


County of San Mateo RFP East Palo Alto City Hall Improvements

ADDENDUM TO REQUEST FOR PROPOSALS – East Palo Alto City Hall Improvements

	ADDENDUM No. 03
	San Mateo County 555 Government Center, Fifth Floor Redwood City, CA 94063
	RFP: East Palo Alto City Hall Improvements
	Date: October 24, 2022

INTENT:

This Addendum is issued by the County of San Mateo to provide for answers to questions on the East Palo Alto City Hall Improvements project that were submitted before October 17th, 2022 at 5pm. Proposers shall ascertain prior to submitting its Proposal that it has received all addenda issued. Please clearly note the addendum date and number on your proposal.

In the event of a conflict between the terms and provisions of this Addendum and the terms and provisions of the RFP for East Palo Alto City Hall Improvements, the terms and provisions of this Addendum shall control. In all other respects, the RFP for East Palo Alto City Hall Improvements shall remain unchanged and in full force and effect.

Response to Questions:

1. Answers to all submitted questions are listed in Request For Information Log Spreadsheet.
2. Section 00 01 10 Table of Contents, Section 07 51 13.13 Built-Up Asphalt Roofing, Cold-Applied, and 11 24 29.01 Facility Fall Protection replaced with updated documents.
3. Attached electrical memorandum listing updates to electrical drawings and specifications.
4. Updated A5.01 and A9.01 drawings sheets attached in response to submitted questions.
5. Requested Drawings that were available have been uploaded.

Uploaded Documents:

1. Appendix C 1975 As-Built Sprinkler Drawings
2. Appendix D 2022 Backflow Preventor Drawings

Initial and Date: _____

RFI No.	Drawing Sheet or Spec Section	Description	Remarks
1	00 11 16 NOTICE TO CONTRACTORS	Page 3 of 6 6th paragraph scope states elevator cab replacement should be refurbishment	Specifications updated
2	Details A3.02 / Specifications	Would concealed Fastener 22 ga GSM Morin F-12 panel or 0.040 Aluminum standard finish be acceptable.	Either concealed fastener metal panels would be acceptable
3	07 51 13.13 BUR Roofing	What is the composition and thickness of the roofing material that is to be removed on this project.	The overall buildup is unknown. The as built documents specify Built-Up-Roofing over 2-1/2" Vermiculite Concrete fill on 1-1/2" metal Deck.
4	E5.01	E5.01 requires we provide new circuit breakers inside the existing MSB & MCCA. What manufacturer are the existing MSB & MCCA?	MSB & MCCA are both GE Equipment
5	26 61 13 Fire Alarm System	Have specifications updated to reflect that Fire Alarm System is a sole source product/vendor by Siemens Industry, Inc.	Specifications have been updated
6	07 51 13.13 BUR Roofing	Tremco, Inc or approved equal. Does the County have alternate products that they would like to list?	Tremco is the County's Roofing Standard; no alternative products should be considered
7	Sprinklers 21 00 00	Are sectional waterflow and tampers going to be required for every floor or is it just going to be the 1 st Floor Sprinkler Riser Room?	First Floor Only. Building size does not require more than one zone
8	Sprinklers 21 00 00	Manual pull stations required they are on the riser diagram but not show on floor plan?	Manual pulls are required at all exits and at stair entrances on the upper floors. Refer to revised Addendum plans.
9	Sprinklers 21 00 00	Will ERRCS' be required?	Contractor to include the test
10		Two way communication system be required?	Yes, it is included
11	Sprinklers 21 00 00	Will the top of the elevator shaft be sprinkled?	Yes per spec 210000 paragraph 1.01F.
12	Sprinklers 21 00 00	Is it Plans and Spec or Design build?	The fire sprinkler system is design/build
13	Terrazzo Base	I cannot find any details regarding the base in Lobby 100. Please let me know if you'd like us to include terrazzo base.	Entrance Lobby 100 to receive Resilient Wall Base. Detail 11/A5.01 added for floor detail, see specifications 09 65 13
14		The specs note a cove base, yet I am unable to find any Details that would give us more information on this base	Detail 11/A5.01 added for floor detail.
15	A6.01 Elevator Cab Flooring	A6.01 detail #7- Elevator Cab Demo Plan calls for removal of cab floor finish. Let me know if I should include terrazzo there as well	Elevator floor to receive new VCT finish, color to be determined
16	A1.10 Phasing Modular	Sheet A1.10 depicts the layout of the temporary building required for Phases 1 thru 3. Willscot who is a supplier for construction trailers indicated that they have a 48x60 trailer available and would be able to modify the interior office walls, but they cannot modify or relocate the restrooms. Also, the restrooms would not have direct access to the outside thus would only be accessible from the interior. Would the proposed floor plan be acceptable (see attached)?	Temporary Structure is required for this project and should be included in the bid Moves for phasing are not in contract
17	Existing Utilities for Modular	Are there existing site utility drawings available to aid in the tie-ins of the sewer and domestic water to the temporary building location?	No current existing site utility drawings are available. Moves for phasing are not in contract

RFI No.	Drawing Sheet or Spec Section	Description	Remarks
18	A2.12/A9.01 Flooring Scope Clarification	Is the Staff Room (128) and Work Room (126) in Library Building to receive new carpet. Floor plan Sheet A2.12 shows new carpet to be installed at these areas, but the schedule on Sheet A9.01 indicates that floor is existing.	Schedule on Sheet A9.01 has been updated to include new carpet in Staff Room 128 and Work Room 126
19	A2.15 Flooring Scope Clarification	Level 3 Floor Plan West, Sheet A2.15, there appears to be no new flooring required for Storage Room (321), but Sheet A9.01 Schedule indicates new carpet to be installed. Please advise which is correct.	The flooring for Storage Room (321) on the Finish Schedule on Sheet A9.01 has been updated to remain as existing finish
20	A2.41 ACT Clarification	Sheet A2.41 shows the ACT grid in Community Room 125 to be removed, but the schedule on Sheet A9.01 indicates the grid type to be "existing 2x2. Please advise which is correct.	Ceiling designation for Community Room 125 on Finish Schedule Sheet A9.01 has been revised to indicate new 2x4 ceiling grid. Layout as shown on sheet A2.51
21	A9.01 Ceiling Notes	1. On Schedules Sheet A9.01, cannot find the legend of where the "Ceiling Notes" column refers to. There are Types A thru D. Please advise where to find information on what these notes mean?	Ceiling Notes' Column has been removed from the schedule
22	Sprinklers 21 00 00	In areas where the existing ceiling is to remain but fixtures are being updated, shall Fire Sprinkler heads be replaced?	As per NAPA 13, If the sprinklers are not removed and damaged, the sprinkle head shall not be replaced. New sprinkler head shall be provided if sprinkler head location is modified. In other notes as per NFPA 13, reconditioned sprinkler head shall not be permitted to be utilized on any new or existing system. When a sprinkler has been removed for any reason, it shall not be reinstalled. any damage to the protective coating occurring at the time of installation shall be replaced at ones using only the coating of the manufacturer of the sprinkler in the approved manner so that no part of the sprinkler will be exposed after installation has been completed.
23	Sprinklers 21 00 00	Please provide any and all as-built drawings of the existing fire sprinkler system to facilitate hydraulic calculations.	As-Built sprinkler drawings from 1975 are included as Appendix C in the project manual
24	Sprinklers 21 00 00	Please provide plans for the new fire service line and backflow preventer currently being installed.	See Appendix D in the project manual
25	Sprinklers 21 00 00	In areas where the ceiling is being replaced but there are other features in the room with fire sprinkler heads, such as the closets along the west wall of Community/Multipurpose Room 125, shall the fire	Fire sprinkler heads to be updated where noted or as required.
26	Sprinklers 21 00 00	During the job walk there did not appear to be individual floor control valves for the fire sprinkler system. Are any of the other concurrent projects adding floor controls to the system?	Based on our field survey we believe that inside the building there is only one water flow switch for the entire building within the first floor ceiling space near Stair #392 (east side) that will need to be picked up by the fire alarm system. Unfortunately we were unable to locate this single water flow switch. The total ft2 for the project is less than 52,000 ft2 and that is why we did not see any water flow switches or supervisory switches on levels 2 & 3. NFPA 13 ft2 limits a single zone not to exceed 52,000 ft2 so we believe that the existing entire building was installed as a single zone.
27		In areas where work will be performed over or around existing finishes which are to remain, who will be responsible for protecting the existing finishes?	General Contractor to provide protection for all finishes and furniture not scheduled to be replaced.
28		In areas with existing furniture that is to remain, will the furniture be temporarily removed to allow work? If so by who? If not, who is responsible for protection?	The existing furniture will not be removed. General Contractor to provide protection for all finishes and furniture not scheduled to be replaced.

RFI No.	Drawing Sheet or Spec Section	Description	Remarks
29	Sprinklers 21 00 00	Since the current system layout does not have isolation valves or floor control valves, in order to perform fire sprinkler work any where in the building, the entire buildings fire sprinklers will need to be shut down. This will require fire watch for the whole building at those times, who will be responsible for fire watch?	Refer to Spec S210000 Section 1.15 for fire protection system shutdown requirements. Contractor to include line item costs for the inclusion of Fire Watch Protection while system is shut down
30	Sprinklers 21 00 00	Section 21 00 00 - 2.03 C/D indicates that fire sprinkler escutcheons and concealed cover plates should match ceiling color. Will custom color equipment be required or will standard colors (white / black /	Standard colors will be sufficient
31	Floor Plans A2.11-A2.16	On the Floor plan sheets along gridlines 1&7 on Levels 1 thru 3, there are areas where it is required to fill in and patch. Is there a detail that shows what to infill the existing wall with as well show what finish material is on interior/exterior sides?	Contractor to provide assembly to coordinate with existing construction. New finishes to match interior finishes as closely as possible
32	Sheet 2.17 Roof Plan	Penthouse West there appears to be a portion of roofwalk that runs under the new mechanical equipment which then 90's down to the pipes. Is this correct?	There is no roofwalk under the proposed mechanical equipment. There is an elevated raceway that runs under the proposed mechanical equipment and steel structure. These items are required to remain during and after construction.



MEMORANDUM

TO: **LARS NILSSON**
FROM: **K.C. HOGAN**
DATE: **10/21/2022**
PROJECT: **EPA GOVERNEMENT CENTER**
SUBJECT: **ADDENDUM #3 ELECTRICAL NARRATIVE**
PROJECT NO.: **20035**

Lars,

Electrical narrative for Addendum #3 is below:

DWG	DESCRIPTION
E001	Removed reference to E101 – Electrical Site Plan from sheet index.
E002	Added general notes for Two-way Communication system and ERRCS Sys scope of work. Added circuit to Panel 1RB for Two-Way Communication System head-end equipment.
E101	Removed sheet from set. The temporary modular is no longer in the scope of work.
E401	Added pull stations to the plan. Changed location of FACP to the ground floor. Added Two-Way Communication system to the plan.
E402	Added pull stations to the plan. Added Two-Way Communication system to the plan.
E403	Added pull stations to the plan. Changed the FACP to a FATC cabinet. Added Two-Way Communication system to the plan.
E501	Removed scope for temporary electrical feed to modular building. Modular building is no longer part of scope of work.
E502	Update FA riser to show FACP on the ground floor and FATC on the 3 rd .
E603	Added Two-Way Communication system block diagram

SPECIFICATIONS	DESCRIPTION
266113	Changed fire alarm system manufacture to Siemens as sole source.
266226	Added Two-Way Communication specification section.
266316	Added ERRCS DAS system specification section.

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Appendix B	Hazardous Material Report
Appendix C	1975 As-Built Sprinkler Drawings
Appendix D	Backflow Preventor Drawings

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SECTION 075113.13**BUILT-UP ASPHALT ROOFING, COLD-APPLIED****PART 1 - GENERAL****1.1 SUMMARY****A. Section Includes:**

1. Cold-applied, hybrid, built-up asphalt roofing system on lightweight insulating concrete over metal deck, including but not limited to:
 - a. Base sheet.
 - b. Roofing membrane ply sheets.
 - c. Roofing membrane cap sheet.
 - d. Base flashings.
 - e. Roof surfacing consisting of surfacer with aggregate surfacing.
 - f. Walkway material.

1.2 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.

1.3 PREINSTALLATION MEETINGS**A. Preinstallation Roofing Conference: Conduct conference at Project site.**

1. Meet with Owner, Architect, 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. Examine substrate conditions and finishes for compliance with requirements, including flatness and fastening.

6. Review structural loading limitations of roof deck during and after roofing.
7. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect roofing.
8. Review governing regulations and requirements for insurance and certificates if applicable.
9. Review temporary protection requirements for roofing during and after installation.
10. Review roof observation and repair procedures after roofing installation.

1.4 ACTION 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.
 - a. Indicate that details meet requirements of this Section.
 2. Membrane fastening or adhesion requirements.

1.5 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.
 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. Warranties: Unexecuted sample copies of special warranties.
- D. 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.
 1. Submit reports within 48 hours after inspection.

1.6 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, Architect, 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. Approval of Comparable Products: Submit the following in accordance with project substitution requirements, within time allowed for substitution review:
 - 1. Product data, including certified independent test data indicating compliance with requirements.
 - 2. Samples of each component.
 - 3. Sample submittal from similar project.
 - 4. Project references: Minimum of five installations of specified products not less than five years old, with Owner and Architect/Owner's Consultant contact information.
 - 5. Sample warranty.
 - 6. Substitutions following award of contract are not allowed except as stipulated in Division 01 General Requirements.
- D. 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.
 - 2. An independent party certified as a Registered Roof Observer by the International Institute of Building Enclosure Consultants (formerly the Roof Consultants Institute) retained by the Contractor or the Manufacturer and approved by the Manufacturer.
- E. Manufacturer's Installation Instructions: Obtain and maintain on-site manufacturer's written recommendations and instructions for installation of products.

1.7 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.
- 1.8 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.

1.9 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 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.
 2. Scope of Warranty: Work of this Section.
 3. Warranty Period: 2 years from date of completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Approved: Subject to compliance with requirements, provide products by one of the following:.
1. Tremco CPG Inc.
 2. Manufacturer of comparable products: Approved by Architect prior to bid.
- B. Source Limitations: Obtain components for roofing system from same manufacturer as membrane roofing or manufacturer approved by membrane roofing manufacturer.

2.2 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: Comply with fire-resistance-rated assembly designs indicated.
1. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.
 2. Identify products with appropriate markings of applicable 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.
- E. Energy Performance: Roofing system shall have an initial solar reflectance index of not less than 0.70 and an emissivity of not less than 0.75 when tested according to CRRC-1.

2.3 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.

2.4 BASE SHEET MATERIALS

- A. Sheathing Paper: Red-rosin type, minimum 3 lb./100 sq. ft. (0.16 kg/sq. m).
- B. Base 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 (25 deg. C), minimum, ASTM D5147: Machine direction, 165 lbf/in (725 N); Cross machine direction, 150 lbf/in (660 N).
 - c. Tear Strength at 77 deg. F (25 deg. C), minimum, ASTM D5147: Machine direction, 260 lbf (1150 N); Cross machine direction, 230 lbf (1120 N).
 - d. Thickness, minimum, ASTM D5147: 0.060 inch (1.5 mm).

2.5 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 (25 deg. C), minimum, ASTM D5147: Machine direction, 165 lbf/in (725 N); Cross machine direction, 150 lbf/in (660 N).
 - c. Tear Strength at 77 deg. F (25 deg. C), minimum, ASTM D5147: Machine direction, 260 lbf (1150 N); Cross machine direction, 230 lbf (1120 N).
 - d. Thickness, minimum, ASTM D5147: 0.060 inch (1.5 mm).
- 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 (25 deg. C), minimum, ASTM D5147: Machine direction 80 lbf/in (14 kN/m); Cross machine direction 75 lbf/in (13 kN/m).
 - d. Tear Strength at 77 deg. F (25 deg. C), minimum, ASTM D5147: Machine direction, 100 lbf (460 N); Cross machine direction 108 lbf (480 N).
 - e. Elongation at 77 deg. F (25 deg. C), minimum, ASTM D5147: Machine direction 7 percent; Cross machine direction 8 percent.
 - f. Low Temperature Flex, maximum, ASTM D5147: -15 deg. F (-26 deg. C).
 - g. Thickness, minimum, ASTM D5147: 0.120 inch (3.0 mm).
- 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 (25 deg. C), minimum, ASTM D5147: Machine direction, 165 lbf/in (725 N); Cross machine direction, 150 lbf/in (660 N).
 - c. Tear Strength at 77 deg. F (25 deg. C), minimum, ASTM D5147: Machine direction, 260 lbf (1150 N); Cross machine direction, 230 lbf (1120 N).
 - d. Thickness, minimum, ASTM D5147: 0.060 inch (1.5 mm).
- 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 (25 deg. C), minimum, ASTM D5147: Machine direction 130 lbf/in (22 kN/m); Cross machine direction 110 lbf/in (19 kN/m).
 - c. Tear Strength at 77 deg. F (25 deg. C), minimum, ASTM D5147: Machine direction, 160 lbf (710 N); Cross machine direction 140 lbf (620 N).
 - d. Elongation at 77 deg. F (25 deg. C), minimum, ASTM D5147: Machine direction 55 percent; Cross machine direction 60 percent.
 - e. Low Temperature Flex, maximum, ASTM D5147: -40 deg. F (-40 deg. C).
 - f. Thickness, minimum, ASTM D5147: 0.150 inch (3.8 mm) .

2.6 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 shall comply with the following limits for VOC content:
 - 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.
 3. Adhesives and sealants shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- 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 Standard 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 (38 deg C).
- 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. (3 mm).
- F. Flashing 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. (3 mm).
- 2.7 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 (285 N); fill, 75 lbf/in (310 N).
 - c. Color: Aqua green.
 - C. Asphalt Roofing Cement / Mastic:

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. (3 mm).
 - D. 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 (2410 kPa).
 - f. Color: White.
 - E. 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.
 1. Base Sheet Fasteners: Tremco or Manufacturer's approved for use by Tremco..
 - F. Metal Flashing Sheet: Metal flashing sheet is specified in Division 07 62 00
 - G. Miscellaneous Accessories: Provide miscellaneous accessories recommended by built-up roofing manufacturer.
- 2.8 ROOF INSULATION ACCESSORIES
- A. Insulation Cant Strips: ASTM C208, Type II, Grade 1, cellulosic-fiber insulation board.
 - B. Tapered Edge Strips: ASTM C208, Type II, Grade 1, cellulosic-fiber insulation board.

2.9 SURFACING

A. Cold-Applied Adhesive Surfacers:

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 Roofing: Highly reflective white marble aggregate, graded up to 3/8 inch (9 mm) diameter, meeting sustainable design requirements for SRI when applied in conjunction with manufacturer's specially formulated adhesive.
 - a. Basis of design product: Tremco/#1 White Marble Roofing Aggregate.
 - b. Hardness: 3.5 Mohs minimum.
 - c. Specific gravity: 2.86.
 - d. Color: White.
 - e. Solar Reflectance Index (SRI), adhesive plus gravel, ASTM E1980: 81.
 - f. Aggregate application rate, average: 225 lb/100 sq ft.

C. Acrylic Emulsion Flashing Coating Material:

1. Acrylic Coating: Highly-reflective water-based low-odor and low-VOC semi-gloss coating formulated with flouropolymer resin for use as a finish coat over water-based acrylic roof and wall coatings and other approved substrates.
 - a. Basis of design product: Tremco, T24 Coating.
 - b. Volatile Organic Content (VOC) maximum, ASTM D3960: 50 g/L.
 - c. Gloss at 60 deg, (white) ASTM D523: 60 percent.
 - d. Solar Reflectance, ASTM C1549: 88 percent initial; 82 percent 3-year aged.
 - e. Thermal Emittance: 0.89 initial; 0.86 3-year aged.
 - f. Solar Reflectance Index (SRI), ASTM E1980: 111 initial; 102 3-year aged.
 - g. Application rate: Flashing surfaces @ 1.5 gal/sq/coat; 2 coat min..

2.10 WALKWAYS

A. Walkway Material:

1. Walkway pads, ceramic-granule-surfaced reinforced asphaltic composition slip-resisting pads, manufactured as a traffic pad for foot traffic, 1/2 inch (13 mm) thick minimum.
 - a. Basis of design product: Tremco, Trem-Tred.
 - b. Flexural Strength at max. load, minimum, ASTM C203: 218 psi (1.5 kPa).
 - c. Granule adhesion (weight loss), maximum, ASTM D4977: 1.1 gram.
 - d. Impact Resistance at 77 deg. F (25 deg. C), ASTM D3746: No Damage to Roof.
 - e. Pad Size: 36 by 48 inch (914 by 1220 mm).

PART 3 - EXECUTION

3.1 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. Verify that, blocking, curbs, and nailers are securely anchored to roof deck at penetrations and terminations and that nailers match thicknesses of insulation. wood cants
 3. Existing Prepared Roof Substrate: Verify that existing insulation and substrate is sound and dry. Refer to requirements of Division 07 Section "Preparation for Re-Roofing."
 4. Lightweight Insulating Concrete: Verify that deck is securely fastened with no projecting fasteners and with no adjacent units in excess of 1/16 inch (1.6 mm) 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.

3.2 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.

3.3 INSTALLATION, GENERAL

- A. Install roofing system in accordance with manufacturer's written instructions, approved shop drawings, and Contract Documents.

3.4 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.

3.5 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. Base-Ply Sheet: One.
 - a. Adhering Method: Mechanically-fastened.
2. Number of Ply Sheets: Two.
 - a. Adhering Method: Cold-applied adhesive.
3. Mineral-granule-surfaced cap sheet in addition to number of ply sheets specified.
 - a. Adhering Method: Cold-applied adhesive.
4. 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 to cover exposed roofing membrane sheets and insulation with a course of coated felt set in compatible roofing cement/mastic, with joints and edges sealed.
 - a. Comply with roofing membrane manufacturer's instructions and details for waterstop/daily tie-in; utilize staggered layout and unadhered, removable "deadman" insulation boards.
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.

3.6 ROOFING MEMBRANE INSTALLATION

- A. Install lapped base-ply sheet according to roofing manufacturer's written instructions, starting at low point of roofing system. Extend roofing membrane sheets over and terminate beyond cants, installing as follows:
1. Fasten to substrate with approved base sheet fasteners and per roofing manufacturer's guidelines.
- B. 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.
- C. 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 cold-applied ply sheet adhesive applied at rate required by roofing manufacturer, to form a uniform membrane without ply sheets touching.

3.7 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 (300 mm) above built-up roofing and 6 inches (150 mm) onto field of built-up roofing.
 2. Prime substrates with asphalt primer if required by built-up roofing manufacturer.
 3. Backer Sheet Application: Mechanically fasten backer sheet to walls or parapets.
 - a. Adhere backer sheet over built-up roofing at cants in cold-applied flashing sheet adhesive.
 4. Backer Sheet Application: Adhere backer sheet to substrate in cold-applied flashing sheet adhesive. Extend backer sheet up and over parapet walls.

5. 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. Heat weld vertical laps in flashing sheet.
 - 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 metal termination bar and a continuous bead of joint sealant.
 - 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. Flashing-Sheet Stripping: Install flashing-sheet stripping in a continuous coating of compatible mastic/adhesive sealer, as recommended by roofing manufacturer, and extend onto roofing membrane. Apply number of courses recommended by manufacturer.
- D. Roof Drains: Set 30-by-30-inch (760-by-760-mm) metal flashing in bed of compatible mastic/adhesive sealer on completed built-up roofing. Cover metal flashing with built-up roofing cap sheet stripping and extend a minimum of 6 inches (150 mm) 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.

3.8 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.
- B. Acrylic Emulsion Coating:
 1. Apply acrylic emulsion coating to prepared base flashings, with number of coats, thickness of application, and application method as recommended in writing by coating manufacturer.

3.9 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 manufacturer's recommended, compatible adhesive.
- 3.10 FIELD QUALITY CONTROL
- A. Roofing Inspector: Contractor shall engage a qualified roofing inspector to perform roof tests and inspections and to prepare test reports.
 1. 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."
 - B. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation at commencement and upon completion.
 1. Notify Architect and Owner 48 hours in advance of date and time of inspection.
 - C. 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.
- 3.11 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 Architect and Owner.

- 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 075113.13

SECTION 112429.01**FACILITY FALL PROTECTION****PART 1 - GENERAL****1.1 SECTION INCLUDES**

- A. Fall protection systems, including:
 - 1. Roof edge rail systems, portable, non-penetrating.
 - 2. Crossover stairs
- B. Related Sections:
 - 1. Division 07 Section 07 51 13 "Cold Applied Built Up Roofing"

1.2 REFERENCES

- A. General: Applicable edition of references cited in this Section is current edition published on date of issue of Project specifications, unless otherwise required by building code in force.
- B. American National Standards Institute (ANSI), www.ansi.org.
 - 1. A 21.1 - Safety Requirements for Floor and Wall Openings, Railings and Toe Boards.
 - 2. A 58.1 - Minimum Design Loads in Buildings and Other Structures.
 - 3. A 117.1 - Accessible and Usable Buildings and Facilities.
- C. Code of Federal Regulations (CFR):
 - 1. 29 CFR 1910.29 - Fall protection systems and falling object protection-criteria and practices.
- D. California Occupational Safety & Health Administration (CAL OSHA):
 - 1. 1620 - Design of Temporary Railing.
 - 2. 1621 - Railings and Toe Boards.
 - 3. 1633 - Elevator Shafts to be Guarded.
 - 4. 3209 - Standard Guardrails.
 - 5. 3210 - Guardrails at Elevated Locations.
 - 6. 3211 - Wall Openings.
 - 7. 3212 - Floor Openings, Floor Holes and Roofs.

8. 3213 - Service Pits and Yard Surface Openings.
 9. 3214 - Stair Rails and Handrails.
- 1.3 COORDINATION
- A. Coordinate layout and location of facility fall protection with Owner and Architect.
- 1.4 ACTION SUBMITTALS
- A. Product Data: For each type of fall protection and accessory, including brackets and fasteners.
 1. Submit manufacturer's published literature including structural design data, structural properties data, grating load/deflection tables, corrosion resistance tables, certificates of compliance, test reports as applicable, concrete anchor systems and their allowable load tables, and design calculations for systems not sized or designed in the contract documents.
 - B. Shop Drawings: Show locations and layout of fall protection components; include dimensioned plans, elevations, sections, and details of installation.
 - C. Samples for Verification: Not less than 6 inches (150 mm) long, of each component in finish indicated.
- 1.5 CLOSEOUT SUBMITTALS
- A. Operation and maintenance data.
- 1.6 QUALITY ASSURANCE
- A. 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.
 - B. 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 329; and, where required by authorities having jurisdiction, that is acceptable to authorities.
- 1.7 PRODUCT DELIVERY AND STORAGE
- A. Deliver manufactured materials in original, unbroken pallets, packages, containers, or bundles bearing the label of the manufacturer. Adhesives, resins and their catalysts and hardeners shall be crated or boxed separately and noted as such to facilitate their movement to a dry indoor storage facility.
 - B. Store and handle materials carefully to prevent abrasion, cracking, chipping, twisting, other deformations, and other types of damage.
 1. Store adhesives, resins and their catalysts in dry indoor storage facilities, between 70- and 85-degrees F (21 to 29 degrees C) until they are required for use.

1.8 WARRANTY

- A. Manufacturer's Warranty: Manufacturer agrees to repair or replace components that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: Twenty (20) years from date of substantial completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Occupational Safety and Health Standards: Provide fall protection components complying with requirements of 29 CFR 1910.23 and 29 CFR 1910.29, including structural performance.
- B. Structural Performance: Railings, including attachment to building construction, shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
 - 1. Handrails and Top Rails of Guards:
 - a. Uniform load of 50 lbf/ ft. (0.73 kN/m) applied in any direction.
 - b. Concentrated load of 200 lbf (0.89 kN) applied in any direction.
 - c. Uniform and concentrated loads need not be assumed to act concurrently.
 - 2. Bottom/Mid Rails of Guards:
 - a. Concentrated load of 50 lbf (0.22 kN) applied horizontally on an area of 1 sq. ft. (0.093 sq. m).

2.2 MANUFACTURERS

- A. Basis-of-Design Manufacturer/Products: Subject to compliance with requirements, provide listed products of Tremco / Fibergrate Composite Structures, Provide specified products.
 - 1. Manufacturer of comparable products, approved by the Architect.
- B. Single Source: Provide fall protection components from a single manufacturer through a single source, unless otherwise indicated.

2.3 ROOF GUARDRAIL SYSTEMS – PORTABLE, NON-PENETRATING

- A. Roof Edge Guardrail Systems: Fall protection safety railing components including pipe or tubing, fittings, and accessories complying with requirements of authorities having jurisdiction.
 - 1. Application: Guardrail system for low slope roofs up to 5 deg. slope, including:
 - a. Roof edge guardrail.
 - b. Roof hatch guardrail with gate.

- c. Skylight guardrail.
2. Basis of Design Product: Fibergrate, Dynaround RG Fiberglass Roof Guardrail System. Slimline
3. System Description: Non-penetrating roof guardrail system having a minimum finished height of 42 inches (1067 mm) with a mid-rail installed at 21 inches (533 mm) above the walking surface; including posts, rails, fittings, and counterweights; and having the following characteristics:
 - a. Fiberglass Reinforcement: Continuous roving, continuous strand mat, and surfacing veil.
 - b. Resin: Fire retardant vinyl ester.
 - c. Flexural Strength (Full Section): 70,000 psi (482 MPa).
 - d. Flame Spread: ASTM E 84; 25 or less.
 - e. Color: Gray, with UV resistant coating.
4. Post Base and Roof Ballasts: Galvanized cast iron, supplied with a rubber anti-skid surface on surface to be in contact with roof.
 - a. Dynaround Slimline Base: Circular base with a diameter of 24.5 inches (622 mm), with four sockets for the installation of posts and slots for the installation of lock pins; 90 degrees of rotational adjustment for the posts.
5. Miscellaneous Fittings: Galvanized cast iron with and feature 9/16-inch (14 mm) diameter socket head set screws for clamping to the FRP round tube pipes, posts, rails and outriggers.

2.4 ROOF CROSSOVER STAIRS

- A. FRP crossover stairs with safety railing components including pipe, fittings, and accessories corresponding to design indicated on Drawings and complying with requirements of authorities having jurisdiction.
 1. Basis of Design Product: Tremco / Fibergrate, FRP Crossover Stair.
 2. System Description: Pre-engineered FRP crossover stair with integral guardrail, handrail and molded grating stairs and platform.
 - a. Fiberglass Reinforcement: Continuous roving, continuous strand mat, and surfacing veil.
 - b. Resin: Fire retardant vinyl ester.
 - c. Flexural Strength (Full Section): 70,000 psi (482 MPa).
 - d. Flame Spread: ASTM E 84; 25 or less.

- e. Color: Gray, with UV resistant coating.
 - 3. Mounting: Ballasted or Curb Mounted
 - B. Miscellaneous Fittings: Galvanized cast iron with and feature 9/16-inch (14 mm) diameter socket head set screws for clamping to the FRP round tube pipes, posts, rails and outriggers.
- 2.5 FITTINGS AND FASTENERS
- A. General: Provide Type 304 or Type 305 stainless-steel fasteners.
 - B. Fittings: Malleable cast iron, ASTM A 47, galvanized according to ASTM A 153.
- 2.6 FABRICATION
- A. Cut and drill FRP and metal shapes cleanly and accurately. Remove burrs and ease edges. Remove sharp or rough areas on exposed surfaces.
 - B. Nonwelded Connections: Connect members with concealed mechanical fasteners and fittings. Fabricate members and fittings to produce flush, smooth, rigid, hairline joints.
 - C. Form changes in direction by inserting prefabricated elbow fittings.
 - D. Close exposed ends of railing members with prefabricated end fittings.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions, and other conditions affecting performance of the Work.
- B. Verify that roof assembly is sound, dry, smooth, clean, sloped for drainage, securely anchored and ready for placement of fall protection.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install fall protection to comply with requirements of 29 CFR 1910.29 and authorities having jurisdiction.
- B. Set fall protection components accurately in location, alignment, and elevation; measured from established lines and levels and free of rack.
 - 1. Do not weld, cut, or abrade surfaces of components that are coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.
 - 2. Set components plumb within a tolerance of 1/8 inch in 3 feet (4 mm in 1 m).

3. Align horizontal members so variations from level for horizontal members and variations from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch in 12 feet (6 mm in 3.5 m).
 - C. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.
- 3.3 FIELD QUALITY CONTROL
- A. Testing Agency:
 1. Owner may engage a qualified testing agency to perform tests and inspections and to prepare test reports. Payment for these services will be made by Owner.
 2. Engage a qualified testing agency to perform tests and inspections and to prepare test reports.
 - B. Extent and Testing Methodology: Testing agency will randomly select completed railing assemblies for testing that are representative of different railing designs and conditions in the completed Work. Test railings according to ASTM E 894 and ASTM E 935 for compliance with performance requirements.
 - C. Remove and replace railings where test results indicate that they do not comply with specified requirements unless they can be repaired in a manner satisfactory to Architect and comply with specified requirements.
 - D. Perform additional testing and inspecting, at Contractor's expense, to determine compliance of replaced or additional work with specified requirements.
- 3.4 ADJUSTING AND CLEANING
- A. Clean exposed surfaces according to manufacturer's written instructions.
 - B. Replace components that have been damaged or that cannot be successfully repaired by finish touchup or similar minor repair procedures.

END OF SECTION 112429.01

SECTION 260010

BASIC ELECTRICAL REQUIREMENTS

PART 1 - GENERAL

1.01 SUMMARY

A. Table of Contents, Division 26 - Electrical:

<u>SECTION NO.</u>	<u>SECTION TITLE</u>
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
<u>266226</u>	<u>TWO-WAY COMMUNICATION SYSTEM</u>
<u>266316</u>	<u>DISTRIBUTED ANTENNA SYSTEM FOR ERRCS</u>

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 $I_p=1.5$. 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.

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2. Two-way Communication System, Section 266216.4.3. Distributed Antenna System for ERRCS, Section 266316.

- 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.
 - b. Two-Way Communication system.
 - a-c. Distributed Antenna System for ERRCS.
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 reproduces.

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	

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
Magnetic Door Hold Open/Release	08	08	26	26	26	26	3
Door Closures	08	08	08	26	26	26	4
Fire/Smoke Dampers:							
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

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
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
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

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
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	
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	

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
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.

MATRIX REMARKS	
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.
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.

MATRIX REMARKS	
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 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 sole source 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.~~

~~4.1.~~ 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 contaminants 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 1-1/2" 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 1-1/2" 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 1-1/2" 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 1-1/2" 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

SECTION 266226

TWO-WAY COMMUNICATION 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. Two-way communication system
- 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 SYSTEM DESCRIPTION

- A. Digital two-way communication system designed for ADA (Americans with Disabilities Act) requirements. This work shall include a main control panel, an internal modem, optional proprietary field switches for systems over 8 zones, remote call stations, power supply(s), outlet boxes, cables, and wiring.
- B. The control panel shall be provided at the fire command center FCC or guard station, as authorized by the fire department, to include indicating lights and tone signals from multiple remote call stations and allow voice communication between panel and individual stations.
 - 1. When the system is operational, a LED signals power is "on."
 - 2. When the remote call station switch is activated, a tone is sounded at the call station and a LED is lit. The call is displayed digitally on the control panel with a display of the call and its location on a 40-character LCD four-line display, and a tone is sounded.
 - 3. When the alarm signal is answered by the control panel, the remote call station is signaled by the LED flashing that voice communication is initiated.
 - 4. Voice communication with the remote call station can then be initiated from the control panel via a handset.
 - 5. External modem connection to a public telephone system shall be provided after a programmable time delay.
 - 6. The system shall poll (supervise) all the call stations, control panels and field switches on a continuous basis at least every 200-seconds to identify line faults and defective equipment. Faults will be alerted and displayed at the control panel(s).

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. Shop Drawings to include:
 - a. Plan drawings with equipment layout, profiles, and product components
 - b. Include anchorage and accessories.
 - c. Provide cabling diagrams, wiring diagrams, station installation details, and equipment cabinet details.
 3. Furnish structural calculations for equipment anchorage as described in Section 260010: Basic Electrical Requirements.
 4. Submit Manufacturer's installation instructions.
 5. Complete Bill of Material listing all components.
 6. Final test results.
 7. Warranty.
- B. Dimensions and configurations of equipment shall conform to the space allocated on the Drawings. The Contractor shall submit a revised layout if equipment furnished varies in size from that indicated on Drawings for the Engineer's approval.
- 1.04 OPERATION AND MAINTENANCE MANUALS
- 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. Pictorial and schematic Electrical Drawings of wiring systems, including operating and safety devices, control panels, instrumentation, and annunciators.
 5. Telephone numbers for the authorized parts and service distributors.
 6. Include all service bulletins and torque Specifications for all terminations.
 7. Final testing report.
- 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: Equipment 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. Components shall be properly packaged in factory-fabricated containers and mounted on shipping skids.

- 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.

1.08 SYSTEM START-UP

- A. Upon completion of installation, a factory trained service technician shall perform initial start-up of the equipment. Sufficient time shall be allowed to properly check the system out and perform required minor adjustments before the Engineer's witnessed test shall begin.

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. Cornell Communications, Inc., 4800 series.
- B. Substitutions: Under provisions of Section 260010: Basic Electrical Requirements.

2.02 EQUIPMENT

- A. System shall consist of multiple remote call stations, which will communicate with a control panel and have access to a public telephone system for external alarm notification and 2-way voice communication. Expansion switches will also be utilized when the number of call stations exceeds eight.
- B. The digital communication system is based on Ethernet/CobraNet Technology. It consists of four primary components:
 - 1. Control panel
 - 2. Call stations
 - 3. Expansion Switch(es)
 - 4. Power supplies
- C. In any given system there will be at least one control panel and between one and 255-call stations.
- D. The system will support a maximum of five control panels.
- E. For larger systems, expansion switches may be used. The expansion switch is based on the control panel hardware design. The control panel and expansion switch are eight port proprietary switches. The control panel and/or expansion switches power the remote call stations.

- F. The system interconnects using standard CAT5 cable. The ethernet restriction of 100m of cable between a control panel and/or expansion switch and endpoint applies.
- G. System also requires 1-Pair #16 AWG, stranded, non-shielded cable, from the PS to the Control Panels/Switches for power and 1-Pair #22 AWG, stranded, non-shielded cable, circulating from the power supplies to all of the power detect (J9) connections on the control panel.

2.03 CONTROL PANEL

- A. When the system is operational, an LED signal light will power “on.” When the system is operating in battery power mode a different LED will be powered “on.”
- B. The panel can be surface mounted in the FCC or other location as authorized by the local fire department.
- C. An LCD display shall display the first three zones in alarm status. Up to 255-zones can be seen via a scroll button.
 - 1. Each zone alarm will be identified by a building identifier, the floor location, and the description of the area.
 - 2. In the case of an electrical fault: a system fault LED light on the control panel shall illuminate, the fault location will be shown on the LCD display and the alarm shall emit a repeating sound.
- D. An audible alarm shall be mounted on the annunciator panel, which will emit a minimum sound level of 90-dBa at 30-cm when a remote zone station calls.
 - 1. Depressing the select zone switch will answer a call and open the intercom line to the first zone displayed. You can talk to the zone via the handset, which operates in full duplex mode.
 - 2. Depressing the select switch again will end the call, change the call status to answered, move the next call to the first line of the display, which allows you to repeat step 4 above answering the next call.
 - 3. If you desire to review all calls: press the scroll button to step through the list of calls.
- E. The control panel shall have operating directions as well as both alarm and voice mute buttons.
- F. The power supply shall be a 24volt DC emergency battery backup. Additional power supplies may be required for larger systems.
- G. The internal modem will place a call to a designated location via a dedicated public telephone line to notify them of the alarm after a user programmed delay to allow for local response.
- H. The system will be configured via a USB flash drive and laptop computer.
- I. Raw call data can be optionally logged via the RS232 terminal interface to a device such as a laptop or desktop computer.

2.04 REMOTE CALL STATIONS

- A. The remote call station shall consist of a momentary switch, microphone, and loudspeaker.

- B. The station shall have hands free voice communication with the control panel.
- C. The station shall have silk screened operating instructions.
- D. The station shall be vandal resistant.
- E. The standard two-gang mounting plate can be flush or surface mounted and incorporates heavy-duty switches and speakers along with stainless steel plates.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Contractor shall thoroughly examine Project site conditions for acceptance of two-way communication 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. Install equipment in accordance with Manufacturer's written instructions, as indicated on the Drawings and as specified herein.
- B. Wiring from the control panel to secondary control panels, field switches and the call stations shall be industry standard CAT5 cable.
- C. Wiring shall be installed in raceways throughout the building.

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, testing, and adjustment of the equipment.
- 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. Independent Testing Agency shall meet the requirements as outlined in Section 260010: Basic Electrical Requirements. Testing Agencies objectives shall be to:
 - 1. Assure equipment installation conforms to specified requirements and operates within specified tolerances.
 - 2. Field test and inspect to insure 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 switchboard upon satisfactory completion of tests and results.
 - 5. Verify ratings and 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. 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.

- E. Testing of overcurrent protective devices shall be done only after all devices are installed and system is energized.
- F. Prefunctional testing:
 - 1. Provide Testing Agency with Contract Documents and Manufacturer instructions for installation and testing.
 - 2. Visual and mechanical inspection:
 - a. Compare nameplate information and connections to Contract Documents.
 - b. Inspect for physical damage, defects alignment and fit.
 - c. Verify appropriate anchorage, required clearances and correct alignment.
 - d. Inspect doors, panels and sections for paint, dents, scratches, fit and missing hardware
 - e. Check tightness of all control and power connections.
 - f. Check that all covers, barriers, and doors are secure.
 - g. Perform operational tests in accordance with Manufacturer's instructions.
- G. 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.
- H. Contractor shall replace at no costs to the Owner all devices which are found defective or do not operate within factory specified tolerances.
- I. 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 equipment, 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 switchboard 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 266316

DSITRIBUTED ANTENNA SYSTEM (DAS) FOR ERRCS

PART 1 - GENERAL

1.01 SUMMARY

A. Work included Base Bid:

1. Emergency Responder Radio Coverage testing per CFC 510.5.
 - a. All testing shall be conducted by a third party testing company. All costs for testing are the responsibility of the contractor.
 - b. Provide final passing test results to the City of East Palo Alto Fire Department for review and approval.
 - c. Note: A failure of the required signal strength in any of the test grids within the building will require design and implementation of the ERRCS (see section 1.1.B, work included in Alternate below). The design shall provide coverage for the areas of deficient signal strength.
2. Pathway Infrastructure for the ERRCS cabling:
 - a. Pathway from Roof to 1st floor
 - b. Floor Antenna pathway.
 - c. Power for the Building Distribution Amplifier (BDA) on roof.
3. Work included in Alternate:
 - a. If the EERCS is required, provide the system design and submit to Fire Department for approval.
 - b. Provide labor, materials, equipment and testing necessary to complete the installation for the ERRCS specified under this Division in compliance with CFC 510.5.3. The ERRCS shall provide adequate radio coverage to, but not limited to floors, elevators and stairwells.

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. American National Standards Institute, Inc. (ANSI)/ Telecommunications Industry Association (TIA):

ANSI/TIA-568-C.0;	Generic Telecommunications Cabling for Customer Premises (February 2009)
ANSI/TIA-568-C.1;	Commercial Building Telecommunications Cabling Standard Part 1: General Requirements (February 2009)
ANSI/TIA-568-C.2;	Balanced Twisted-Pair Telecommunications Cabling and Components Standards (April 201 0)

- ANSI/TIA-569-B; Commercial Building Standard for Telecommunications Pathways and Spaces (May 2009)
- ANSI/TIA-606-A; The Administration Standard for the Telecommunications Infrastructure of Commercial Building (November 2008)
- ANSI/TIA-J-607-A; Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications (October 2002)
- 2. Federal Communications Commission (FCC) Regulations:
 - FCC - Title 47; Code of Federal Regulations, Part 90.
 - FCC Rules; Parts 15 and 22
- 3. National Fire Protection Association (NFPA):
 - NFPA 72; National Fire Alarm and Signaling Code, Chapter 24, 2013
 - NFPA 5000; Building Construction and Safety Code, Annex F – In Building Radio Systems, 2013

1.03 SYSTEM DESCRIPTION

- A. The ERRCS shall be contractor design build and requires AHJ approval. Provide drawings showing:
 - 1. Floor Plans of expected coverage using iBWave design software.
 - 2. Floor Plans of Antenna Location.
 - 3. Conduit plan
 - 4. DAS Headend (DBA)
 - 5. Roof top Yagi Antenna
 - 6. Power requirements
 - 7. Fire Alarm connection
 - 8. Single line drawing
 - 9. System Calculations
 - 10. Installation Details
- B. The DAS shall provide coverage for the PSN listed below on all frequencies currently being used by the designated PSNs in the given market:

SERVICE	UPLINK, MHZ	DOWNLINK, MHZ
700 Band	764-776	794-806
800 Band	806-824	851-869
900 Band	896-902	935-941

- C. The contractor shall propose and deploy an ERRCS system capable of receiving approval of the authority having jurisdiction (AHJ). The contractor shall coordinate and submit all documentation required for AHJ approval.
- D. Network Management:

1. The DAS shall have a network management system capable of alarm, monitoring, configuration, and control of all active components.
 2. The DAS shall be capable of integration with 3rd party SNMP based Network management system products for alarm purposes and provide alarming information.
- E. The DAS components covered herein include:
1. Bi-directional amplifiers
 2. Loose or pre-manufactured cable and remote units
 3. Donor antennas
 4. Coverage antennas
 5. Coaxial cable and connectors
 6. Splitters, combiners, and couplers
 7. UPS back-up battery system for ERRCS
 8. Remote monitoring capabilities via fire alarm system.

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. Shop Drawings to include:
 - a. To scale floor plans showing the location of system components.
 - b. Riser and schematic diagrams.
 - c. Detail drawings for donor antenna and grounding.
 - d. Area coverage diagrams.
 - e. Battery calculations.
 3. Furnish structural calculations for equipment anchorage as described in Section 260010: Basic Electrical Requirements.
 4. Submit Manufacturer's installation instructions.
 5. Complete Bill of Material listing all components.
 6. Final test results.
 7. Warranty.
- B. Dimensions and configurations of equipment shall conform to the space allocated on the Drawings. The Contractor shall submit a revised layout if equipment furnished varies in size from that indicated on Drawings for the Engineer's approval.

1.05 OPERATION AND MAINTENANCE MANUALS

- 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. Pictorial and schematic Electrical Drawings of wiring systems, including operating and safety devices, control panels, instrumentation, and annunciators.
5. Telephone numbers for the authorized parts and service distributors.
6. Include all service bulletins and torque Specifications for all terminations.
7. 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.
- C. Installer's requirements:
 1. Installation personnel shall have an FCC issued general radio operator's license "GROL."
 2. Certificate from the manufacturer of the equipment to be installed stating that the DAS installer is trained/qualified on the equipment.
 3. iBWAIVE Software Certifications

1.07 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Delivery: Equipment 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. Components shall be properly packaged in factory-fabricated containers and mounted on shipping skids.
- 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 one (1)-year parts and labor warranty for malfunctions resulting from defects in materials and workmanship. Warranty shall begin upon acceptance by the Owner.

1.09 SYSTEM START-UP

- A. Upon completion of installation, a factory trained service technician shall perform initial start-up of the equipment. Sufficient time shall be allowed to properly check

the system out and perform required minor adjustments before the Engineer's witnessed test shall begin.

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. DAS Simplified
 - 2. Red Cloud, Inc.
- B. Substitutions: Under provisions of Section 260010: Basic Electrical Requirements.

2.02 PERFORMANCE REQUIREMENTS

- A. Public safety network emergency responder radio coverage system (ERRCS) DAS:
 - 1. The public safety ERRCS shall comply with NFPA-5000 and NFPA 72, 2013 Editions.
 - 2. Where the in-building coverage requirements include 700 to 800MHz ERRCS and commercial wireless coverage, the two systems shall operate over separate and independent passive cable and coverage antenna infrastructures.
 - 3. Contractors shall state the assumed channel count for the ERRCS frequency bands identified above with submittal. Prior to installation, contractors shall confirm the channel count and frequencies with the AHJ and shall guarantee coverage for these channels per the criteria stated above.
 - 4. The ERRCS shall deliver coverage per the criteria in Table 1 throughout 95% of all occupied building spaces and 99% in critical areas as defined in NFPA 72.

TABLE 1 – SYSTEM PARAMETERS ERRCS		
Parameters	Units	Public Safety 380-512, 700, 800 MHz
Minimum Down-Link RSL	dBm	-95

- 5. The ERRCS shall be capable of upgrade, without additional hardware or software, to allow for changes to system frequencies within the deployed frequency band in order to maintain radio system coverage as originally designed.
- 6. The contractor shall explain the method used to avoid downlink and uplink interference.
- 7. The ERRCS shall be monitored by a dedicated monitoring panel furnished and installed as part of the fire alarm/life safety system. Provide monitoring points for fire alarm system connections consisting of the following:
 - a. Normal AC power available
 - b. Signal booster trouble
 - c. Loss of normal AC power

- d. Failure of battery charger
- e. Low battery capacity

2.03 HEAD END EQUIPMENT

A. Bidirectional amplifier (BDA):

- 1. BDA: The BDA shall be of modular design and use digital filtering to mitigate interference and accommodate multiple services for PSN.
- 2. Characteristics:
 - a. Operating temperature range: -33-degree C to +50-degree C
 - b. Chassis: Shall be of modular design with ≥ 4 frequency bands per 19" chassis. Chassis shall not exceed four Rack Units (RUs) in height.
 - c. Filtering: Digital
 - d. FCC Part 90.219 type classification: Class A narrowband for LMR/SMR/ESMR frequency bands
 - e. Alarming: Shall support both SNMP and SMS using wireless modem
 - f. Mounting options: Shall support rack, wall and pole mounting
 - g. Frequency bands supported: 380 to 512 MHz LMR, 698 to 787 MHz commercial, 769 to 806 MHz LMR, 806 to 869 MHz LMR/SMR/ESMR, 896 to 941MHz LMR/SMR/ESMR, 824 to 894 MHz cellular, 1710 to 1755 MHz AWS, 1900 to 1950 MHz PCS
- 3. Compliance:
 - a. NFPA: The BDA shall comply with 2012 NFPA-72, chapter 24 requirements for supervision and monitoring.
 - b. FCC: Shall be FCC type certified.

B. Donor antenna:

- 1. Public Safety:
 - a. 746 to 986 MHz Yagi antenna
 - b. Electrical specifications:
 - 1) Gain: 11-degree dB
 - 2) VSWR: <1.7: 1
 - 3) Horizontal beamwidth: 48-degrees
 - 4) Vertical beamwidth: 42-degrees
 - 5) Polarization: Vertical
 - 6) Maximum input power: 100watts
 - 7) Electrical downtilt: 0-degrees
 - 8) Front-back ration: >16-dB
 - 9) Connectors: N type, female
- 2. Multiband cellular antenna, electrical specifications:

FREQUENCY BAND, MHZ	698-800	800-960
Gain, dBi	11.0	11.0
Beamwidth, Horizontal, Degrees	71	64
Beamwidth, Vertical, Degrees	36.0	30.0
Front-to-Back Ratio at 180-degree, dB	20	20
VSWR/Return Loss, dB	1.8/10.9	1.8/10.9
PIM, 3rd Order, 2 x 20W, dB	-150	-150
Input Power per Port, Max Watts	100	100
Polarization	Vertical	Vertical
Impedance	50ohm	50ohm

C. Surge arrestor, DC blocked protector:

1. Flange mounted, dc block, single transmitter coaxial lightning protection for 125MHz to 1GHz with N type, female connectors
2. Mount type: Flange mount
3. Standards: CE compliant, RoHS compliant
4. Frequency range: 125 MHz to 1 GHz
5. Protected side connector: N type, female
6. Surge side connector: N type, female
7. Turn On Voltage: 600volt DC $\pm 20\%$
8. VSWR: $\leq 1.1:1$ over frequency range
9. Insertion loss: ≤ 0.1 dB over frequency range
10. RF power: 220 to 700MHz at 125watt, 700 to 1000MHz at 50watt

2.04 LOOSE AND/OR PRE-MANUFACTURED CABLE/REMOTE UNITS

A. Electrical characteristics:

1. Operating temperature range: +5-degree C to +40-degree C
2. Impedence: 50ohm
3. Power consumption: ≤ 105 watts, maximum
4. MTBF (excluding external power supply): $\geq 160,000$ -hours
5. Frequency bands supported: 698 to 806MHz LMR/Commercial, 806 to 869 MHz LMR/SMR/ESMR, 896 to 941MHz LMR/SMR/ESMR.
6. Antenna port: Simplex or duplex 50ohm N-type, female connectors
7. Auxiliary ports: Two SMA female for future add-on modules

B. Enclosure:

1. 24" wide x 36" high x 6" deep
2. NEMA 4X rated
3. Red for public safety ERRCS

C. Cables:

1. Air dielectric, plenum rated coaxial cable, low PIM, braided coaxial cable, off white jacket
2. Material characteristics:
 - a. Jacket: PVC
 - b. Braid material: Tinned copper
 - c. Shield tape material: Aluminum
 - d. Dielectric material: Foam PE
 - e. Inner conductor: Copper clad aluminum wire
 - f. Jacket color: White
3. Electrical characteristics:
 - a. Impedance: 50ohm
 - b. Frequency band: 30 to 6000MHz
 - c. Return loss: >24-dB at 3-GHz
4. Mechanical characteristics:
 - a. Bending moment: 0.5-feet/lb
 - b. Fire retardancy test method: NFPA 262/CATVP/ CMP
 - c. Minimum bending radius, single bends: 1-inch
 - d. Tensile Strength: 120lb
5. Electrical Performance:

FREQUENCY	ATTENUATION (DB/100 FT))
50 MHz	0.93
150 MHz	1.65
200 MHz	1.95
220 MHz	2.03
300 MHz	2.47
450 MHz	3.10
900 MHz	4.63

6. PIM performance: Lower than -152dBc static and -149dBc dynamic PIM with N type, male connectors on both ends.
7. Environmental:
 - a. Meet IEC60068 standard.
 - b. IP65 water resistance level.
 - c. Outdoor rated with the application of adhesive hear shrink tube to the jumper boot and wrapped with butyl tape.
8. Connectors: N type, male

- D. Omni-directional coverage antennas shall feature a multi band design, accommodating multiple frequency bands in a single small antenna.
 - 1. Performance criteria:
 - a. Pattern type: Omni-directional
 - b. Frequency range: 450 to 2700MHz
 - c. Gain: 1.9-dBd (4-dBi), similar at 2100MHz and 450MHz
 - d. VSWR: 1.2:1-1.8:1
 - e. Polarization: Multi-polarized
 - f. Impedance: 50ohms nominal
 - g. Connector: N type, female
 - 2. Each antenna assembly will be provided with 60' of pre-terminated plenum rated, low PIM, braided coaxial cable.
 - 3. Provided with one 3-way splitter per 3-antennas.

2.05 DONOR ANTENNA CABLING

- A. Construction materials:
 - 1. Jacket material: Non-halogenated, fire retardant polyolefin
 - 2. Outer conductor material: Corrugate copper
 - 3. Dielectric Material: Foam PE
 - 4. Flexibility: Standard
 - 5. Inner conductor material: Copper
 - 6. Jacket color: Black
- B. Electrical characteristics:
 - 1. Cable impedance: 50ohm, ± 1 ohm
 - 2. Capacitance: 22.0 pF/feet
 - 3. Operating band: 1 to 5000MHz
- C. Mechanical specifications:
 - 1. Fire retardancy test method: UL 1666/ CATVR/ CMR
 - 2. Smoke test method: IEC 61034
 - 3. Toxicity index test method: IEC 60754-1/ -2

2.06 UNINTERRUPTIBLE POWER SUPPLY (UPS) BATTERIES:

- A. A UPS system shall be provided for the ERRCS system to support all electrical components upon loss of utility power. UPS battery backup shall have a duration of 12-hours at full load. Where an emergency generator is provided on the project, the battery duration can be offset by the generator, but cannot be eliminated entirely. As a minimum, the batteries shall provide 2-hours of backup in this case.
- B. When available, emergency generator feed adequate to serve all active system components requiring electrical service.

- C. Uninterruptible power supply (batteries):
1. Provide an uninterruptible power source for all active system components with backup from the building emergency generator when available. Power source shall consist of, but not be limited, to all necessary conduits, wire, outlets, transformers, panels, and connections to each piece of equipment as required.
 2. Uninterruptible power shall be required such that loss of power shall not cause the system operator to be required to restart the system or any part thereof upon return of power. The uninterruptible power supply shall be NFPA approved for applications and shall provide a 12-hour backup of the system.
 3. Provide a dual rate battery charger capable of recharging batteries to 80% capacity in 8-hours.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Contractor shall thoroughly examine Project site conditions for acceptance of DAS 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 equipment in accordance with Manufacturer's written instructions, as indicated on the Drawings and as specified herein.
- B. Locate equipment, antennas and splitters at locations shown on the shop drawings.
- C. Install cabling, connectors, and splitters in a neat and orderly manner per the routing indicated on the shop drawings. Support cabling in compliance with CEC and manufacturers recommendations.
- D. Maintain a 6" minimum distance from the DAS cabling and other cabling for parallel runs. Do not install coaxial cabling open in any areas were the cabling will be subject to physical damage.
- E. ERRCS cabling shall be installed to meet the survivability ratings required by Code and by the AHJ. All vertical risers shall be installed within a 2-hour rated shaft type enclosure and, where required, all horizontal feeder runs shall be installed in PVC conduit and embedded in the concrete floor slab or deck. Although, it is the preference for this project to not install any horizontal feeder runs, but instead utilize vertical risers in multiple locations. The risers should be installed utilizing any of the following options:
1. 2-hour rated stacked electrical rooms from the lowest level to the roof. Cable and splitters shall be installed in EMT conduit and NEMA 1 pullboxes in these rooms.
 2. 2-hour rated Stairwell(s) from the lowest level to the roof. Cable and splitters shall be installed in EMT conduit and NEMA 1 pullboxes and located within the wall between the stair and the vestibule, assuming a high-rise building.
 3. 2-hour rated stacked telecom rooms from the lowest level to the roof. Cable and splitters shall be installed in EMT conduit and NEMA 1 pullboxes in these rooms.
 4. Multiple vertical runs will be required to cover the entire floorplate at each floor of the building.

- 5. Cable embedded in the floor slab to interconnection the riser cables listed above shall be required.
- F. It is assumed that the ERRCS coverage antennas will be required at every level of the building, to provide coverage throughout each floor. The riser cables shall be tapped with splitters on each floor, within the pullbox, for connections to the antennas. Antennas shall be located on opposite side of wall from 2-hour rated enclosure where riser cable is located, to limit the horizontal cable length. If riser cables are limited throughout the building, then cabling to antennas shall be routed within floor slabs or decks at each level, to meet the coverage requirements.

3.03 EQUIPMENT MOUNTING

- A. Install wall mounted equipment enclosures in spaces as indicated on shop drawings in accordance with manufacturer's instructions and seismic requirements.
- B. Install floor mounted headend equipment enclosure within equipment space indicated on the shop drawings. Fasten to the floor per manufacturer's instructions and provide seismic bracing as required in compliance with Codes.
- C. Install donor antennas per details shown on the shop drawings.

3.04 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, testing, and adjustment of the equipment.
- 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. Independent Testing Agency shall meet the requirements as outlined in Section 260010: Basic Electrical Requirements. Testing Agencies objectives shall be to:
 - 1. Assure equipment installation conforms to specified requirements and operates within specified tolerances.
 - 2. Field test and inspect to insure 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 switchboard upon satisfactory completion of tests and results.
 - 5. Verify ratings and 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. Testing:
 - 1. Public safety ERRCS procedure:
 - a. Test location:
 - 1) Each floor of the building shall be divided into a grid of 20 approximately equal test areas.

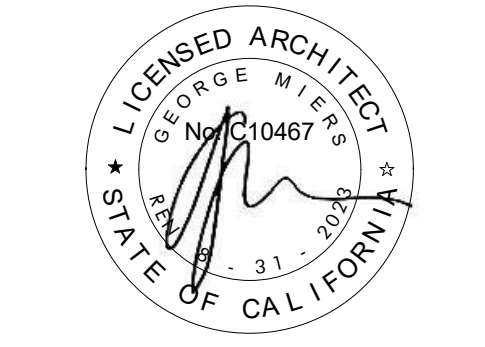
- 2) Downlink received signal level measurements will be recorded in the coverage area using a CW test signal. Measurements will be collected using a spectrum analyzer and a dipole antenna.
 - 3) Failure of a maximum of two non-adjacent test areas shall not result in failure of the test.
 - 4) In the event that three of the test areas fail the test, in order to be more statistically accurate, the floor shall be divided into 40 equal test areas. Failure of a maximum of four non-adjacent test areas shall not result in failure of the test. If the system fails the 40-area test, the system shall be altered to meet the 90% coverage.
 - 5) A test location approximately in the center of each test area shall be selected for the test. Once the location has been selected, the location shall represent the entire test area.
- b. Equipment requirements:
- 1) Test equipment shall be allowed to stabilize in test environment prior to calibration for a minimum of thirty minutes. Any change in temperature can void the calibration.
 - 2) Signal generator must be connected to the head end downlink (TX) interface via tested and approved coaxial cabling and connectors.
 - 3) Signal generator transmits frequency (MHz) and power (dBm) must be preapproved by project engineer prior to testing. The control channel from the base station can be used as a signal source as well.
 - 4) Verify that all remote units for the area under test are ON.
 - 5) Test frequency and power must be recorded corresponding to the date and time of each site walk measurement.
 - 6) Spectrum analyzer with unity gain (0dB, frequency specific) dipole receive antenna must be preapproved by the project engineer.
 - 7) Site walk screen shots shall be saved with frequency span +/-20MHz relative to the center/measured frequency.
- c. Documentation:
- 1) Exact location of measurement must be marked on the grid print.
 - 2) Screen shots must be taken in all designated grid spaces. If more than one reading is saved per grid zone, saved results shall be distinguished from one another using Grid ##"A", Grid ## "B", etc.
 - 3) Results of testing are reported to project engineer for analysis and reporting.
- E. 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.
- F. Contractor shall replace at no costs to the Owner all devices which are found defective or do not operate within factory specified tolerances.

- G. 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.

3.05 TRAINING

- A. Factory authorized service representative shall conduct a 4-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



ABBREVIATIONS

ACT	ACOUSTIC CEILING TILE
ALUM	ALUMINUM
CONC	CONCRETE
CRPT	CARPET
GLAZ	GLASS/GLAZING
GYP BD	GYPSPUM BOARD
MTL	METAL
PTD	PAINT/PAINTE
SEALED	CLR SEALED
SST	STAINLESS STEEL
STAIN	STAIN/VARNISH
TILE	CERAMIC TILE
RESIL	RESILIENT
VCT	VINYL COMPOSITE TILE

EAST PALO ALTO GOVERNMENT CENTER

2415 University Ave.
East Palo Alto, CA 94303
APN: 063-103-370

Rev	Date	Description
1	11/05/2021	Permit Submittal
3	10/24/22	Addendum #3

Drawn By: HE
Checked By: JH
Job No.: 1919
Scale: As indicated

SCHEDULES

- (3) HINGE, SBB1 4.5x4.5, 652, IVE
- (1) VANDL STOREROOM LOCK, N68TD RHD, 626, SCH, CONFIRM WITH CLIENT FACILITIES' DEPT
- (1) PRIMAS CORE, 20-74, 626, SCH, CONFIRM WITH CLIENT FACILITIES' DEPT
- (1) SURFACE CLOSER, 4040VP, 689, LCN
- (2) KICK PLATE, 8400 10" x 2" LDW BAE, 630, IVE
- (1) WALL STOP (WHERE APPLICABLE), WS407COV, 630, IVE
- (1) SET OF SEALS, S88D, DKB, BEM

A9.01

Sheet
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FINISH SCHEDULE GENERAL NOTES

- ALL LIGHTS REPLACED WITH LED UNLESS OTHERWISE NOTED.
- THE FINISHES NOTED ON THE PLANS INDICATES THE TYPES AND EXTENT OF FINISHES. REFER TO OTHER CONTRACT DOCUMENTS FOR ADDITIONAL INFORMATION.
- SUBMIT SAMPLES IN ACCORDANCE WITH SPECIFICATIONS OF EACH FINISH AND FLOOR COVERING TO THE ARCHITECT FOR REVIEW AND APPROVAL BEFORE BEGINNING WORK. THE ARCHITECT HAS TEN (10) WORKING DAYS TO PROCESS SHOP DRAWINGS.
- SUBSTITUTIONS, REVISIONS OR CHANGES MUST HAVE APPROVAL OF THE ARCHITECT PRIOR TO PURCHASE AND INSTALLATION.
- VERIFY WITH ARCHITECT AT BEGINNING OF PROJECT WHAT ELEMENTS ARE TO BE PAINTED.
- PAINT AT ALL INTERIOR WALLS PATCHING SHALL MATCH EXISTING COLOR
- NO GYP. BD. SURFACES EXPOSED TO VIEW SHALL BE LEFT UNFINISHED OR UNPAINTED.
- "WATER RESISTANT" GYP. BD. AND/OR CEMENTITIOUS BOARD AT ALL BATHROOMS, POWDER ROOM, AND UTILITY ROOM.
- PROVIDE METAL TRIM OR CASING AT ALL EDGES OF PLASTER OR GYPSPUM BOARD WHERE IT TERMINATES OR MEETS ANY OTHER MATERIAL, EXCEPT FINISHES.
- IN ALL CASES, PROVIDE ISOLATION OF ALUMINUM FROM ADJACENT STEEL OR COAT SURFACES IN CONTACT WITH BITUMINOUS PAINTS.

ACOUSTIC TILE CEILING WORK TIERS

- EXISTING CEILING SYSTEM TO REMAIN. SELECTIVE DISASSEMBLY REQUIRED AT AREAS OF NEW HVAC WORK. PROTECT ALL ITEMS FROM DAMAGE, REINSTATE AND REPLACE DAMAGED ITEMS WITH MATCHING MATERIALS AS NECESSARY.
- EXISTING GRID TO REMAIN, DISPOSE OF ALL EXISTING TILES AND REPLACE WITH NEW AS SPECIFIED. CLEAN GRID THOROUGHLY AND REPAIR/REPLACE DAMAGED AREAS WITH MATCHING MATERIALS AS NECESSARY. REFER TO SCHEDULE FOR GRID TO BE PAINTED.
- DEMOLISH ENTIRE CEILING SYSTEM AND REPLACE WITH NEW AS SPECIFIED.

DOOR SCHEDULE GENERAL NOTES

- DOOR DIMENSIONS SHOWN ARE NOMINAL (APPROXIMATE) FRAME SIZES. FIELD VERIFY ROUGH OPENING SIZES AND COORDINATE WITH WINDOW MANUFACTURER'S CLEARANCE REQUIREMENTS AND ADJACENT FINISHES.
- COORDINATE ALL STRUCTURAL FRAMING REQUIREMENTS WITH DOOR MANUFACTURER AND ARCHITECT.

DOOR HARDWARE

- HARDWARE GROUP #1 ITEMS - DESCRIPTION, CATALOG NUMBER, FINISH, MANUFACTURER.
- (3) HINGE, SBB1 4.5x4.5, 652, IVE
 - (1) VANDL STOREROOM LOCK, N68TD RHD, 626, SCH, CONFIRM WITH CLIENT FACILITIES' DEPT
 - (1) PRIMAS CORE, 20-74, 626, SCH, CONFIRM WITH CLIENT FACILITIES' DEPT
 - (1) SURFACE CLOSER, 4040VP, 689, LCN
 - (2) KICK PLATE, 8400 10" x 2" LDW BAE, 630, IVE
 - (1) WALL STOP (WHERE APPLICABLE), WS407COV, 630, IVE
 - (1) SET OF SEALS, S88D, DKB, BEM

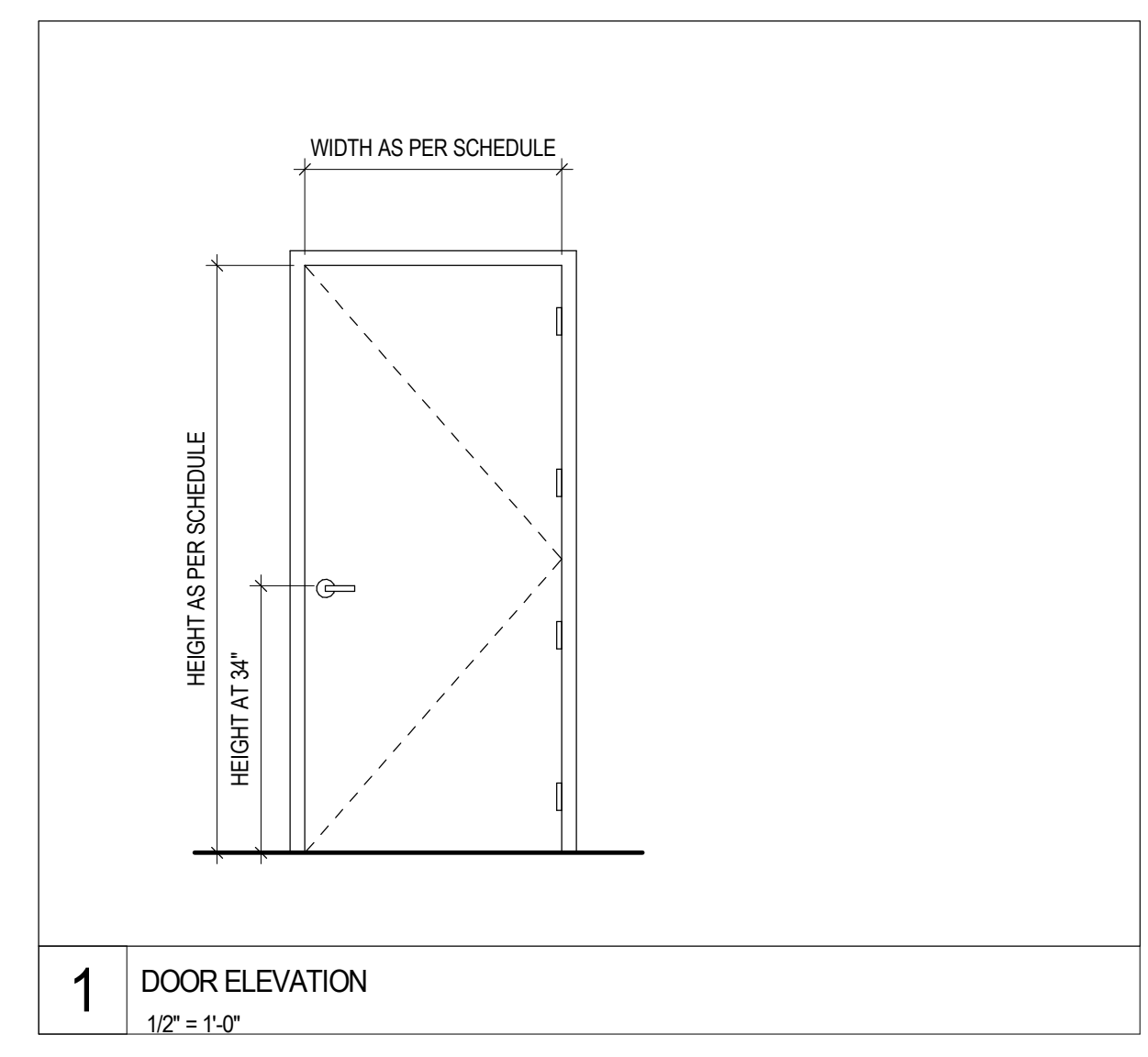
LEVEL 1

WTWT	ROOM #	LEVEL	NAME	PHASE	FLOOR	CEILING	TILE TYPE	GRID TYPE	WALL	ACT SQ FT	REMARKS
		125A	CONTROL ROOM								
		1									
CITY OF E.P.A	107	1	ALCOVE	2	EXISTING	EXISTING GYP					
CITY OF E.P.A	114	1	EPA CITY OFFICE	2	EXISTING	ACT TIER 3	1	NEW 2X4		1271	
CITY OF E.P.A	118	1	OFFICE	2	EXISTING	ACT TIER 3	1	NEW 2X4		103	
CITY OF E.P.A	119	1	OFFICE	2	EXISTING	ACT TIER 3	1	NEW 2X4		63	
CITY OF E.P.A	120	1	OFFICE	2	EXISTING	ACT TIER 3	1	NEW 2X4		92	
CITY OF E.P.A	121	1	OFFICE	2	EXISTING	ACT TIER 3	1	NEW 2X4		100	
CITY OF E.P.A	122	1	SERVER	2	EXISTING	ACT TIER 3	1	NEW 2X4		90	
CITY OF E.P.A	123	1	WAITING	2	EXISTING	ACT TIER 3	1	NEW 2X4		87	
CITY OF E.P.A	125	1	COMMUNITY / MULTIPURPOSE ROOM	2	EXISTING	ACT TIER 2	3	NEW 2X4		2310	
COUNTY	000	1	HALL	ALL	VCT	ACT TIER 3	1	NEW 2X4		191	
COUNTY	100	1	ENTRANCE LOBBY	ALL	TERRAZZO	ACT TIER 3	3	NEW 2X2		915	
COUNTY	102	1	STAIRS	ALL	EXISTING	--	--	--		--	
COUNTY	103	1	STAIRS	ALL	EXISTING	--	--	--		--	
COUNTY	104	1	STAIRS	ALL	EXISTING	--	--	--		--	
COUNTY	106	1	ELEVATOR	ALL	EXISTING	--	--	--		--	CAB REPLACEMENT-SEE SHEET A6.01
COUNTY	109	1	EL MACH. ROOM	ALL	EXISTING	EXISTING GYP					
COUNTY	110	1	WOMEN TOILET	ALL	EXISTING	EXISTING GYP					
COUNTY	112	1	MEN TOILET	ALL	EXISTING	EXISTING GYP					
COUNTY	115	1	ELEC. CLOSET	ALL	EXISTING	EXISTING GYP					
COUNTY	116	1	ELECTRICAL / MENS BATH	ALL	EXISTING	EXISTING GYP					
COUNTY	117	1	WOMENS BATH	ALL	EXISTING	EXISTING GYP					
COUNTY	124	1	TOILET	ALL	EXISTING	EXISTING GYP					
LIBRARY	101	1	EAST PALO ALTO LIBRARY	1	CARPET	ACT TIER 3	2	NEW 2X2		6341	
LIBRARY	105	1	TOILET	1	EXISTING	EXISTING GYP					
LIBRARY	126	1	WORK ROOM	1	CARPET	ACT TIER 3	1	NEW 2X4		664	
LIBRARY	127	1	CLOSET	1	EXISTING	EXISTING GYP					
LIBRARY	128	1	STAFF ROOM	1	CARPET	ACT TIER 3	1	NEW 2X4		163	
LIBRARY	129	1	STORE ROOM	1	EXISTING	ACT TIER 3	1	NEW 2X4		163	

LEVEL 2

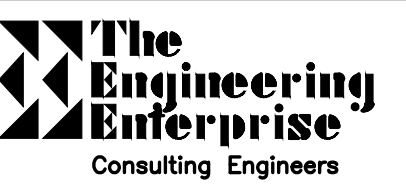
WTWT	ROOM #	LEVEL	NAME	PHASE	FLOOR	CEILING	TILE TYPE	GRID TYPE	WALL	ACT SQ FT	REMARKS
CITY OF E.P.A	204	2	EXECUTIVE CONFERENCE ROOM	2	EXISTING	ACT TIER 2	2	EXISTING 2X4	EXTEND WALL	230	
CITY OF E.P.A	205	2	COUNTY SUPERVISOR	2	EXISTING	ACT TIER 2	2	EXISTING 2X4	EXTEND WALL	75	
CITY OF E.P.A	215	2	CORRIDOR	2	VCT	ACT TIER 2	1	EXISTING 2X4		230	
CITY OF E.P.A	220	2	STORAGE/FILE ROOM	ALL	EXISTING	EXISTING GYP					
CITY OF E.P.A	225	2	AMERICAN WATER	1	EXISTING	ACT TIER 1	EXISTING	EXISTING 2X4		440	
CITY OF E.P.A	225A	2	PRV COUNTER	1	EXISTING	ACT TIER 1	EXISTING	EXISTING 2X4		45	
CITY OF E.P.A	230	2	EAST PALO ALTO RECEPTION	1	EXISTING	ACT TIER 1	EXISTING	EXISTING 2X4		96	
CITY OF E.P.A	232	2	CITY OFFICE	1	EXISTING	ACT TIER 3	3	NEW 2X2		224	
CITY OF E.P.A	233	2	CITY OFFICE	1	EXISTING	ACT TIER 3	3	NEW 2X2		223	
CITY OF E.P.A	234	2	CONFERENCE ROOM	1	EXISTING	ACT TIER 3	3	NEW 2X2		223	
CITY OF E.P.A	237	2	STORAGE	2	EXISTING	ACT TIER 3	1	NEW 2X4		88	
CITY OF E.P.A	240	2	RENT STABILIZATION	1	EXISTING	ACT TIER 1	EXISTING	EXISTING 2X4		220	
CITY OF E.P.A	251	2	OFFICE	1	EXISTING	ACT TIER 1	EXISTING	EXISTING 2X4		150	
CITY OF E.P.A	252	2	OFFICE	1	EXISTING	ACT TIER 1	EXISTING	EXISTING 2X4		226	
CITY OF E.P.A	253	2	OFFICE	1	EXISTING	ACT TIER 1	EXISTING	EXISTING 2X4		157	
CITY OF E.P.A	254	2	EAST PALO ALTO OPEN OFFICE	1	EXISTING	ACT TIER 1	EXISTING	EXISTING 2X4		147	
COUNTY	218	2	WOMENS STAFF TOILET	ALL	EXISTING	EXISTING GYP					
COUNTY	219	2	JANITOR	ALL	EXISTING	EXISTING GYP					
COUNTY	222	2	JANITOR	ALL	EXISTING	EXISTING GYP					
COUNTY	223	2	MENS STAFF TOILET	ALL	EXISTING	EXISTING GYP					
COUNTY	224	2	IT AND ELECTRICAL	ALL	EXISTING	EXISTING GYP					
COUNTY	227	2	BREAK ROOM	3	VCT	ACT TIER 3	1	NEW 2X4		692	
COUNTY	228	2	MENS PUBLIC WC	ALL	EXISTING	EXISTING GYP					
COUNTY	229	2	CORRIDOR	ALL	VCT	ACT TIER 3	1	NEW 2X4		188	
COUNTY	231	2	CORRIDOR	ALL	VCT	ACT TIER 3	3	NEW 2X2		811	
COUNTY	235	2	STAIRS	ALL	EXISTING	--	--	--		--	
COUNTY	236	2	STAIRS	ALL	EXISTING	--	--	--		--	
COUNTY	238	2	STAIRS	ALL	EXISTING	--	--	--		--	
COUNTY	243	2	ANTE ROOM	2	EXISTING	ACT TIER 2	2	EXISTING 2X4		85	
COUNTY	246	2	WOMENS PUBLIC WC	ALL	EXISTING	EXISTING GYP					
COUNTY	255	2	CORRIDOR	ALL	VCT	ACT TIER 2	2	EXISTING 2X4		331	
LIBRARY	226	2	SAN MATEO COUNTY READS	3	EXISTING	ACT TIER 3	1	NEW 2X4		623	
PRENATAL ADVANTAGE	203	2	OFFICE	2	EXISTING	ACT TIER 2	1	EXISTING 2X4		124	
PRENATAL ADVANTAGE	244	2	HALLWAY	2	EXISTING	ACT TIER 2	1	EXISTING 2X4		52	
PRENATAL ADVANTAGE	245	2	PRENATAL ADVANTAGE BIH	2	EXISTING	ACT TIER 2	1	EXISTING 2X4	EXTEND WALL	754	
PROBATION	202	2	PROBATION CONFERENCE ROOM	2	EXISTING	ACT TIER 3	2	NEW 2X4	EXTEND WALL	420	
PROBATION	205	2	OFFICE	2	EXISTING	ACT TIER 3	2	NEW 2X4	EXTEND WALL	120	
PROBATION	206	2	EQUIPMENT ROOM	2	EXISTING	ACT TIER 3	2	NEW 2X4	EXTEND WALL	75	
PROBATION	207	2	LUNCH ROOM	2	EXISTING	ACT TIER 3	1	NEW 2X4		129	
PROBATION	208	2	OFFICE	2	EXISTING	ACT TIER 3	2	NEW 2X4	EXTEND WALL	100	
PROBATION	209	2	OFFICE	2	EXISTING	ACT TIER 3	2	NEW 2X4	EXTEND WALL	113	
PROBATION	210	2	SERVER ROOM	2	EXISTING	ACT TIER 3	2	NEW 2X4		50	
PROBATION	211	2	ROOM	2	EXISTING	ACT TIER 3	2	NEW 2X4	EXTEND WALL	50	
PROBATION	212	2	INTERVIEW	2	EXISTING	ACT TIER 3	1	NEW 2X4		50	
PROBATION	213	2	INTERVIEW	2	EXISTING	ACT TIER 3	1	NEW 2X4		50	
PROBATION	214	2	INTERVIEW	2	EXISTING	ACT TIER 3	1	NEW 2X4		50	
PROBATION	216	2	EXERCISE	2	EXISTING	ACT TIER 3	2	NEW 2X4	EXTEND WALL	94	
PROBATION	221	2	RECEPTION - PROBATION DEPARTMENT	2	EXISTING	ACT TIER 3	1	NEW 2X4		163	
PROBATION	239	2	EPA PROBATION OFFICE	2	EXISTING	ACT TIER 3	1	NEW 2X4		2173	
PROBATION	240	2	EPA PROBATION OFFICE	2	EXISTING	ACT TIER 3	1	NEW 2X4		1901	
PROBATION	241	2	HALLWAY	2	EXISTING	ACT TIER 3	1	NEW 2X4		195	
PROBATION	242	2	HALLWAY	2	EXISTING	ACT TIER 3	2	NEW 2X4	EXTEND WALL	79	

DOOR SCHEDULE PENTHOUSE												
DOOR												
DR.#	WIDTH	HEIGHT	THICKNESS	CONST	FINISH	GLAZING TYPE	FIRE RATING	FRAME CONST	FRAME FINISH	HW GROUP	HW - INT / EXT	Phase Created
N001	3'-0"	7'-0"	1 7/8"	HM	PTD	-	-	HM	PTD	1	EXT	New Construction
N002	3'-0"	7'-0"	1 7/8"	HM	PTD	-	-	HM	PTD	1	EXT	New Construction
N003	3'-0"	7'-0"	1 7/8"	HM	PTD	-	-	HM	PTD	1	EXT	New Construction
N004	3'-0"	7'-0"	1 7/8"	HM	PTD	-	-	HM	PTD	1	EXT	New Construction



LEVEL 3

WTWT	ROOM #	LEVEL	NAME	PHASE	FLOOR	CEILING	TILE TYPE	GRID TYPE	WALL	ACT SQ FT	REMARKS
COUNTY	309	3	ELECTRICAL	ALL	EXISTING	EXISTING GYP					
COUNTY	311	3	STAIRS	ALL	EXISTING	EXISTING GYP					
COUNTY	341	3	JANITOR	ALL	EXISTING	EXISTING GYP					
COUNTY	342	3	MENS STAFF TOILET	ALL	EXISTING	EXISTING GYP					
COUNTY	343	3	SERVER	ALL	EXISTING	ACT TIER 2	1	EXISTING 2X4		69	
COUNTY	344	3	WOMENS STAFF TOILET	ALL	EXISTING	EXISTING GYP					
COUNTY	345	3	STAIRS	ALL	EXISTING	EXISTING GYP					
COUNTY	347	3	CORRIDOR	ALL	EXISTING	ACT TIER 3	2	NEW 2X2		1061	
COUNTY	354	3	BREAK AREA	ALL	EXISTING	ACT TIER 2	1	EXISTING 2X4		160	
COUNTY	362	3	MENS PUBLIC TOILET	ALL	EXISTING	EXISTING GYP					
COUNTY	363	3	WOMENS PUBLIC TOILET	ALL	EXISTING	EXISTING GYP					
COUNTY	509	3	STAIRS	ALL	EXISTING	EXISTING GYP					
HUMAN SERVICES	301	3	OFFICE 1	ALL	EXISTING	ACT TIER 1	EXISTING	EXISTING 2X4		160	
HUMAN SERVICES	302	3	OFFICE 2	ALL	EXISTING	ACT TIER 1	EXISTING	EXISTING 2X4		121	
HUMAN SERVICES	303	3	OFFICE 3	ALL	EXISTING	ACT TIER 1	EXISTING	EXISTING 2X4		101	
HUMAN SERVICES	304	3	OFFICE 4	ALL	EXISTING	ACT TIER 1	EXISTING	EXISTING 2X4		124	
HUMAN SERVICES	305	3	OFFICE 5	ALL	EXISTING	ACT TIER 1	EXISTING	EXISTING 2X4		113	
HUMAN SERVICES	306	3	OFFICE 6	ALL	EXISTING	ACT TIER 1	EXISTING				



SYMBOLS LIST

SOME OF THESE SYMBOLS SHOWN MAY NOT BE USED ON THIS PROJECT

ABBREVIATIONS

Table with columns for POWER DISTRIBUTION, WIRING DEVICES, LIGHTING, TELECOMMUNICATIONS, and FIRE ALARM. Contains various electrical symbols and their corresponding descriptions.

Table with columns for RACEWAYS and CONVENTIONS. Contains symbols for conduit runs, raceways, and drawing conventions.

Table with columns for LIGHTING, TELECOMMUNICATIONS, and FIRE ALARM. Contains symbols for digital lighting controls, telecommunication devices, and fire alarm components.

Table with columns for TELECOMMUNICATIONS and FIRE ALARM. Contains symbols for telecommunication devices and fire alarm components.

Table with columns for TELECOMMUNICATIONS and FIRE ALARM. Contains symbols for telecommunication devices and fire alarm components.

Table with columns for ABBREVIATIONS and ELECTRICAL SHEET INDEX. Contains abbreviations for electrical components and an index of electrical sheets.

EAST PALO ALTO GOVERNMENT CENTER

2415 University Ave. East Palo Alto, CA 94303

APR: 063-103-370

Issue

Rev Date By Description

11/05/21 PERMIT SUBMITTAL

3 10/24/22 ADDENDUM #3

DESIGN DEVELOPMENT

ISSUED FOR PERMIT

E2.01 POWER AND SIGNAL PLAN - LEVEL 1

E2.02 POWER AND SIGNAL PLAN - LEVEL 2

E2.03 POWER AND SIGNAL PLAN - LEVEL 3

E2.04 POWER, LIGHTING AND SIGNAL PLAN - ROOF/PENTHOUSE

E3.01 LIGHTING PLAN - LEVEL 1

E3.02 LIGHTING PLAN - LEVEL 2

E3.03 LIGHTING PLAN - LEVEL 3

E3.04 LIGHTING PLAN - ROOF/PENTHOUSE

E4.01 FIRE ALARM PLAN - LEVEL 1

E4.02 FIRE ALARM PLAN - LEVEL 2

E4.03 FIRE ALARM PLAN - LEVEL 3

E4.04 FIRE ALARM PLAN - ROOF/PENTHOUSE

E5.01 POWER SINGLE LINE DIAGRAM

E5.02 FIRE ALARM RISER DIAGRAM

E6.01 ELECTRICAL DETAILS

E6.02 ELECTRICAL DETAILS

E6.03 ELECTRICAL DETAILS

E6.04 ELECTRICAL DETAILS

Drawn By KH

Checked By KM

Job No. 20035

Issue Date 02/04/2022

Scale NONE

Drawing Title

SYMBOLS LIST AND DRAWING INDEX

Sheet

E0.01

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EPA GOVT CENTER - NEW LOAD SUMMARY					
Area Description	Load		Peak Demand	Units	Notes
	Value	Units			
Utility Monthly Peak Loads					
Apr-18			127	kw	
May-18			109	kw	
Jun-18			113	kw	
Jul-18			115	kw	
Aug-18			116	kw	
Sep-18			118	kw	
Oct-18			128	kw	
Nov-18			134	kw	
Dec-18			139	kw	
Jan-19			123	kw	
Feb-19			129	kw	
Mar-19			138	kw	
Apr-19			118	kw	
May-19			115	kw	
Jun-19			111	kw	
Jul-19			135	kw	
Aug-19			136	kw	
Sep-19			138	kw	
Oct-19			145	kw	
Nov-19			138	kw	
Dec-19			138	kw	
Jan-20			114	kw	
Feb-20			113	kw	
Mar-20			123	kw	
Apr-20			112	kw	
Peak Load:			145	kw	Oct-19
MSB Load Calculation					
MSB Peak Demand (Oct-19)			144,640	w	
x1.25%			180,800	va	
New Loads ⁽¹⁾			249,873	va	
Removed Loads ⁽¹⁾			(211,527)	va	
Total Load:			219,146	va	
Total Amps:			609	amps	

EPA GOVT CENTER ELECTRICAL LOAD CALCS				
Area Description	Load		Load	Units
	Value	Units		
Building Square Footage				
Level 1	16163	sqft		
Level 2	16207	sqft		
Level 3	16207	sqft		
Penthouse	1243	sqft		
Lighting Loads				
Level 1	6.3	kw	6,300	w
Level 2	6.3	kw	6,300	w
Level 3	6.3	kw	6,300	w
Penthouse	1.0	kw	1,000	w
Total:				19,900
Mechanical Loads (New)				
AWHP-1	93	kw	93,000	w
AWHP-2	93	kw	93,000	w
HWP-1	7.5	hp	9,134	w
EVH-1	4.5	hp	4,500	w
RF-1	15	hp	17,438	w
Misc Exhaust Fans	2.5	kw	2,500	w
Fan Power Boxes	10.4	kw	10,400	w
Total:				229,973
Mechanical Loads (Removed)				
Chiller	172	kw	172,000	w
Cooling Tower	15	hp	17,438	w
CWP	7.5	hp	9,134	w
CHWP	7.5	hp	9,134	w
HWP	3	hp	3,820	w
Total:				211,527
Total:				18,446
Total Loads				38,346

Notes:
(1) Refer to Load Calcs spreadsheet.

General Notes:
1. Peak demand over a one year period was observed.
2. 1600 Amp 277/480V, 3P, 4W existing service size/main.

- GENERAL SHEET NOTES**

 - REFER TO MECHANICAL PLANS FOR PHASING OF PROJECT TO SWITCH OVER TO NEW EQUIPMENT. SWITCHOVER TO NEW EQUIPMENT SHALL BE DONE IN A COORDINATED AND TIMELY FASHION TO MINIMIZE DOWNTIME.
 - EXISTING EQUIPMENT SHOWN SHADED ON THE POWER SINGLE LINE DIAGRAM.
- NUMBERED SHEET NOTES**

 - REMOVE EXISTING BREAKER AND STARTER FOR REMOVED MECHANICAL EQUIPMENT TO FREE UP SPACE IN BUCKET FOR NEW BREAKER. PROVIDE NEW BREAKER IN BUCKET. MODIFY MCC AS NECESSARY TO ACCOMMODATE NEW BREAKER. NEW BREAKER SHALL HAVE A MINIMUM 42 KAIC RATING AT 480V.
 - REPLACE EXISTING 70 AMP 3-POLE BREAKER WITH A NEW 70 AMP 3-POLE BREAKER WITH A SHUNT TRIP. PROVIDE 120 VOLT POWER (DEDICATED BRANCH CIRCUIT) TO SHUNT TRIP UNIT. MONITOR BRANCH CIRCUIT POWER THROUGH THE NEW FIRE ALARM PANEL. NEW BREAKER SHALL HAVE A MINIMUM 65 KAIC RATING AT 480 VOLT.
 - NOT USED.
 - NOT USED.
 - REFER TO POWER PLANS FOR REMOVAL OF EQUIPMENT.
 - NOT USED.
 - PROVIDE VFD RATED DISCONNECT WITH BREAK-BEFORE-BREAK AUXILIARY CONTACTS TO INTERLOCK WITH VFD SHUTDOWN WHEN DISCONNECT IS IN OPEN POSITION. PROVIDE 3/4" CONDUIT BETWEEN DISCONNECT AND VFD. LOW VOLTAGE WIRE BY DIV 23.
 - REMOVE THREE 20 AMP SINGLE POLE BREAKERS (CIRCUITS 2.4.6) AND REPLACE WITH NEW 100 AMP 3-POLE BREAKER TO SERVE NEW PANEL. RELOCATE THREE EXISTING CIRCUITS TO NEW PANEL.

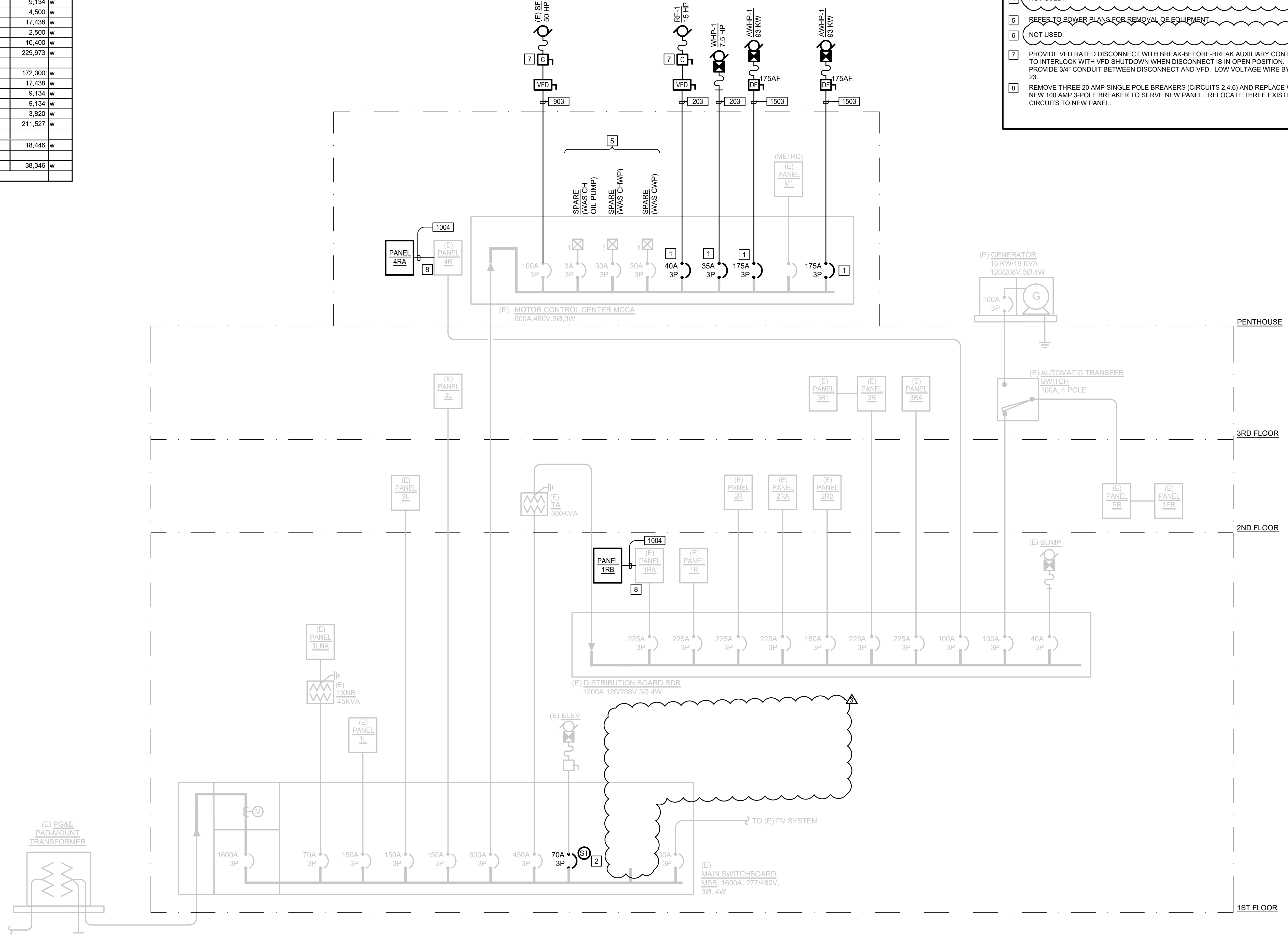
COPPER FEEDER SCHEDULE					
FEEDER TAG	FEEDER DESCRIPTION	CONDUIT	CONDUCTORS		REMARKS
			PHASE/NEUTRAL	GROUND	
2254	225 AMP, 3 PHASE, 4 WIRE	1-2.50"	4 #4/0	1 #4	-
2253	225 AMP, 3 PHASE, 3 WIRE	1-2.00"	3 #4/0	1 #4	-
2004	200 AMP, 3 PHASE, 4 WIRE	1-2.00"	4 #3/0	1 #6	-
2003	200 AMP, 3 PHASE, 3 WIRE	1-2.00"	3 #3/0	1 #6	-
1754	175 AMP, 3 PHASE, 4 WIRE	1-2.00"	4 #2/0	1 #6	-
1753	175 AMP, 3 PHASE, 3 WIRE	1-2.00"	3 #2/0	1 #6	-
1504	150 AMP, 3 PHASE, 4 WIRE	1-2.00"	4 #1/0	1 #6	-
1503	150 AMP, 3 PHASE, 3 WIRE	1-1.50"	3 #1/0	1 #6	-
1254	125 AMP, 3 PHASE, 4 WIRE	1-1.50"	4 #1	1 #6	-
1253	125 AMP, 3 PHASE, 3 WIRE	1-1.25"	3 #1	1 #6	-
1004	95 AMP, 3 PHASE, 4 WIRE	1-1.25"	4 #2	1 #8	②
1003	95 AMP, 3 PHASE, 3 WIRE	1-1.25"	3 #2	1 #8	②
904	85 AMP, 3 PHASE, 4 WIRE	1-1.25"	4 #3	1 #8	②
903	85 AMP, 3 PHASE, 3 WIRE	1-1.25"	3 #3	1 #8	②
804	80 AMP, 3 PHASE, 4 WIRE	1-1.25"	4 #3	1 #8	-
803	80 AMP, 3 PHASE, 3 WIRE	1-1.25"	3 #3	1 #8	-
704	70 AMP, 3 PHASE, 4 WIRE	1-1.25"	4 #4	1 #8	-
703	70 AMP, 3 PHASE, 3 WIRE	1-1.00"	3 #4	1 #8	-
604	55 AMP, 3 PHASE, 4 WIRE	1-1.00"	4 #6	1 #10	②
603	55 AMP, 3 PHASE, 3 WIRE	1-0.75"	3 #6	1 #10	② ③
504	50 AMP, 3 PHASE, 4 WIRE	1-1.00"	4 #6	1 #10	-
503	50 AMP, 3 PHASE, 3 WIRE	1-0.75"	3 #6	1 #10	-
404	40 AMP, 3 PHASE, 4 WIRE	1-0.75"	4 #8	1 #10	-
403	40 AMP, 3 PHASE, 3 WIRE	1-0.75"	3 #8	1 #10	-
304	30 AMP, 3 PHASE, 4 WIRE	1-0.75"	4 #10	1 #10	-
303	30 AMP, 3 PHASE, 3 WIRE	1-0.75"	3 #10	1 #10	-
204	20 AMP, 3 PHASE, 4 WIRE	1-0.50"	4 #12	1 #12	-
203	20 AMP, 3 PHASE, 3 WIRE	1-0.50"	3 #12	1 #12	-
154	15 AMP, 3 PHASE, 4 WIRE	1-0.50"	4 #12	1 #12	-
153	15 AMP, 3 PHASE, 3 WIRE	1-0.50"	3 #12	1 #12	-

FEEDER SCHEDULE GENERAL NOTES

- CONDUCTORS AND CONDUITS SHOWN IN THIS SCHEDULE ARE BASED ON COPPER CONDUCTORS WITH DUAL RATED THHN/THWN-2 INSULATION IN AMBIENT TEMPERATURE OF 30° C (86° F) AND EMT CONDUIT.
- FEEDERS CONSISTING OF MULTIPLE SETS OF CONDUCTORS AND CONDUITS ARE TO BE PROVIDED WITH THE INDICATED SIZE GROUND CONDUCTOR IN EACH CONDUIT.

FEEDER SCHEDULE REMARK

- PER NEC SECTION 240.4(B), THE NEXT HIGHER STANDARD OVERCURRENT DEVICE RATING (ABOVE THE AMPACITY OF THE CONDUCTORS) CAN BE USED. RULE CAN NOT BE APPLIED IF 100% RATED BREAKERS ARE PVC.
- INCREASE CONDUIT TO THE NEXT LARGER TRADE SIZE WHEN USING SCHEDULE 40 OR 80 PVC CONDUIT.



A
E501 POWER RISER DIAGRAM
N.T.S.

EAST PALO ALTO GOVERNMENT CENTER

2415 University Ave.
East Palo Alto, CA 94303
APH: 063-103-370

Issue

Rev	Date	By	Description
1	11/05/21		PERMIT SUBMITTAL
3	10/24/22		ADDENDUM #3

Drawn By: KH
Checked By: KM
Job No.: 20035
Issue Date: 02/04/2022
Scale: N.T.S.

Drawing Title
POWER SINGLE LINE DIAGRAM



FIRE ALARM SEQUENCE OF OPERATION MATRIX

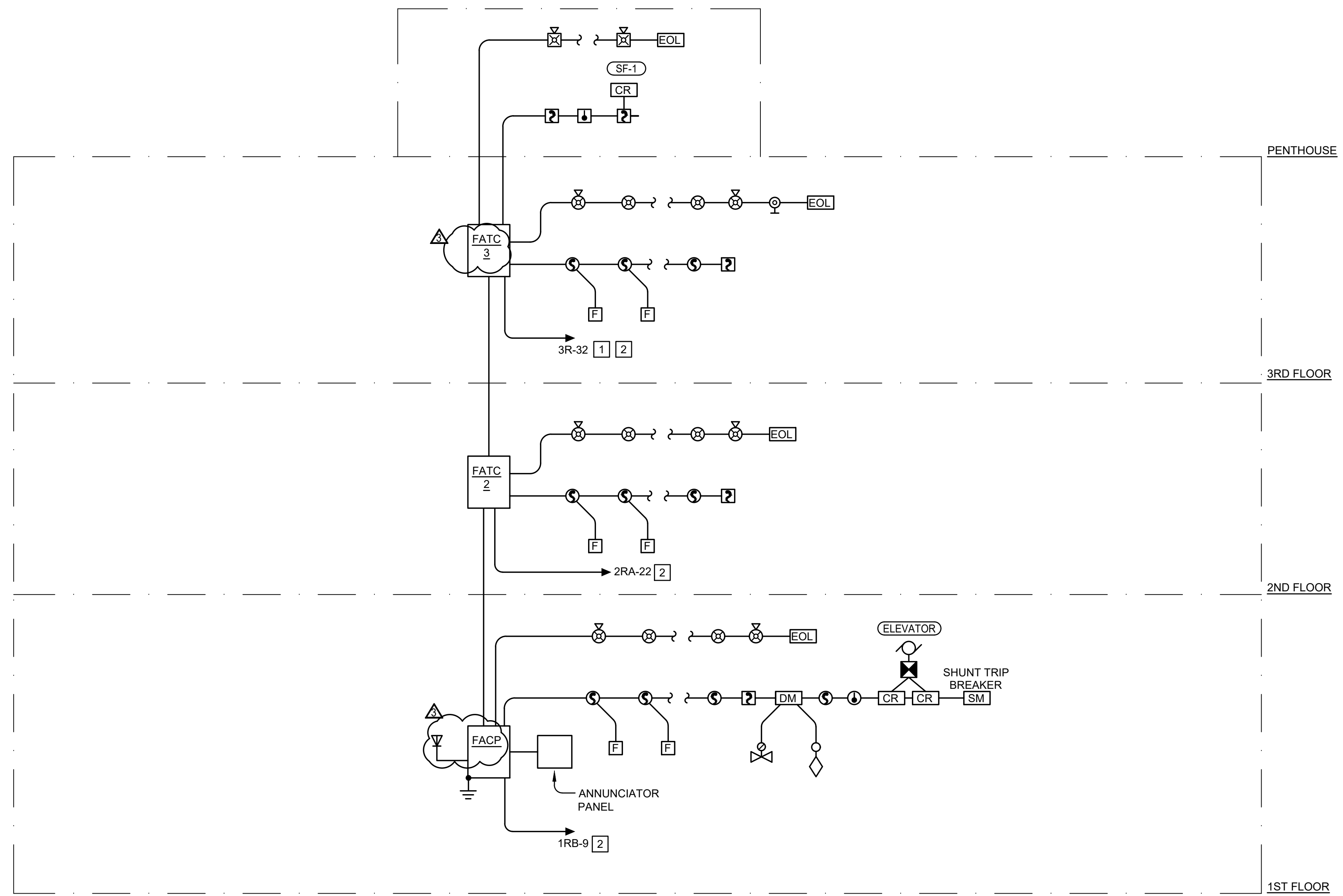
SYSTEM OPERATION INPUT SIGNALS AND OUTPUT FUNCTIONS	SYSTEM OUTPUTS		FACP ANNUNCIATION				NOTIFICATION				EQUIPMENT CONTROLLED				
	ACTIVATE ALARM SIGNAL INDICATOR (RED LED)	ACTIVATE ALARM SIGNAL AUDIBLE (BUZZER)	ACTIVATE TROUBLE SIGNAL INDICATOR (AMBER LED)	ACTIVATE TROUBLE SIGNAL AUDIBLE (BUZZER)	ACTIVATE SUPERVISORY SIGNAL INDICATOR (AMBER LED)	ACTIVATE SUPERVISORY SIGNAL AUDIBLE (BUZZER)	INDICATE INPUT SIGNAL ON LCD DISPLAY	ACTIVATE INDICATORS ON FAN & DAMPER CONTROL PANEL	ACTIVATE AUDIBLE & VISUAL EVACUATION FOR BUILDING	TRANSMIT ALARM SIGNAL TO REMOTE ANNUNCIATOR	TRANSMIT TROUBLE SIGNAL TO REMOTE ANNUNCIATOR	TRANSMIT SUPERVISORY SIGNAL TO REMOTE ANNUNCIATOR	TRANSMIT ALARM SIGNAL TO MONITORING COMPANY	TRANSMIT TROUBLE SIGNAL TO MONITORING COMPANY	TRANSMIT SUPERVISORY SIGNAL TO MONITORING COMPANY
MANUAL PULL STATION	●	●					●	●	●	●	●	●	●	●	
AREA SMOKE DETECTOR	●	●					●	●	●	●	●	●	●	●	
AREA HEAT DETECTOR	●	●					●	●	●	●	●	●	●	●	
ELEVATOR INTERFACE INPUTS:															
LOBBY SMOKE DETECTOR, EXCEPT 1ST FLR	●	●					●	●	●	●	●	●	●	●	
LOBBY SMOKE DETECTOR @ 1ST FLR	●	●					●	●	●	●	●	●	●	●	
MACHINE ROOM SMOKE DETECTOR	●	●					●	●	●	●	●	●	●	●	
ELEVATOR SHAFT SMOKE DETECTOR	●	●					●	●	●	●	●	●	●	●	
MACHINE ROOM HEAT DETECTOR	●	●					●	●	●	●	●	●	●	●	
ELEVATOR SHAFT HEAT DETECTOR	●	●					●	●	●	●	●	●	●	●	
DUCT-MTD SMOKE DETECTOR @ HVAC UNIT					●	●						●			
SURFACE PLENUM SMOKE DETECTOR @ FSD					●	●						●			
WATERFLOW SWITCH	●	●					●	●	●	●	●	●	●	●	
VALVE TAMPER SWITCH					●	●						●			
POST INDICATING VALVE					●	●						●			
INITIATING CIRCUIT:															
OPEN WIRE			●	●			●					●			
GROUND WIRE			●	●			●					●			
SHORTED WIRES	●	●					●		●	●	●	●	●	●	
NOTIFICATION CIRCUIT:															
OPEN WIRE			●	●			●					●			
GROUND WIRE			●	●			●					●			
SHORTED WIRES			●	●			●					●			
SIGNALING LINE CIRCUIT:															
OPEN WIRE			●	●			●					●			
GROUND WIRE			●	●			●					●			
WIRE TO WIRE SHORT & OPEN			●	●			●					●			
WIRE TO WIRE SHORT & GROUND			●	●			●					●			
OPEN & GROUND			●	●			●					●			
LOSS OF CARRIER			●	●			●					●			
POWER DISCONNECT SUPERVISION					●	●					●				
FIRE ALARM SYSTEM LOW BATTERY			●	●			●					●			●

GENERAL SHEET NOTES

- NOT ALL EQUIPMENT HAS BEEN SHOWN ON THIS RISER DIAGRAM. THIS DRAWING IS MAINLY TO ILLUSTRATE THE GENERAL RISER CONFIGURATION WITHIN THE BUILDING AND CONNECTIONS TO CABINETS AND PANELS.
- REFER TO ELECTRICAL SPECIFICATIONS FOR MORE DETAILED DESCRIPTION OF THE SYSTEM AND EQUIPMENT REQUIREMENTS.

NUMBERED SHEET NOTES

- REUSE EXISTING BRANCH CIRCUIT FROM OLD FACP BEING REPLACED.
- CIRCUIT BREAKER FEEDING FIRE ALARM CONTROL PANEL(S) SHALL BE RED IN COLOR. REPLACE BREAKER WITH NEW IF NECESSARY.



A FIRE ALARM RISER DIAGRAM

N.T.S.

EAST PALO ALTO GOVERNMENT CENTER

2415 University Ave.
East Palo Alto, CA 94303

APR: 063-103-370

Issue

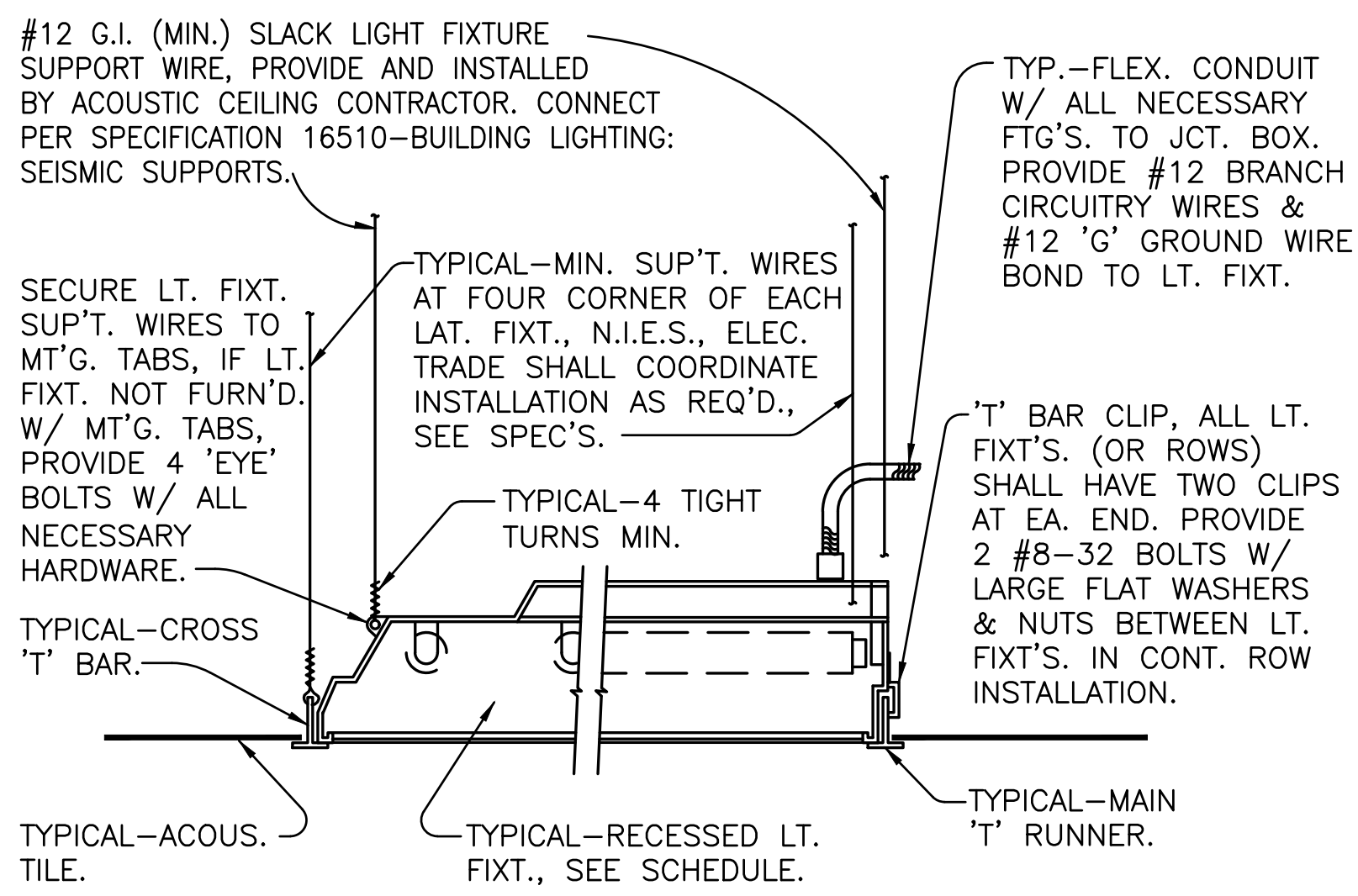
Rev Date By Description

3 10/24/22 PERMIT SUBMITTAL

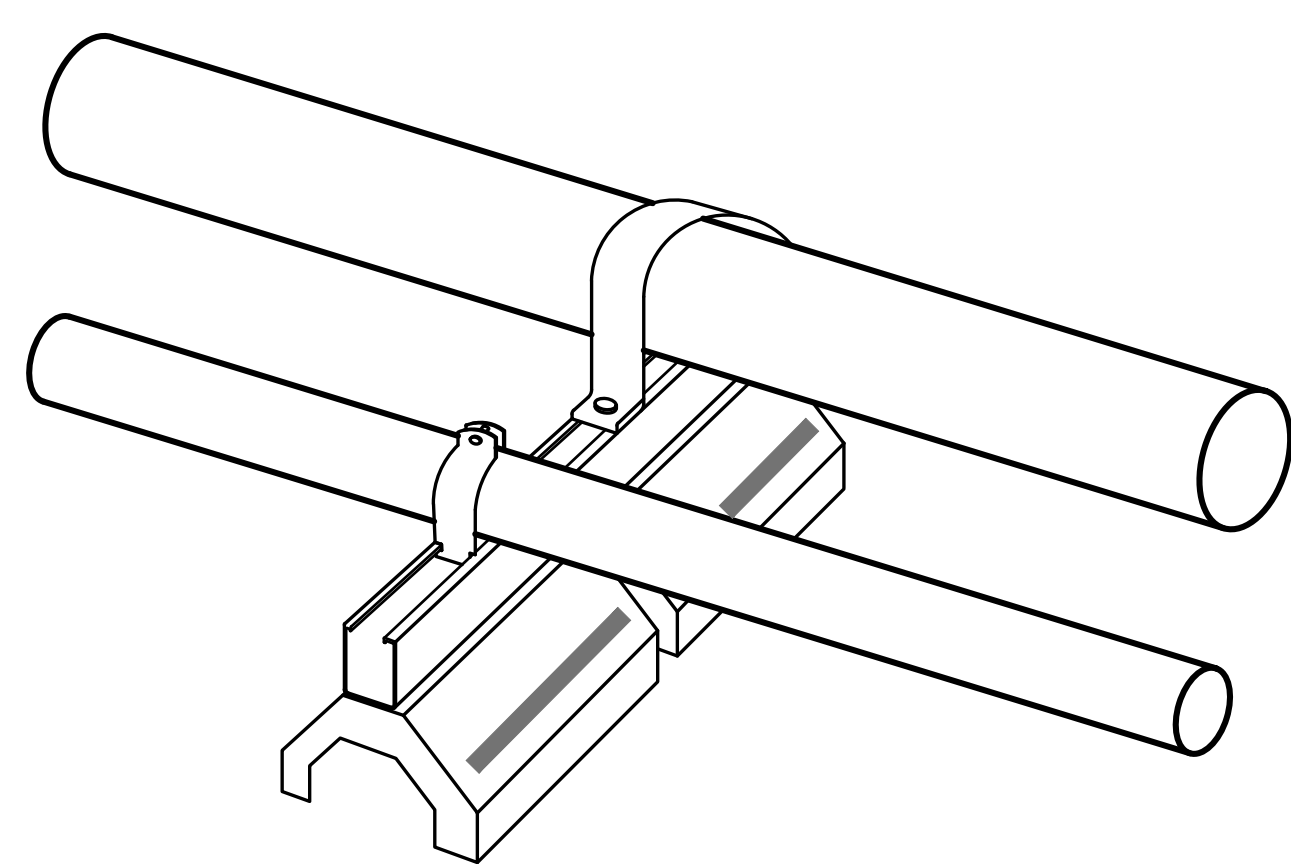
ADDENDUM #3

E5.02

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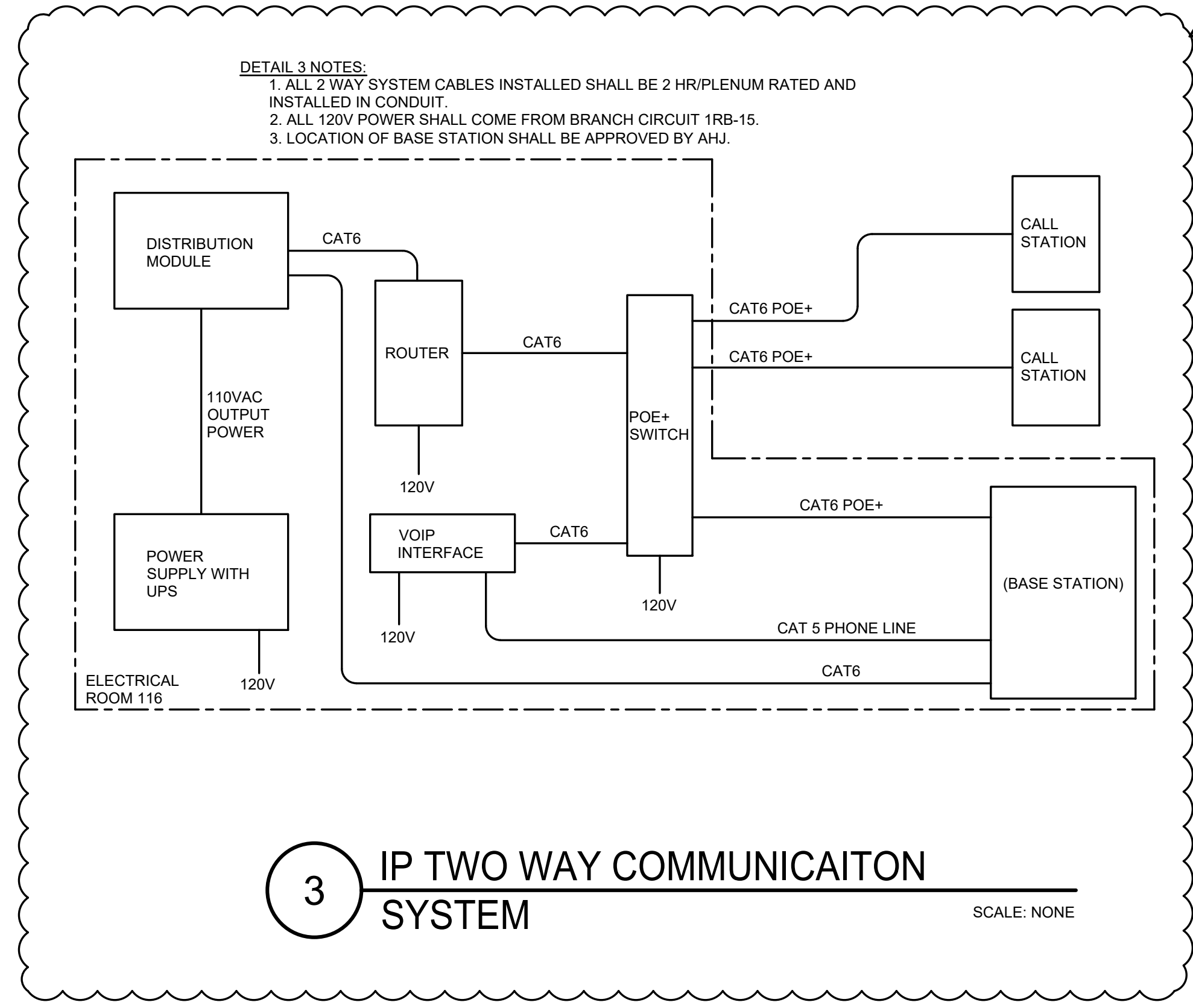


1 RECESSED LIGHT FIXTURE ON T-BAR MOUNTING DETAIL (N.T.S.)

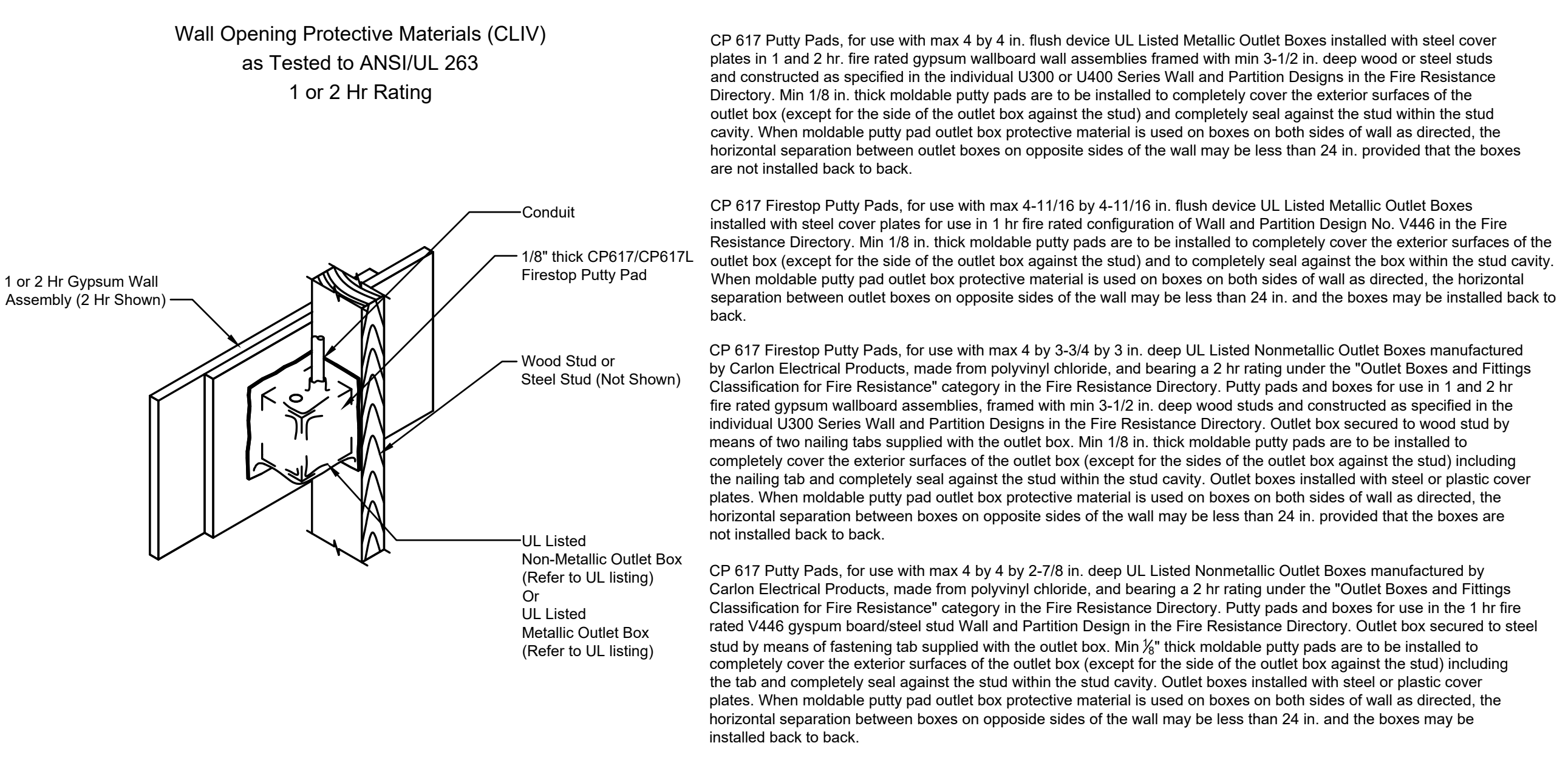


- NOTES:
- BASE WITH 12 ga. GALVANIZED CHANNEL 2 7/16" TALL, DURA-BLOCK #DB620: 6 7/16" X 6" X 20.2".
 - 100% RECYCLED RUBBER, UV RESISTANT.
 - LOAD RATING - ULTIMATE UNIFORM LOAD, 1000 LBS.
 - CHANNEL SUPPORT IS DESIGNED FOR SUPPORT OF CONDUIT SYSTEMS, CABLE TRAY SYSTEMS AND CABLE TRAY. SHALL BE UV RESISTANT AND SUITABLE FOR INSTALLATION ON ANY TYPE OF ROOFING MATERIAL OR OTHER FLOAT SURFACES.

2 ROOF PIPE SUPPORT BASE WITH B12 CHANNEL SCALE: NONE



3 IP TWO WAY COMMUNICAITON SYSTEM SCALE: NONE



4 OUTLET BOX AT FIRE RATED WALL (N.T.S.)

CP 617 Firestop Putty Pads, for use with max 4 by 4 in. flush device UL Listed Metallic Outlet Boxes installed with steel cover plates in 1 and 2 hr fire rated gypsum wallboard wall assemblies framed with min 3-1/2 in. deep wood or steel studs and constructed as specified in the individual U300 or U400 Series Wall and Partition Designs in the Fire Resistance Directory. Min 1/8 in. thick moldable putty pads are to be installed to completely cover the exterior surfaces of the outlet box (except for the side of the outlet box against the stud) and completely seal against the stud within the stud cavity. When moldable putty pad outlet box protective material is used on boxes on both sides of wall as directed, the horizontal separation between outlet boxes on opposite sides of the wall may be less than 24 in. provided that the boxes are not installed back to back.

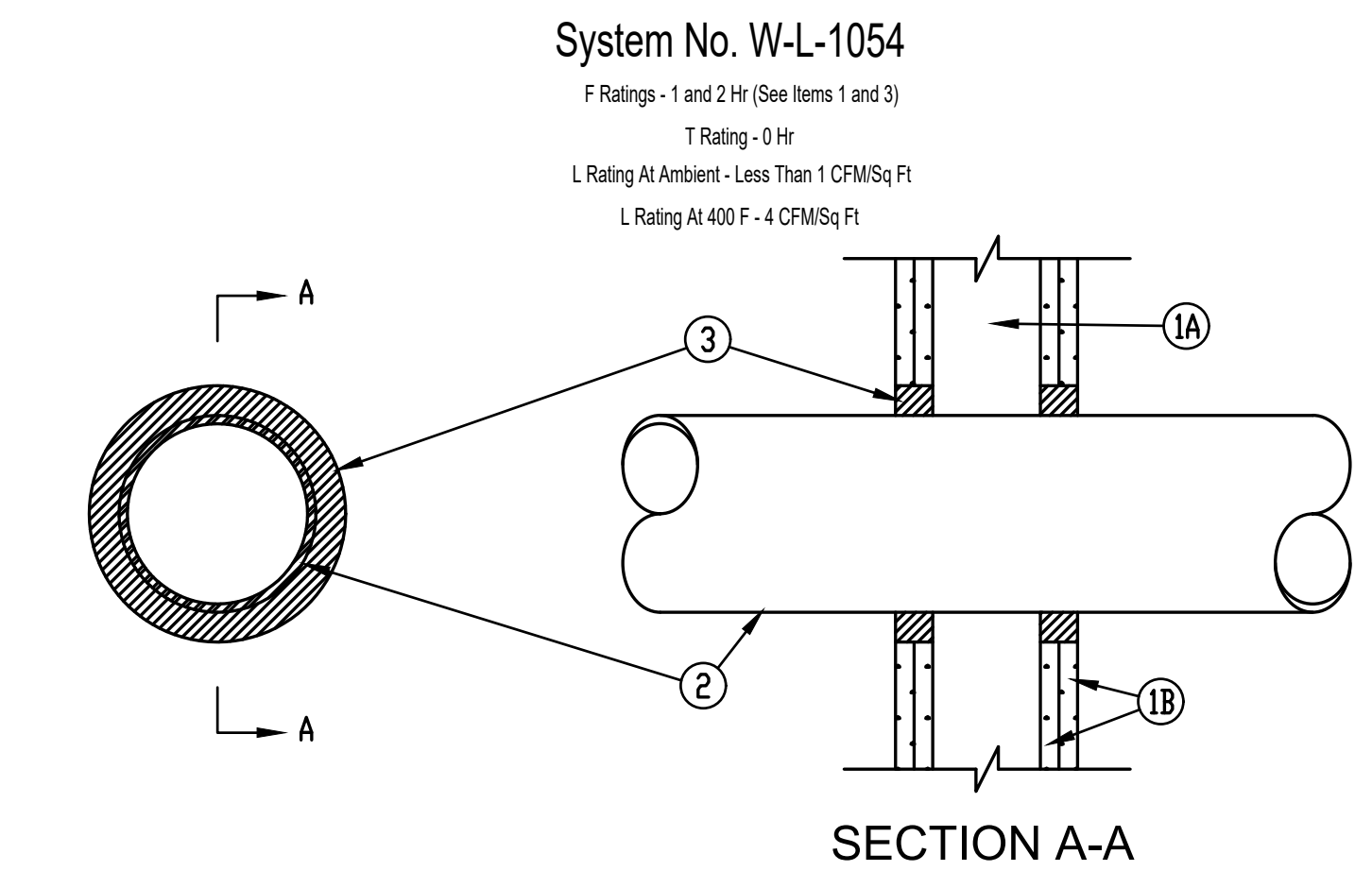
CP 617 Firestop Putty Pads, for use with max 4-11/16 by 4-11/16 in. flush device UL Listed Metallic Outlet Boxes installed with steel cover plates for use in 1 hr fire rated configuration of Wall and Partition Design No. V446 in the Fire Resistance Directory. Min 1/8 in. thick moldable putty pads are to be installed to completely cover the exterior surfaces of the outlet box (except for the side of the outlet box against the stud) and to completely seal against the box within the stud cavity. When moldable putty pad outlet box protective material is used on boxes on both sides of wall as directed, the horizontal separation between outlet boxes on opposite sides of the wall may be less than 24 in. and the boxes may be installed back to back.

CP 617 Firestop Putty Pads, for use with max 4 by 3-3/4 by 3 in. deep UL Listed Nonmetallic Outlet Boxes manufactured by Allied Molded Products, Inc., made from fiber reinforced thermoplastic and bearing a 2 hr rating under the "Outlet Boxes and Fittings Classification for Fire Resistance" category in the Fire Resistance Directory. Putty pads and boxes for use in 1 hr fire rated gypsum wallboard assemblies, framed with min 3-1/2 in. deep wood studs and constructed as specified in the individual U300 Series Wall and Partition Designs in the Fire Resistance Directory. Outlet box secured to wood stud by means of two nailing tabs supplied with the outlet box. Min 1/8 in. thick moldable putty pads are to be installed to completely cover the exterior surfaces of the outlet box (except for the sides of the outlet box against the stud) including the nailing tabs and completely seal against the stud within the stud cavity. Outlet boxes installed with steel or plastic cover plates. When moldable putty pad outlet box protective material is used on boxes on both sides of wall as directed, the horizontal separation between boxes on opposite sides of the wall may be less than 24 in. provided that the boxes are not installed back to back.

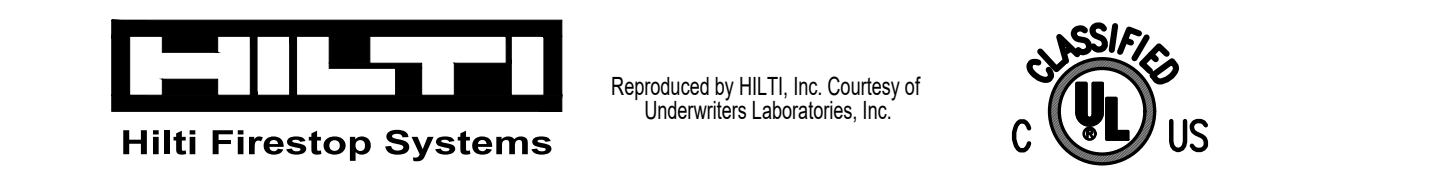
CP 617 Firestop Putty Pads, for use with max 4 by 3-3/4 by 3 in. deep UL Listed Nonmetallic Outlet Boxes manufactured by Hilti Firestop Systems, made from poly(vinyl chloride), and bearing a 2 hr rating under the "Outlet Boxes and Fittings Classification for Fire Resistance" category in the Fire Resistance Directory. Putty pads and boxes for use in the 1 hr fire rated V446 gypsum board/steel stud Wall and Partition Design in the Fire Resistance Directory. Outlet box secured to steel stud by means of fastening tab supplied with the outlet box. Min 1/8" thick moldable putty pads are to be installed to completely cover the exterior surfaces of the outlet box (except for the side of the outlet box against the stud) including the tab and completely seal against the stud within the stud cavity. Outlet boxes installed with steel or plastic cover plates. When moldable putty pad outlet box protective material is used on boxes on both sides of wall as directed, the horizontal separation between boxes on opposite sides of the wall may be less than 24 in. and the boxes may be installed back to back.

(N.T.S.)

5 FIRE STOP SYSTEMS (N.T.S.)



- Wall Assembly -- The 1 or 2 hr fire-rated gypsum wallboard/stud wall assembly shall be constructed of the materials and in the manner specified in the individual U300 or U400 Series Wall and Partition Designs in the UL Fire Resistance Directory and shall include the following construction features:
 - Studs -- Wall framing may consist of either wood studs or steel channel studs. Wood studs to consist of nom 2 1/4 in. x 4 in. spaced 16 in. OC. Steel studs to be min 2-1/2 in. wide and spaced max 24 in. OC. When steel studs are used and the diam of opening exceeds the width of stud cavity, the opening shall be framed on all sides using lengths of steel stud installed between the vertical studs and screw-attached to the steel studs at each end. The framed opening in the wall shall be 4 to 6 in. wider and 4 to 6 in. higher than the diam of the penetrating item such that, when the penetrating item is installed in the opening, a 2 to 3 in. clearance is present between the penetrating item and the framing on all four sides.
 - Gypsum Board -- 5/8 in. thick, 4 ft wide with square or tapered edges. The gypsum board type, thickness, number of layers, fastener type and sheet orientation shall be as specified in the individual U300 or U400 Series Design in the UL Fire Resistance Directory. Max diam of opening is 32-1/4 in. for steel stud walls. Max diam of opening is 14-1/2 in. for wood stud walls. The F Rating of the firestop system is equal to the fire rating of the wall assembly.
- Through-Penetrants -- One metallic pipe, conduit or tubing to be installed either concentrically or eccentrically within the firestop system. The annular space shall be min 0 in. to max 2-1/4 in. Pipe may be installed with continuous point contact. Pipe, conduit or tubing may be installed at an angle not greater than 45 degrees from perpendicular. Pipe, conduit or tubing to be rigidly supported on both sides of wall assembly. The following types and sizes of metallic pipes, conduits or tubing may be used:
 - Steel Pipe -- Nom 30 in diam (or smaller) Schedule 10 (or heavier) steel pipe.
 - Iron Pipe -- Nom 30 in diam (or smaller) cast or ductile iron pipe.
 - Conduit -- Nom 4 in diam (or smaller) steel electrical metallic tubing or 6 in. diam steel conduit.
 - Copper Tubing -- Nom 6 in. diam (or smaller) Type L (or heavier) copper tubing.
 - Copper Pipe -- Nom 6 in. diam (or smaller) regular (or heavier) copper pipe.
- Fill, Void or Cavity Material -- Sealant -- Min 1/8 in. thickness of fill material applied within the annulus, flush with both surfaces of wall. At the point or continuous contact locations between pipe and wall, a min 1/2 in. diam bead of fill material shall be applied at the pipe wall interface on both surfaces of wall.
 - HILTI CONSTRUCTION CHEMICALS, DIV OF HILTI INC -- FS-One Sealant
 - *Bearing the UL Classification Mark



(N.T.S.)

