	100
2415-CONC-15-3	EM 1533295	A	Gray cementitious material	100		**ND**	0	100
2415-WLSH-16-1	EM 1533296	A	White paint	1		**ND**	0	100
		B	White compound	2	**Chrysotile**	**3**	0	97
		C	White tape	2		**ND**	95	5
		D	White joint compound	2	**Chrysotile**	**3**	0	97
		E	Pink/brown drywall	93		**ND**	15	85

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2415-WLSH-16-2	EM 1533297	A	White paint	1		**ND**	0	100
		B	White compound	2	**Chrysotile**	**3**	0	97
		C	White tape	2		**ND**	95	5
		D	White joint compound	2	**Chrysotile**	**3**	0	97
		E	Pink/brown drywall	93		**ND**	15	85
2415-WLSH-16-3	EM 1533298	A	Gray paint w/ white texture	10		**ND**	0	100
		B	White joint compound	10		**ND**	0	100
		C	White tape	35		**ND**	95	5
		D	White/brown drywall	45		**ND**	50	50
2415-BBMAS-17-1	EM 1533299	A	Brown resinous material	100		**ND**	0	100
2415-BBMAS-17-2	EM 1533300	A	White compound	TR	**Chrysotile**	**4**	0	96
		B	Brown resinous material	100		**ND**	0	100

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2415-BBMAS-17-3	EM 1533301	A	White paint	1		**ND**	0	100
		B	White compound	3	**Chrysotile**	**3**	0	97
		C	Brown resinous material	96		**ND**	0	100
2415-CLSH-18-1	EM 1533302	A	White paint	1		**ND**	0	100
		B	White compound	2	**Chrysotile**	**2**	0	98
		C	White tape	2		**ND**	95	5
		D	White joint compound	2	**Chrysotile**	**2**	0	98
		E	Pink/brown drywall	93		**ND**	15	85
2415-CLSH-18-2	EM 1533303	A	White paint	1		**ND**	0	100
		B	White compound	2	**Chrysotile**	**2**	0	98
		C	White tape	2		**ND**	95	5
		D	White joint compound	2	**Chrysotile**	**3**	0	97
		E	Pink/brown drywall	93		**ND**	15	85

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2415-CLSH-18-3	EM 1533304	A	White paint	1		**ND**	0	100
		B	White compound	2	**Chrysotile**	**3**	0	97
		C	White tape	2		**ND**	95	5
		D	White joint compound	2	**Chrysotile**	**3**	0	97
		E	Pink/brown drywall	93		**ND**	15	85
2415-CARMAS-19-1	EM 1533305	A	Off white resinous material	1		**ND**	0	100
		B	Yellow - orange resinous material	99		**ND**	0	100
2415-CARMAS-19-2	EM 1533306	A	Off white resinous material w/ green resinous material	100		**ND**	0	100
2415-CARMAS-19-3	EM 1533307	A	Off white resinous material w/ green resinous material	100		**ND**	0	100
2415-12FLVCT/M-20-1	EM 1533308	A	Black tar	1	**Chrysotile**	**8**	0	92
		B	Blue tile	99		**ND**	0	100
2415-12FLVCT/M-21-1	EM 1533309	A	Gray resinous material	10		**ND**	0	100
		B	Gray leveling compound	15		**ND**	0	100
		C	Purple/multi-colored sheet vinyl	75		**ND**	0	100

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2415-BBMAS-22-1	EM 1533310	A	Brown resinous material	100		**ND**	0	100
2415-BBMAS-22-2	EM 1533311	A	Brown resinous material w/ black debris	100		**ND**	0	100
2415-BBMAS-22-3	EM 1533312	A	White debris	TR	**Chrysotile**	**2**	0	98
		B	Brown resinous material	100		**ND**	0	100
2415-CLLI-23-1	EM 1533313	A	White resinous material	50		**ND**	0	100
		B	Yellow fibrous material	50		**ND**	95	5
2415-CLLI-23-2	EM 1533314	A	White resinous material	50		**ND**	0	100
		B	Yellow fibrous material	50		**ND**	95	5
2415-CLLI-23-3	EM 1533315	A	White resinous material	50		**ND**	0	100
		B	Yellow fibrous material	50		**ND**	95	5
2415-CLSP-24-1	EM 1533316	A	White/gray ceiling tile	100		**ND**	90	10
2415-CLSP-24-2	EM 1533317	A	White/gray ceiling tile	100		**ND**	90	10
2415-CLSP-24-3	EM 1533318	A	White resinous material	20		**ND**	0	100
		B	White/gray ceiling tile	80		**ND**	90	10

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Client Project Number / P.O.: **F11899**
Client Project Description: **E. Palo Alto Govt Center, 2415 University**
Date Samples Received: **November 24, 2015**
Method: **EPA 600/R-93/116 - Point Count, Bulk**
Turnaround: **24 Hour**
Date Samples Analyzed:

ND=None Detected
TR=Trace, <1% Visual Estimate
Trem/Act=Tremolite/Actinolite

Client Sample Number	Lab ID Number	LAYER	Physical Description	Sub Part (%)	Asbestos Content: Mineral	Asbestos Content: Visual Estimate (%)	Non Asbestos Fibrous Components (%)	Non-Fibrous Components (%)
2415-CLSH-25-1	EM 1533319	A	White paint	1		**ND**	0	100
		B	White tape	10		**ND**	95	5
		C	Pink/brown drywall	29		**ND**	50	50
		D	White compound	30		**ND**	0	100
		E	White joint compound	30		**ND**	0	100
2415-CLSH-25-2	EM 1533320	A	White paint	1		**ND**	0	100
		B	White compound	2	**Chrysotile**	**2**	0	98
		C	White tape	2		**ND**	95	5
		D	White joint compound	2	**Chrysotile**	**2**	0	98
		E	Pink/brown drywall	93		**ND**	15	85
2415-CLSH-25-3	EM 1533321	A	Pink/brown drywall w/ off white paint	100		**ND**	15	85

TEM Analysis recommended for organically bound material (i.e. floor tile) if PLM results are <1%.

RESERVOIRS ENVIRONMENTAL INC.

NVLAP Lab Code 101896-0

TABLE: PLM BULK ANALYSIS, PERCENTAGE COMPOSITION BY VOLUME

RES Job Number: **RES 337279-2**
Client: **SCA Environmental, Inc.**
Client Project Number / P.O.: **F11899**
Client Project Description: **E. Palo Alto Govt Center, 2415 University**
Date Samples Received: **November 24, 2015**
Method: **EPA 600/R-93/116 - Point Count, Bulk**
Turnaround: **24 Hour**
Date Samples Analyzed:

ND=None Detected
TR=Trace, <1% Visual Estimate
Trem/Act=Tremolite/Actinolite

Client Sample Number	Lab ID Number	LAYER	Physical Description	Sub Part (%)	Asbestos Content: Mineral	Asbestos Content: Visual Estimate (%)	Non Asbestos Fibrous Components (%)	Non-Fibrous Components (%)
2415-CLSH-25-4	EM 1533322	A	Light gray paint	1		**ND**	0	100
		B	White compound	1	**Chrysotile**	**2**	0	98
		C	White joint compound	1	**Chrysotile**	**2**	0	98
		D	White tape	2		**ND**	95	5
		E	Pink/brown drywall	95		**ND**	15	85
2415-CLSH-25-5	EM 1533323	A	Off white paint	1		**ND**	0	100
		B	White compound	2	**Chrysotile**	**3**	0	97
		C	White tape	2		**ND**	95	5
		D	White joint compound	2	**Chrysotile**	**3**	0	97
		E	White/brown drywall	93		**ND**	15	85

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Client Sample Number	Lab ID Number	LAYER	Physical Description	Sub Part (%)	Asbestos Content: Mineral	Asbestos Content: Visual Estimate (%)	Non Asbestos Fibrous Components (%)	Non-Fibrous Components (%)
2415-CLSH-25-6	EM 1533324	A	Off white paint	1		**ND**	0	100
		B	White compound	2	**Chrysotile**	**3**	0	97
		C	White tape	2		**ND**	95	5
		D	White joint compound	2	**Chrysotile**	**3**	0	97
		E	Gray/brown drywall	93		**ND**	15	85
2415-SINK-26-1	EM 1533325	A	Gray fibrous sink undercoating	100		**ND**	15	85
2415-12FLVCT/M-27-1	EM 1533326	A	Grayish tile	99		**ND**	0	100
		B	Yellow mastic	1		**ND**		
2415-12FLVCT/M-27-2	EM 1533327	A	Yellow mastic	TR		**ND**	0	100
		B	Grayish tile	100		**ND**	0	100
2415-DEBRIS-28-1	EM 1533328	A	Opaque resinous material	20		**ND**	0	100
		B	Gray/tan/white fibrous granular debris	80		**ND**	50	50

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RESERVOIRS ENVIRONMENTAL INC.

NVLAP Lab Code 101896-0

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Date Samples Analyzed:

ND=None Detected
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Trem/Act=Tremolite/Actinolite

Client Sample Number	Lab ID Number	LAYER	Physical Description	Sub Part (%)	Asbestos Content: Mineral	Asbestos Content: Visual Estimate (%)	Non Asbestos Fibrous Components (%)	Non-Fibrous Components (%)
2415-DEBRIS-28-2	EM 1533329	A	White compound	30		**ND**	0	100
		B	Gray/tan/white fibrous granular debris	70		**ND**	50	50
2415-WLSH-29-1	EM 1533330	A	White paint	1		**ND**	0	100
		B	White joint compound	1		**ND**	0	100
		C	White compound	2		**ND**	0	100
		D	White tape	2		**ND**	95	5
		E	White/brown drywall	94		**ND**	15	85
2415-WLSH-29-2	EM 1533331	A	White paint	1		**ND**	0	100
		B	White compound	2	**Chrysotile**	**3**	0	97
		C	White tape	2		**ND**	95	5
		D	White joint compound	2	**Chrysotile**	**3**	0	97
		E	White paint w/ white granular compound	3		**ND**	0	100
		F	White/brown drywall	90		**ND**	15	85

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Client Sample Number	Lab ID Number	LAYER	Physical Description	Sub Part (%)	Asbestos Content: Mineral	Asbestos Content: Visual Estimate (%)	Non Asbestos Fibrous Components (%)	Non-Fibrous Components (%)
2415-WLSH-29-3	EM 1533332	A	White paint	1		ND	0	100
		B	White compound	2		ND	0	100
		C	White tape	2		ND	95	5
		D	White joint compound	2		ND	0	100
		E	White/brown drywall	93		ND	15	85
2415-BBMAS-30-1	EM 1533333	A	Off white resinous material	100		ND	0	100
2415-BBMAS-30-2	EM 1533334	A	White paint w/ brown paper	15		ND	50	50
		B	Light gray resinous material	85		ND	0	100
2415-BBMAS-30-3	EM 1533335	A	Gray resinous material	15		ND	0	100
		B	Off white resinous material	85		ND	0	100
2415-CLLI-31-1	EM 1533336	A	White/gray perlitic ceiling tile	100		ND	80	20
2415-CLLI-31-2	EM 1533337	A	White/gray perlitic ceiling tile	100		ND	80	20
2415-CLLI-31-3	EM 1533338	A	White/gray perlitic material	100		ND	80	20

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Client Sample Number	Lab ID Number	LAYER	Physical Description	Sub Part (%)	Asbestos Content: Mineral	Asbestos Content: Visual Estimate (%)	Non Asbestos Fibrous Components (%)	Non-Fibrous Components (%)
2415-FLVCS-32-1	EM 1533339	A	Off white mastic	3		**ND**	0	100
		B	Brown tile	97		**ND**	0	100
2415-FLVCS-32-2	EM 1533340	A	Off white mastic	2		**ND**	0	100
		B	Brown tile	98		**ND**	0	100
2415-FLVCS-32-3	EM 1533341	A	Off white resinous material	TR		**ND**	0	100
		B	Gray leveling compound	TR		**ND**	0	100
		C	White compound	1		**ND**	0	100
		D	Off white resinous material	1		**ND**	0	100
		E	Brown tile	98		**ND**	0	100

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Client Sample Number	Lab ID Number	LAYER	Physical Description	Sub Part (%)	Asbestos Content: Mineral	Asbestos Content: Visual Estimate (%)	Non Asbestos Fibrous Components (%)	Non-Fibrous Components (%)
2415-12FLVCT/M-33-1	EM 1533342	A	Clear resinous material	TR		**ND**	0	100
		B	Yellow resinous material	TR		**ND**	0	100
		C	Off white tile	30		**ND**	0	100
		D	Green tile	30		**ND**	0	100
		E	Blue tile	40		**ND**	0	100
2415-12FLVCT/M-33-2	EM 1533343	A	Yellow resinous material	TR		**ND**	0	100
		B	Clear resinous material	TR		**ND**	0	100
		C	Off white tile	30		**ND**	0	100
		D	Green tile	35		**ND**	0	100
		E	Blue tile	35		**ND**	0	100

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Client Sample Number	Lab ID Number	LAYER	Physical Description	Sub Part (%)	Asbestos Content: Mineral	Asbestos Content: Visual Estimate (%)	Non Asbestos Fibrous Components (%)	Non-Fibrous Components (%)
2415-12FLVCT/M-33-3	EM 1533344	A	Yellow resinous mastic	TR		**ND**	0	100
		B	Blue tile	10		**ND**	0	100
		C	Off white tile	45		**ND**	0	100
		D	Green tile	45		**ND**	0	100
2415-SINK-34-1	EM 1533345	A	Gray fibrous sink undercoating	100		**ND**	15	85
2415-FLVCS-35-1	EM 1533346	A	Off white resinous material	10		**ND**	0	100
		B	Blue flooring	90		**ND**	0	100
2415-HDUTP-36-1	EM 1533347	A	White woven material w/ white resinous material	100		**ND**	65	35
2415-HDUTP-36-2	EM 1533348	A	White woven material w/ white resinous material	100		**ND**	65	35
2415-12FLVCT/M-37-1	EM 1533349	A	Black fibrous tar	10	**Chrysotile**	**15**	0	85
		B	Gray tile	90	**Chrysotile**	**6**	0	94
2415-12FLVCT/M-37-2	EM 1533350		Not Analyzed per Client Request.					
2415-12FLVCT/M-37-3	EM 1533351		Not Analyzed per Client Request.					

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Client Sample Number	Lab ID Number	LAYER	Physical Description	Sub Part (%)	Asbestos Content: Mineral	Asbestos Content: Visual Estimate (%)	Non Asbestos Fibrous Components (%)	Non-Fibrous Components (%)
2415-9FLVCT/M-38-1	EM 1533352	A	Yellow resinous material	1		**ND**	0	100
		B	Red/gray flooring	99		**ND**	0	100
2415-12FLVCT/M-39-1	EM 1533353	A	Yellow mastic	1		**ND**	0	100
		B	Purplish - blue tile	99		**ND**	0	100
2415-12FLVCT/M-39-2	EM 1533354	A	Yellow mastic	1		**ND**	0	100
		B	Purplish - blue tile	99		**ND**	0	100
2415-12FLVCT/M-39-3	EM 1533355	A	Yellow mastic	1		**ND**	0	100
		B	Purplish - blue tile	99		**ND**	0	100
2415-FLCER-40-1	EM 1533356	A	White compound	TR		**ND**	0	100
		B	Brown resinous material	5		**ND**	0	100
		C	Dark gray grout	20		**ND**	0	100
		D	Gray/white ceramic tile	75		**ND**	0	100
2415-12FLVCT/M-41-1	EM 1533357	A	White/gray tile	100		**ND**	0	100

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Client Sample Number	Lab ID Number	LAYER	Physical Description	Sub Part (%)	Asbestos Content: Mineral	Asbestos Content: Visual Estimate (%)	Non Asbestos Fibrous Components (%)	Non-Fibrous Components (%)
2415-12FLVCT/M-41-2	EM 1533358	A	Yellow mastic	TR		**ND**	0	100
		B	White/gray tile	100		**ND**	0	100
2415-12FLVCT/M-42-1	EM 1533359	A	Off white mastic	TR		**ND**	0	100
		B	Gray leveling compound	15		**ND**	0	100
		C	Bluish - gray tile	25		**ND**	0	100
		D	Gray tile	60		**ND**	0	100
2415-12FLVCT/M-42-2	EM 1533360	A	Yellow mastic	TR		**ND**	0	100
		B	Gray tile	50		**ND**	0	100
		C	Bluish - gray tile	50		**ND**	0	100
2415-CLLI-43-1	EM 1533361	A	White/gray ceiling tile	100		**ND**	90	10
2415-CLLI-43-2	EM 1533362	A	White/gray ceiling tile	100		**ND**	90	10
2415-CLLI-43-3	EM 1533363	A	White/gray ceiling tile	100		**ND**	90	10
2415-CONC-44-1	EM 1533364	A	Gray cementitious material	100		**ND**	0	100

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Client Sample Number	Lab ID Number	LAYER	Physical Description	Sub Part (%)	Asbestos Content: Mineral	Asbestos Content: Visual Estimate (%)	Non Asbestos Fibrous Components (%)	Non-Fibrous Components (%)
2415-CONC-44-2	EM 1533365	A	Gray cementitious material	100		ND	0	100
2415-CONC-44-3	EM 1533366	A	Gray cementitious material	100		ND	0	100
2415-ASPHALT-45-1	EM 1533367	A	Black granular tar	100		ND	0	100
2415-ASPHALT-45-2	EM 1533368	A	Black granular tar	100		ND	0	100
2415-ASPHALT-45-3	EM 1533369	A	Black granular tar	100		ND	0	100

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Anita Grigg
Analyst / Data QA

Appendix B

Due Date: 11-30-12
Due Time: 9:55a

Reservoirs Environmental, Inc.

5801 Logan St. Denver, CO 80216 • Ph: 303 964-1986 • Fax 303-477-4275 • Toll Free :866 RESI-ENV

After Hours Cell Phone: 720-339-9228

RES 337279

SUBMITTED BY:		INVOICE TO: (IF DIFFERENT)		CONTACT INFORMATION:	
Company:	SCA Environmental, Inc.	Company:		Contact:	Contact:
Address:	650 Delancey St. Ste. 222	Address:		Phone:	Phone:
	San Fransisco CO 94107			Fax:	Fax:
				Cell/pager:	Cell/pager:
Project Number and/or P.O. #:	F11899			Final Data Deliverable Email Address:	
Project Description/Location:	E. Palo Alto Govt Center, 2415 University			ccodemo@sca-enviro.com & dleung@sca-enviro.c pgervasio@scaehs.com	

ASBESTOS LABORATORY HOURS: Weekdays: 7am - 7pm & Sat. 8am - 5pm

PLM / PCM / TEM ___ RUSH (Same Day) ___ PRIORITY (Next Day) _X_ STANDARD (5 Day)
(Rush PCM = 2hr, TEM = 6hr.)

CHEMISTRY LABORATORY HOURS: Weekdays: 8am - 5pm

Metal(s) / Dust**	___ RUSH ___ 24 hr. _X_ 3-5 Day	**Prior notification is required for RUSH turnarounds.**
RCRA 8 / Metals & Welding Fume Scan / TCLP**	__RUSH (3 Day)__5 Day __10 Day	
Organics	___ 24 hr. ___ 3 day ___5 Day	

MICROBIOLOGY LABORATORY HOURS: Weekdays: 9am - 6pm

E.coli and/or Coliforms*	___ 24-48 Hour	Other: _____
Pathogens*	___ 24-48 Hour	*TAT dependent on speed of microbial growth.*
Microbial Growth*	___ 5-10 Day	
Legionella	___ 10 Day	
Mold	___ RUSH ___ 24 Hr ___ 48 Hr ___ 3 Day ___ 5 Day	

Turnaround times establish a laboratory priority, subject to laboratory volume and are not guaranteed. Additional fees apply for afterhours, weekends and holidays.

Special Instructions:

REQUESTED ANALYSIS

VALID MATRIX CODES

Air = A	Bulk = B
Dust = D	Paint = P
Soil = S	Wipe = W
Swab = SW	F = Food
Drinking Water = DW	Waste Water = WW
O = Other	

ASTM E1792 approved wipe media only

LAB NOTES:

Client sample ID number (Sample ID's must be unique)	PLM - Short report, Point Count, Long report, Qualitative	TEM - AHERA, Level II, 7402, ISO, +/- (Air, Bulk or Dust), Quant, Semi-Quant, Micro-vac, ISO-Indirect Preps	PCM - 7400A, 7400B, OSHA	DUST - Total, Respirable	METALS - Analyte(s) _____ RCRA 8, TCLP, Welding Fume, Metals Scan, pH	ORGANICS - METH, TSS	MICROBIOLOGY: Pathogens: Aerobic Plate Count, Salmonella, E.coli O157:H7, Listeria, S.aureus, Campylobacter: +/- or Quantification	MICROBIOLOGY: E.coli and/or Coliforms: +/- or Quantification	MICROBIOLOGY: Microbial Growth: Aerobic Plate Count ID, Bacteria or Y & M: +/- or Quantification	MICROBIOLOGY: Legionella: +/- or Quantification	MICROBIOLOGY: Other: Bioburden, LAL or Environmental	MICROBIOLOGY: Mold: Spore Trap or Bulk: +/-, Identification, Quantification	SAMPLER'S INITIALS OR OTHER NOTES:	Sample Volume (L) / Area	Matrix Code	# Containers	Date Collected mm/dd/yy	Time Collected hh/mm a/p	EM Number (Laboratory Use Only)
1 2415-CONC-1-1	X														B			1533248
2 2415-CONC-1-2	X														B			49
3 2415-CONC-1-3	X														B			50
4 2415-CONC-2-1	X														B			51
5 2415-CONC-2-2	X														B			52
6 2415-CONC-2-3	X														B			53
7 2415-WLSH-3-1	X														B			54
8 2415-WLSH-3-2	X														B			55
9 2415-WLSH-3-3	X														B			56
10 2415-WLSH-3-4	X														B			57

Number of samples received: 122 (Additional samples shall be listed on attached long form.)

NOTE: REI will analyze incoming samples based upon information received and will not be responsible for errors or omissions in calculations resulting from the inaccuracy of original data. By signing client/company representative agrees that submission of the following samples for requested analysis as indicated on this Chain of Custody shall constitute an analytical services agreement with payment terms of NET 30 days, failure to comply with payment terms may result in a 1.5% monthly interest surcharge.

Relinquished By: Date/Time:

Laboratory Use Only
Received By: Date/Time: 11/29/12 9:55 Carrier: Hand / FedEx / UPS / USPS / Drop Box / Courier

Sample Condition: Temp. (F°) ____ On Ice Yes / No Sealed Yes / No Intact Yes / No

Data Entry QA:	Contact	Phone Email Fax	Date	Time	Initials	Contact	Phone Email Fax	Date	Time	Initials
	Contact	Phone Email Fax	Date	Time	Initials	Contact	Phone Email Fax	Date	Time	Initials

REI LAB **Reservoirs Environmental, Inc.**
5801 Logan St. Denver, CO 80216 • Ph: 303 964-1986 • Fax 303-477-4275 • Toll Free :866 RESI-ENV

RES Job # 337279 Page 2 of 5

Submitted by: SCA Environmental, Inc.

	Client sample ID number (Sample ID's must be unique)	PLM - Short report, Long report, Point Count	TEM - AHERA, Level II, 7402, ISO, +/-, Quant, Semi-quant, Micro-vac, ISO-Indirect Preps	PCM - 7400A, 7400B, OSHA	DUST - Total, Respirable	METALS - Analyte(s) _____ RCRA 8, TCLP, Welding Fume, Metals Scan	ORGANICS - METH	MICROBIOLOGY: Pathogens: Aerobic Plate Count, Salmonella, E.coli O157:H7, Listeria, S.aureus, Campylobacter: +/- or Quantification	MICROBIOLOGY: E.coli and/or Coliforms: +/- or Quantificatino	MICROBIOLOGY: Microbial Growth: Aerobic Plate Count ID, Bacteria or Y & M: +/- or Quantification	MICROBIOLOGY: Legionella +/- or Quantification	MICROBIOLOGY: Other: Bioburden, LAL or Environmental	MICROBIOLOGY: Mold: Spore Trap or Bulk: +/- or Quantification	SAMPLER'S INITIALS OR OTHER NOTES:	Sample Volume (L) / Area	Matrix Code	# Containers	Date Collected mm/dd/yy	Time Collected hh/mm a/p	EM Number (Laboratory Use Only)
11	2415-WLSH-3-5	X														B			1533258
12	2415-WLSH-3-6	X														B			59
13	2415-WLSH-3-7	X														B			67
14	2415-STSFP-4-1	X														B			61
15	2415-STSFP-4-2	X														B			62
16	2415-STSFP-4-3	X														B			63
17	2415-STSFP-4-4	X														B			64
18	2415-STSFP-4-5	X														B			65
19	2415-STSFP-4-6	X														B			66
20	2415-STSFP-4-7	X														B			67
21	2415-PICW-5-1	X														B			68
22	2415-PICW-5-2	X														B			69
23	2415-PIHW-6-1	X														B			70
24	2415-PIHW-6-2	X														B			71
25	2415-GASKET-7-1	X														B			72
26	2415-RFROLL-8-1	X														B			73
27	2415-RFROLL-8-2	X														B			74
28	2415-RFROLL-8-3	X														B			75
29	2415-PENMAS-9-1	X														B			76
30	2415-PENMAS-9-2	X														B			77
31	2415-PENMAS-9-3	X														B			78
32	2415-RFPAD-10-1	X														B			79
33	2415-RFPAD-10-2	X														B			80
34	2415-RFPAD-10-3	X														B			81
35	2415-RFPATCH-11-1	X														B			82
36	2415-RFPATCH-11-2	X														B			83
37	2415-RFMAS-12-1	X														B			84
38	2415-RFMAS-12-2	X														B			85
39	2415-RFMAS-12-3	X														B			86
40	2415-CAULK-13-1	X														B			87
41	2415-CAULK-13-2	X														B			88

REQUESTED ANALYSIS

VALID MATRIX CODES

Air = A	Bulk = B
Dust = D	Paint = P
Soil = S	Wipe = W
Swab = SW	F = Food
Drinking Water = DW	Waste Water = WW
O = Other	

ASTM E1792 approved wipe media only

LAB NOTES:

Reservoirs Environmental, Inc.
5801 Logan St. Denver, CO 80216 • Ph: 303 964-1986 • Fax 303-477-4275 • Toll Free 866 RESI-ENV

RES Job # 337279 Page 3 of 5

Submitted by: SCA Environmental, Inc.

Client sample ID number (Sample ID's must be unique)		REQUESTED ANALYSIS: PLM - Short report, Long report, Point Count	TEM - AHERA, Level II, 7402, ISO, +/-, Quant, Semi-quant, Micro-vac, ISO-Indirect Preps	PCM - 7400A, 7400B, OSHA	DUST - Total, Respirable	METALS - Analyte(s) RCRA 8, TCLP, Welding Fume, Metals Scan	ORGANICS - METH	MICROBIOLOGY: Pathogens: Aerobic Plate Count, Salmonella, E.coli O157:H7, Listeria, S.aureus, Camphlobacter: +/- or Quantification	MICROBIOLOGY: E.coli and/or Coliforms: +/- or Quantificatino	MICROBIOLOGY: Microbial Growth: Aerobic Plate Count ID, Bacteria or Y & M: +/- or Quantification	MICROBIOLOGY: Legionella: +/- or Quantification	MICROBIOLOGY: Other: Bioburden, LAL or Environmental	MICROBIOLOGY: Mold: Spore Trap or Bulk: +/- or Quantification	SAMPLER'S INITIALS OR OTHER NOTES:	Sample Volume (L) / Area	Matrix Code	# Containers	Date Collected mm/dd/yy	Time Collected hh/mm a/p	EM Number (Laboratory Use Only)
42	2415-CAULK-13-3	X														B			1533287
43	2415-CONC-14-1	X														B			88
44	2415-CONC-14-2	X														B			89
45	2415-CONC-14-3	X														B			92
46	2415-CONC-15-1	X														B			93
47	2415-CONC-15-2	X														B			94
48	2415-CONC-15-3	X														B			95
49	2415-WLSH-16-1	X														B			96
50	2415-WLSH-16-2	X														B			97
51	2415-WLSH-16-3	X														B			98
52	2415-BBMAS-17-1	X														B			99
53	2415-BBMAS-17-2	X														B			200
54	2415-BBMAS-17-3	X														B			01
55	2415-CLSH-18-1	X														B			02
56	2415-CLSH-18-2	X														B			03
57	2415-CLSH-18-3	X														B			04
58	2415-CARMAS-19-1	X														B			05
59	2415-CARMAS-19-2	X														B			06
60	2415-CARMAS-19-3	X														B			07
61	2415-12FLVCT/M-20-1	X														B			08
62	2415-12FLVCT/M-21-1	X														B			09
63	2415-BBMAS-22-1	X														B			10
64	2415-BBMAS-22-2	X														B			11
65	2415-BBMAS-22-3	X														B			12
66	2415-CLLI-23-1	X														B			13
67	2415-CLLI-23-2	X														B			14
68	2415-CLLI-23-3	X														B			15
69	2415-CLSP-24-1	X														B			16
70	2415-CLSP-24-2	X														B			17
71	2415-CLSP-24-3	X														B			18
72	2415-CLSH-25-1	X														B			19

VALID MATRIX CODES: Air = A; Bulk = B; Dust = D; Paint = P; Soil = S; Wipe = W; Swab = SW; F = Food; Drinking Water = DW; Waste Water = WW; O = Other; **ASTM E1792 approved wipe media only**

LAB NOTES:

4-2014_version 1

REI LAB **Reservoirs Environmental, Inc.**
5801 Logan St. Denver, CO 80216 • Ph: 303 964-1986 • Fax 303-477-4275 • Toll Free 866 RESI-ENV

RES Job # 337279 Page 4 of 5

Submitted by: SCA Environmental, Inc.

Client sample ID number (Sample ID's must be unique)		REQUESTED ANALYSIS: PLM - Short report, Long report, Point Count	TEM - AHERA, Level II, 7402, ISO, +/-, Quant, Semi-quant, Micro-vac, ISO-Indirect Preps	PCM - 7400A, 7400B, OSHA	DUST - Total, Respirable	METALS - Analyte(s) _____ RCRA 8, TCLP, Welding Fume, Metals Scan	ORGANICS - METH	MICROBIOLOGY: Pathogens Aerobic Plate Count, Salmonella, E.coli O157:H7, Listeria, S.aureus, Campilobacter +/- or Quantification	MICROBIOLOGY: E.coli and/or Coliforms: +/- or Quantificatino	MICROBIOLOGY: Microbial Growth Aerobic Plate Count ID, Bacteria or Y & M: +/- or Quantification	MICROBIOLOGY: Legionella: +/- or Quantification	MICROBIOLOGY: Other Bioburden, LAL or Environmental	MICROBIOLOGY: Mold Spore Trap or Bulk: +/- or Quantification	SAMPLER'S INITIALS OR OTHER NOTES:	Sample Volume (L) / Area	Matrix Code	# Containers	Date Collected mm/dd/yy	Time Collected hh/mm a/p	EM Number (Laboratory Use Only)
73	2415-CLSH-25-2	X														B				1533326
74	2415-CLSH-25-3	X														B				21
75	2415-CLSH-25-4	X														B				22
76	2415-CLSH-25-5	X														B				23
77	2415-CLSH-25-6	X														B				24
78	2415-SINK-26-1	X														B				25
79	2415-12FLVCT/M-27-1	X														B				26
80	2415-12FLVCT/M-27-2	X														B				27
81	2415-DEBRIS-28-1	X														B				28
82	2415-DEBRIS-28-2	X														B				29
83	2415-WLSH-29-1	X														B				30
84	2415-WLSH-29-2	X														B				31
85	2415-WLSH-29-3	X														B				32
86	2415-BBMAS-30-1	X														B				33
87	2415-BBMAS-30-2	X														B				34
88	2415-BBMAS-30-3	X														B				35
89	2415-CLLI-31-1	X														B				36
90	2415-CLLI-31-2	X														B				37
91	2415-CLLI-31-3	X														B				38
92	2415-FLVCS-32-1	X														B				39
93	2415-FLVCS-32-2	X														B				40
94	2415-FLVCS-32-3	X														B				41
95	2415-12FLVCT/M-33-1	X														B				42
96	2415-12FLVCT/M-33-2	X														B				43
97	2415-12FLVCT/M-33-3	X														B				44
98	2415-SINK-34-1	X														B				45
99	2415-FLVCS-35-1	X														B				46
100	2415-HDUTP-36-1	X														B				47
101	2415-HDUTP-36-2	X														B				48
102	2415-12FLVCT/M-37-1	X														B				49
103	2415-12FLVCT/M-37-2	X														B				50

VALID MATRIX CODES

Air = A	Bulk = B
Dust = D	Paint = P
Soil = S	Wipe = W
Swab = SW	F = Food
Drinking Water = DW	Waste Water = WW
O = Other	

ASTM E1792 approved wipe media only

LAB NOTES:

4-2014_version 1

REI LAB **Reservoirs Environmental, Inc.**
5801 Logan St. Denver, CO 80216 • Ph: 303 964-1988 • Fax 303-477-4275 • Toll Free 866 RESI-ENV

RES Job # 3372D

Page 5 of 5

Submitted by: SCA Environmental, Inc.

	Client sample ID number (Sample ID's must be unique)	PLM - Short report, Long report, Point Count	TEM - AHERA, Level II, 7402, ISO, +/-, Quant, Semi-quant, Micro-vac, ISO-Indirect Preps	PCM - 7400A, 7400B, OSHA	DUST - Total, Respirable	METALS - Analyte(s) _____ RCRA 8, TCLP, Welding Fume, Metals Scan	ORGANICS - METH	MICROBIOLOGY: Pathogens Aerobic Plate Count, Salmonella, E.coli O157:H7, Listeria, S.aureus, Campylobacter: +/- or Quantification	MICROBIOLOGY: E.coli and/or Coliforms: +/- or Quantificatino	MICROBIOLOGY: Microbial Growth Aerobic Plate Count ID, Bacteria or Y & M: +/- or Quantification	MICROBIOLOGY: Legionella: +/- or Quantification	MICROBIOLOGY: Other Bioburden, LAL or Environmental	MICROBIOLOGY: Mold Spore Trap or Bulk: +/- or Quantification	SAMPLER'S INITIALS OR OTHER NOTES:	Sample Volume (L) / Area	Matrix Code	# Containers	Date Collected mm/dd/yy	Time Collected hh/mm a/p	EM Number (Laboratory Use Only)
104	2415-FLVCT/M-37-3	X														B				1537351
105	2415-9FLVCT/M-38-1	X														B				52
106	2415-12FLVCT/M-39-1	X														B				53
107	2415-12FLVCT/M-39-2	X														B				54
108	2415-12FLVCT/M-39-3	X														B				55
109	2415-FLCER-40-1	X														B				56
110	2415-12FLVCT/M-41-1	X														B				57
111	2415-12FLVCT/M-41-2	X														B				58
112	2415-12FLVCT/M-42-1	X														B				59
113	2415-12FLVCT/M-42-2	X														B				60
114	2415-CLLI-43-1	X														B				61
115	2415-CLLI-43-2	X														B				62
116	2415-CLLI-43-3	X														B				63
117	2415-CONC-44-1	X														B				64
118	2415-CONC-44-2	X														B				65
119	2415-CONC-44-3	X														B				66
120	2415-ASPHALT-45-1	X														B				67
121	2415-ASPHALT-45-2	X														B				68
122	2415-ASPHALT-45-3	X														B				69
123																				
124																				
125																				
126																				
127																				
128																				
129																				
130																				
131																				
132																				
133																				
134																				

VALID MATRIX CODES

Air = A	Bulk = B
Dust = D	Paint = P
Soil = S	Wipe = W
Swab = SW	F = Food
Drinking Water = DW	Waste Water = WW
O = Other	

ASTM E1792 approved wipe media only

LAB NOTES:

4-2014_version 1

RES 337279

SCA
Environmental, Inc.

CHAIN OF CUSTODY FORM

	Tel	Fax
650 Delancey St., Ste. 222, San Francisco, CA 94107	415-882-1675	415-962-0736
1 Lakeside Dr, #215, Oakland, CA 94612	510-645-6200	415-962-0736

CALL/TXT with results:

Email rpt / COC & invoice:
dleung@sca-enviro.com & pgervasio@scaehs.com

Email Prj Mgr Name:
Chuck Siu   Glenn Cass   (Christina Codemo)

Accounting Data:

EMAIL HEADING:	(Project #) -	(Project Manager Initials) -	(Site Name/Address) -	(Date MMDD)
CTY OF GM EAST PALO ALTO GVT	F11899	CC	E PALO ALTO GOVT CENTER	11/23
LAB CTR GVY REI			2415 UNIVERSITY	

COURIER

LAB REP NOTIFIED:		Notification DATE/TIME:	
AIRBILL/FLIGHT NO.:		Shipper REFERENCE I.D.	
EST ARRIVAL DATE:		EST. ARRIVAL TIME:	

Method Reference   7400 PCM   AHERA TEM (≤0.005 s/cc AnaSen)   CARB-AHERA TEM 0.001 s/cc Ana Sensitivity
(PLM (asbestos))   Flame AA (Lead)

Sample Media   25   37 mm   0.45   0.8 micron   MCEF   (Bulk)   Water   Wipe

RESULTS DUE: 5 DAYS   AM / PM

CHAIN OF CUSTODY DATA:
Sending Info: 122 samples submitted by DL (SCA) on 11/23 at 9:00A
Received by Lab: ______ samples received by ______ on ______ at ______
Received by Analyst: ______ samples received by ______ on ______ at ______

SAMPLE ID	LITERS	~~Results~~ SAMPLE ID	~~Inv/Blanks/Outs~~ SAMPLE ID
2415 - CONC-1-1,2,3		2415 - BBMAG-17-1,2,3	2415 - HDUTP-36-1,2
- CONC-2-1,2,3		- CLGH-18-1,2,3	- 12FLVCT/M-37,1,2,3
- WLGH-3-1,2,3,4,5,6,7		- CARMAG-19-1,2,3	- 9FLVCT/M-38-1
- GYGFP-4-1,2,3,4,5,6,7		- 12FLVCT/M-20-1	- 12FLVCT/M-39-1,2,3
- PICW-5-1,2		- 12FLVCT/M-21-1	- FLCER-40-1
- PIHW-6-1,2		- BBMAG-22-1,2,3	- 12FLVCT/M-41-1,2
- GASKET-7-1		- CLLI-23-1,2,3	- 12FLVCT/M-42-1,2
- RFROLL-8-1,2,3		- CLGP-24-1,2,3	- CLLI-43-1,2,3
- PENMAG-9-1,2,3		- CLGH-25-1,2,3,4,5,6	- CONC-44-1,2,3
- RFPAD-10-1,2,3		- SINK-26-1	- ASPHALT-45-1,2,3
- RFPTCH-11-1,2		- 12FLVCT/M-27-1,2	
- RFMAG-12-1,2,3		- DEBRIS-28-1,2	
- CAULK-13-1,2,3		- WLGH-29-1,2,3	
- CONC-14-1,2,3		- BBMAG-30-1,2,3	
- CONC-15-1,2,3		- CLLI-31-1,2,3	
- WLGH-16-1,2,3		- FLVCG-32-1,2,3	
	0 LITERS	- 12FLVCT/M-33-1,2,3	BLANK
	0 LITERS	- SINK-34-1	BLANK
	0 LITERS	- FLVCG-35-1	BLANK

Turnaround		Wipes	Flame AA	Units (each)	LEAD			CARB AHERA 10-15 grid openings	CARB AHERA 35-40 grid openings	TEM AHERA	PLM Std Point Count 400	CARB 435 (400 Pt Ct) w/ prep	PLM Bulk	PCM NIOSH 7400	Units (each)	ASBESTOS
< 6 hours				1 to 9											1 to 9	< 6 hours
				10 to 40											10 to 40	
				>40											>40	
24 hours				1 to 9											1 to 9	24 hours
				10 to 40											10 to 40	
				>40											>40	
48 hours				1 to 9											1 to 9	48 hours
				10 to 40											10 to 40	
				>40											>40	
3 to 5 days				1 to 9											1 to 9	3 to 5 days
				10 to 40											10 to 40	
				>40											>40	
> 6 days				1 to 9											1 to 9	> 6 days
				10 to 40											10 to 40	
				>40											>40	

INSTRUCTIONS TO LAB (delete items not applicable AND circle items applicable):

~~1. Pickup requested:~~
~~Contact:~~ ______
~~Time of Call:~~ ______
~~2. Call SCA's contact to acknowledge receipt of samples.~~
~~3. Analyze samples by PCM only.~~
~~4. Analyze inside samples by PCM first; if any sample >0.01 f/cc, contact SCA.~~
~~5. If all samples are <0.01 f/cc, proceed with items 6, 7 or 8, as noted.~~
~~6. Analyze inside samples only; stop if Avg >70 str/mm^2, contact SCA before analyzing outsides or blanks.~~
~~7. Analyze all samples, including outside samples and blanks.~~
~~8. Do NOT analyze outside or blank samples.~~
~~9. Analyze by TEM only the inside air sample with the highest PCM result.~~
(10) Serial analysis; stop at first positive (>1%); first trace (<0.1%); except sheetrock and plaster samples.
~~11. Analyze all bulk samples, unless otherwise indicated.~~
~~12. PCB: <25 PPM detection limit required. Authorized to perform cleanup to meet the detection limit.~~
13. ______

Report Number:

Invoice Number:

Supplies /Equipment	Qty
Hi-Vol (3040)	
Lo-Vol (3020)	
TEM / Pb cassettes (3520)	
PCM cassettes (3500)	
Bulk sampling supply (3710)	122

RES 337279

SCA ENVIRONMENTAL
5106456200
SCA ENVIRONMENTAL
ONE LAKESIDE DRIVE
OAKLAND CA 94612

1 LBS

1 OF 1

SHIP TO:
REI LAB
LAB ANALYST
SUITE 100
5801 LOGAN STREET
DENVER CO 80216-1308

CO 802 9-10

UPS NEXT DAY AIR SAVER 1P
TRACKING #: 1Z 892 7E7 13 9641 0406

BILLING: P/P

F-11899 11/23/15

Reference#1: DL.3

UIS 17.5.62 WNTNV50 66.0A 07/2015

FOR UPS SHIPPING ONLY

ALSF ANALYTICAL LABS SAN FRANCISCO INC.

POLARIZED LIGHT MICROSCOPY ANALYSIS FOR ASBESTOS CONTENT

Client:	SCA ENVIRONMENTAL, INC. 650 DELANCEY ST. #222 SAN FRANCISCO, CA 94107	Report Number: Date: Analyst: Date Analyzed:	BL21002 DECEMBER 15, 2015 OLGA KIST DECEMBER 15, 2015
Project No.:	F11899	Sample Collector:	DAN LEUNG
Project:	CO OF SM GOVT. CENTER BLDG. SVY	Collection Date:	DECEMBER 10, 2015
Location:	2415 UNIVERSITY AVE., E. PALO ALTO, CA	**0 Sample(s) containing Asbestos**	

6 Sample(s) Analyzed
6 Sample(s) Received 12/10/15 10:00

Sample #	Location / Description	ASBESTOS Type and Range % or NONE DETECTED	NONASBESTOS Other Fibers (%) Balance
1. 2415-STSFP-4-8	OFF-WHITE FIREPROOFING	NONE DETECTED	CELL, GL 20-30, VERMICULITE, GYPSUM, MISC.
2. 2415-STSFP-4-9	OFF-WHITE FIREPROOFING	NONE DETECTED	GL, CELL 20-30, VERMICULITE, GYPSUM, MISC.
3. 2415-STSFP-4-10	OFF-WHITE FIREPROOFING	NONE DETECTED	GL, CELL 20-30, VERMICULITE, GYPSUM, CARB, MISC.
4. 2415-STSFP-4-11	A) OFF-WHITE FIREPROOFING B) BLACK TAR PARTICLES ON SURFACE	NONE DETECTED NONE DETECTED	CELL, GL 30-40, VERMICULITE, GYPSUM, ASPHALT, MISC.
5. 2415-CLSP-24-4	A) WHITE COATING B) WHITE ACOUSTIC TILE	NONE DETECTED NONE DETECTED	GL 70-80, SYN, SILI, CARB, MISC.
6. 2415-CLSP-24-5	A) WHITE COATING B) WHITE ACOUSTIC TILE	NONE DETECTED NONE DETECTED	GL 70-80, SYN, SILI, CARB, MISC.
121415	LABORATORY BLANK (1866 GLASS FIBERS)	NONE DETECTED	

ASBESTOS TYPES
CHRYS: Chrysotile
AMOS: Amosite
CROC: Crocidolite
TREM: Tremolite/Actinolite
ANTH: Anthophyllite

NONASBESTOS
CELL: Cellulose
GL: Fiberglass/Mineral Wool
SYN: Synthetic
CARB: Carbonates
SILI: Mixed Silicates
POLY: Polyethylene
FTALC: Fibrous Talc
FGYP: Fibrous Gypsum
FELD: Feldspar
CASI: Calcium Silicates

Bulk samples analyzed in accordance with "Method for the Determination of Asbestos in Bulk Building Materials" EPA/600/R-93/116, July 1993. The detection limit is 1%. Quantitation of asbestos is by calibrated visual estimation. Analytical Labs San Francisco, Inc. (ALSF) is recognized under the National Laboratory Accreditation Program for satisfactory compliance with criteria established in Title 15, Part 7 code of Federal Regulations and accredited for bulk asbestos fiber analysis (NVLAP lab code: 101909-0). Asbestos fibers less than 0.2 microns cannot be resolved by light microscope. This report must not be reproduced except in full, without the written approval of ALSF and pertains only to the samples analyzed.

AUTHORIZED SIGNATURE _____ DATE 12/16/15

467 Potrero Avenue, San Francisco, CA 94110 (415) 552-4595 FAX 552-0730

BL21002-

SCA Environmental, Inc.

CHAIN OF CUSTODY FORM

650 Delancey St., Ste. 222, San Francisco, CA 94107 — Tel 415-882-1675 — Fax 415-962-0736
1 Lakeside Dr. #215, Oakland, CA 94612 — Tel 510-645-6200 — Fax 415-962-0736

CALL/TXT with results:

Email rpt / COC & invoice: dleung@sca-enviro.com & pgervasio@scaehs.com

Email Prj Mgr Name: Chuck Siu Glenn Cass (Christina Codemo)

Accounting Data:

EMAIL HEADING: CO OF SM GOVT CTR SURVEY

(Project #)	(Project Manager Initials)	(Site Name/Address)	(Date MMDD)
F11899	CC	GOVT CTR BLDG; 2415 UNIVERSITY AVE, E PALO ALTO	12/10

LAB AIGF

COURIER

LAB REP NOTIFIED: — Notification DATE/TIME:
AIRBILL/FLIGHT NO.: — Shipper REFERENCE I.D.
EST ARRIVAL DATE: — EST. ARRIVAL TIME:

Method Reference 7400 PCM AHERA TEM (≤0.005 s/cc Ana Sen) CARB-AHERA TEM 0.001 s/cc Ana Sensitivity (PLM (asbestos)) Flame AA (Lead)

Sample Media 25 37mm 0.45 0.8 micron MCEF (Bulk) Water Wipe

RESULTS DUE: 5 DAYS AM / PM

CHAIN OF CUSTODY DATA:

Sending Info 6 samples submitted by DL (SCA) on 12/10 at 9:50 A
Received by Lab: 6 samples received by OL on 12/10 at 10:00
Received by Analyst: 6 samples received by [illegible] on ✓ at

SAMPLE ID	LITERS	Results	Ins/Blanks/Outs
2415-SMGFP-4-	8,9,10,11	-1,2,3,4	
↓ - CLRP - 24-	4,5	-5,6	
	0 LITERS		BLANK
	0 LITERS		BLANK
	0 LITERS		BLANK

Analysis	< 6 hours			24 hours			48 hours			3 to 6 days			> 6 days		
Units (each)	1 to 9	10 to 40	>40	1 to 9	10 to 40	>40	1 to 9	10 to 40	>40	1 to 9	10 to 40	>40	1 to 9	10 to 40	>40

LEAD: Wipes, Flame AA, Units (each)

ASBESTOS: CARB AHERA 10-15 grid openings, CARB AHERA 38-40 grid openings, TEM AHERA, PLM Std Point Count 400, CARB 435 (400 Pt Ct) w/ prep, PLM Bulk, PCM NIOSH 7400, Units (each)

INSTRUCTIONS TO LAB (delete items not applicable AND circle items applicable):

~~1. Pickup requested:~~
~~Contact:~~
~~Time of Call:~~
~~2. Call SCA's contact to acknowledge receipt of samples.~~
~~3. Analyze samples by PCM only.~~
~~4. Analyze inside samples by PCM first; if any sample >0.01 f/cc, contact SCA.~~
~~5. If all samples are <0.01 f/cc, proceed with items 6, 7 or 8, as noted.~~
~~6. Analyze inside samples only; stop if Avg >70 str/mm^2, contact SCA before analyzing outsides or blanks.~~
~~7. Analyze all samples, including outside samples and blanks.~~
~~8. Do NOT analyze outside or blank samples.~~
~~9. Analyze by TEM only the inside air sample with the highest PCM result.~~
(10) Serial analysis; stop at first positive (>1%); first trace (<0.1%); except sheetrock and plaster samples.
~~11. Analyze all bulk samples, unless otherwise indicated.~~
~~12. PCB: <25 PPM detection limit required. Authorized to perform cleanup to meet the detection limit.~~
13.

Report Number: BL21002-

Invoice Number: BL21002-

Supplies /Equipment	Qty
Hi-Vol (3040)	
Lo-Vol (3020)	
TEM / Pb cassettes (3520)	
PCM cassettes (3500)	
Bulk sampling supply (3710)	6

RESERVOIRS ENVIRONMENTAL, INC

NVLAP Lab Code 101896-0
AIHA Certificate of Accreditation #480 LAB ID 101533

TABLE: I ANALYSIS: LEAD IN BULK

RES Job Number:	**RES 466163-1**
Client:	**SCA Environmental, Inc.**
Client Project/P.O.:	**F13225**
Client Project Description:	**County of San Mateo 2415 University Ave Destructive Sampling**
Date Samples Received:	**June 24, 2020**
Analysis Type:	**REI CHEMISTRY SOP / USEPA SW846 3050B/6020A-M**
Turnaround:	**Standard 3**
Date Samples Analyzed:	**June 26, 2020**

NA = Not Analyzed
NR = Not Received
ND = None Detected
BAS = Below Analytical Sensitivity
BRL = Below Reporting Limit

Client ID Number	Reporting Limit (mg/kg)	LEAD CONCENTRATION (mg/kg)
WLCER-51	0.85	9.8

* Unless otherwise noted all quality control samples performed within specifications established by the laboratory

Ryan Ellerby
Analyst/Data QA

Reservoirs Environmental, Inc.

RES Job #: 466163

SUBMITTED BY	INVOICE TO	CONTACT INFORMATION	SERIES
Company: SCA ENVIRONMENTAL, INC.	Company: SCA ENVIRONMENTAL, INC.	Contact: TUCKER KALMAN	-1 CHEM STANDARD 3
Address: 320 JUSTIN DRIVE	Address: 320 JUSTIN DRIVE	Phone: (415) 723-0962	
		Fax:	
SAN FRANCISCO, CA 94112	SAN FRANCISCO, CA 94112	Cell:	
Project Number and/or P.O. #: F13225		Final Data Deliverable Email Address:	
Project Description/Location: COUNTY OF SAN MATEO 2415 UNIVERSITY AVE DESTRUCTIVE SAMPLING		TKALMAN@SCA-ENVIRO.COM (+ 2 ADDNL. CONTACTS)	

ASBESTOS LABORATORY HOURS: Weekdays: 7am - 7pm & Sat. 8am - 5pm

PLM / PCM / TEM — DTL RUSH PRIORITY STANDARD

CHEMISTRY LABORATORY HOURS: Weekdays: 8am - 5pm

Dust — RUSH PRIORITY STANDARD

Metals — RUSH PRIORITY STANDARD *PRIOR NOTICE REQUIRED FOR SAME DAY TAT

Organics* — SAME DAY RUSH PRIORITY STANDARD

MICROBIOLOGY LABORATORY HOURS: Weekdays: 8am - 5pm

Viable Analysis** — PRIORITY STANDARD

**TAT DEPENDENT ON SPEED OF MICROBIAL GROWTH

Medical Device Analysis — RUSH STANDARD

Mold Analysis — RUSH PRIORITY STANDARD

****Turnaround times establish a laboratory priority, subject to laboratory volume and are not guaranteed. Additional fees apply for afterhours, weekends and holidays.****

Special Instructions:

REQUESTED ANALYSIS

Client Sample ID Number (Sample ID's must be unique)	PLM - Short Report, Long Report, CARB 435	TEM - AHERA, (+/- or Quantified), Microvac (+/- or Quantified), Wipe (+/- or Quantified), NIOSH 7402, Yamate Level II, ISO 10312, ISO 13794, Chatfield, Waste Water, Drinking Water, Bulk +/-, CARB Modified Ahera	PCM - 7400A, 7400B, OSHA	DUST - Total, Respirable	METALS - Analyte(s)	ORGANICS - Methamphetamine, TSS	Viables: Campylobacter, Bacillus, Salmonella (Culturable, 1-2), Listeria, E.coli O157:H7, E.coli/Coliforms - Plated, S. aureus, Yeast & Mold, Areobic Plate Count, Coliforms/E.coli (State Water, Drinking Water, Non-Drinking Water, +/-, Quantification), Lactic Acid, Viable Microbioal Count (wo/ID, w/ID), Enterococcus (+/- or Quantification)	MEDICAL - Bioburden, LAL	MOLD - Spore Trap, Bulk Mold, Particulate Identification	Sample Volume (L) / Area	Length(or Aliquots) x Width(or Area per Aliquot)	Matrix Code	# of Containers	Date Collected mm/dd/yy	Time Collected hh:mm	Laboratory Analysis Instructions
	ASBESTOS			CHEMISTRY			MICROBIOLOGY									
1 WLCER-51					X							B				

VALID MATRIX CODES

Air = A	Bulk = B
Dust = D	Food = F
Paint = P	Soil = S
Surface = SU	Swab = SW
Tape = T	Wipe = W
Drinking Water = DW	
Waste Water = WW	
ASTM E1792 approved wipe media only	

LAB NOTES

REI will analyze incoming samples based on information received and will not be responsible for errors or omissions in calculations resulting from the inaccuracy of original data. By signing, client/company representative agrees that submission of the following samples for requested analysis as indicated on this Chain of Custody shall consitute an analytical services agreement with payment terms of NET 30 days. Failure to comply with payment terms may result in a 1.5% monthly interest surcharge.

Relinquished By:	DAN LEUNG	Date/Time: 06/24/2020 11:19:23	Sample Condition: ACCEPTABLE - INTACT
Received By:	HANNA MARTI	Date/Time: 06/24/2020 11:19:23	Carrier: UPS