

RIVERSIDE COUNTY REGIONAL MEDICAL CENTER  
ED REMODEL  
MORENO VALLEY, CALIFORNIA

3.3 FIRESTOPPING

- A. Apply firestopping to electrical penetrations of fire rated floor and wall assemblies to maintain fire-resistance rating of the assembly. Firestopping materials and installation requirements are specified in Division 7 section "Firestopping".

3.4 PAINTING

- A. Items furnished under this Division that are scratched or marred in shipment or installation shall be refinished with touchup paint selected to match installed equipment finish.

3.5 EQUIPMENT CONNECTION

- A. For equipment furnished under this or other Divisions of the specifications, or by owner, provide complete all electrical connections necessary to serve such equipment and provide required control connections to all equipment so that the equipment is fully operational upon completion of the project. Provide disconnect switch as required by code whenever an equipment connection is shown on the drawings.
- B. Investigate existing equipment to be relocated and provide new connections as required.

3.6 CLEAN UP

- A. Contractor shall continually remove debris, cuttings, crates, cartons, etc., created by his work. Such clean up shall be done daily and at sufficient frequency to eliminate hazard to the public, other workmen, the building or the Owner's employees. Before acceptance of the installation, Contractor shall carefully clean cabinets, panels, lighting fixtures, wiring devices, cover plates, etc., to remove dirt, cuttings, paint, plaster, mortar, concrete, etc. Blemishes to finished surfaces of apparatus shall be removed and new finish equal to the original applied.
  - 1. Wipe surfaces of electrical equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.

3.7 TESTING AND DEMONSTRATION

- A. Demonstrate that all electrical equipment operates as specified and in accordance with manufacturer's instructions. Perform tests in the presence of the Architect, Owner or Engineer. Provide all instruments, manufacturer's operating instructions and personnel required to conduct the tests. Repair or replace any electrical equipment that fails to operate as specified and or in accordance with manufacturer's requirements.

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SPARLING ELECTRICAL JOB COMPLETION FORM

PROJECT NAME: RIVERSIDE COUNTY REGIONAL MEDICAL CENTER ED EXPANSION  
 PROJECT LOCATION: \_\_\_\_\_  
 DATE: \_\_\_\_\_

A. Electrical Inspectors Final Acceptance (Copy of certificate attached.)

	Name	Agency	Date
B.	Fire Marshal's Final Acceptance of Fire Alarm System (Copy of certificate attached.)		

	Name	Agency	Date
C.	The following systems have been demonstrated to Owner's representative.		
1.	Access Control	Owner's Rep.	Date
2.	Video Surveillance	Owner's Rep	Date

D. Record Drawings  
 Attached Transmitted previously to \_\_\_\_\_  
Date

E. O & M Manuals  
 Attached Transmitted previously to \_\_\_\_\_

F. Test Reports  
 Attached Transmitted previously to \_\_\_\_\_  
Date

G. The work is complete in accordance with contract documents and authorized changes except for \_\_\_\_\_  
 \_\_\_\_\_ and the architect/engineer's representative is requested to meet with  
 \_\_\_\_\_ at \_\_\_\_\_ on \_\_\_\_\_  
 Supervisor of Electrical Work Time Date  
 \_\_\_\_\_  
 Contractors Rep. Signature Date

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**SPARLING SCHEDULE OF VALUES FOR HOAG HOSPITAL ED EXPANSION**

Description of Work	Amount
Device Rough-in (boxes and raceways) - Labor and Materials	
Circuit Conductors - Labor and Materials	
Access Control System - Labor and Materials	
Video Surveillance - Labor and Materials	
Fire Detection and Alarm - Labor and Materials	
Testing, Demonstration (AHJ approvals)	
Training	
Close Out (Record Drawings, O&M, etc.) - Materials & Labor	
<b>TOTAL DIVISION 28</b>	

**SPARLING SUBMITTAL LIST HOAG HOSPITAL ED EXPANSION**

SECTION	DESCRIPTION	SUBMIT RECEIVE DATE	STATUS
28 0500	COMMON WORKS RESULTS FOR ELECTRONIC SAFETY AND SECURITY		
28 1300	ACCESS CONTROL		
28 2300	VIDEO SURVEILLANCE		

END OF SECTION 28 0500

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SECTION 28 0513

CONDUCTORS AND CABLES FOR ELECTRONIC SAFETY AND SECURITY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
  - 1. RS-232 cabling.
  - 2. RS-485 cabling.
  - 3. Low-voltage control cabling.
  - 4. Control-circuit conductors.
  - 5. Fire alarm wire and cable.
  - 6. Identification products.

1.3 DEFINITIONS

- A. Basket Cable Tray: A fabricated structure consisting of wire mesh bottom and side rails.
- B. BICSI: Building Industry Consulting Service International.
- C. Channel Cable Tray: A fabricated structure consisting of a one-piece, ventilated-bottom or solid-bottom channel section.
- D. EMI: Electromagnetic interference.
- E. IDC: Insulation displacement connector.
- F. Ladder Cable Tray: A fabricated structure consisting of two longitudinal side rails connected by individual transverse members (rungs).
- G. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control and signaling power-limited circuits.
- H. Open Cabling: Passing telecommunications cabling through open space (e.g., between the studs of a wall cavity).

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- I. RCDD: Registered Communications Distribution Designer.
- J. Solid-Bottom or Non-ventilated Cable Tray: A fabricated structure consisting of integral or separate longitudinal side rails, and a bottom without ventilation openings.
- K. Trough or Ventilated Cable Tray: A fabricated structure consisting of integral or separate longitudinal rails and a bottom having openings sufficient for the passage of air and using 75 percent or less of the plan area of the surface to support cables.
- L. UTP: Unshielded twisted pair.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
  - 1. For cable, include the following installation data for each type used:
    - a. Nominal OD.
    - b. Minimum bending radius.
    - c. Maximum pulling tension.
- B. Shop Drawings:
  - 1. Conduits and back boxes
  - 2. Wall and rack elevations for all equipment installed in the IDF rooms including power requirements and hook ups.
- C. Qualification Data: For qualified layout technician, installation supervisor, and field inspector.
- D. Source quality-control reports.
- E. Field quality-control reports.
- F. Maintenance Data: For wire and cable to include in maintenance manuals.

1.5 QUALITY ASSURANCE

- A. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
  - 1. Flame-Spread Index: 25 or less.
  - 2. Smoke-Developed Index: 50 or less.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

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PART 2 - PRODUCTS

2.1 FIRE ALARM WIRE AND CABLE

- A. Manufacturers: Subject to compliance with requirements of contract Documents as judged by the Security Design Engineer, provide by one of the manufactures listed. If note listed, submit as substitution according to conditions of the Contract and Division 01 Section "Substitution Procedures".
1. Comtran Corp.
  2. Draka USA.
  3. Genesis Cable Products; Honeywell International, Inc.
  4. Rockbestos-Suprenant Cable Corporation.
  5. West Penn Wire/CDT; a division of Cable Design Technologies.
- B. General Wire and Cable Requirements: NRTL listed and labeled as complying with NFPA 70, Article 760.
- C. Signaling Line Circuits: Twisted, shielded pair.
1. Circuit Integrity Cable: Twisted shielded pair, NFPA 70, Article 760, Classification CI, for power-limited fire alarm signal service Type FPL. NRTL listed and labeled as complying with UL 1424 and UL 2196 for a 2-hour rating.
- D. Non-Power-Limited Circuits: Solid-copper conductors with 600-V rated, 75 deg C, color-coded insulation.
1. Low-Voltage Circuits: No. 16 AWG, minimum.
  2. Line-Voltage Circuits: No. 12 AWG, minimum.

2.2 IDENTIFICATION PRODUCTS

- A. Manufacturers:
1. Brady Corporation
  2. HellermannTyton.
  3. Kroy LLC.
  4. Panduit Corp.
- B. Comply with UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.
- C. Comply with requirements in Section 260553 Identification for Electrical Systems.

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PART 3 - EXECUTION

3.1 INSTALLATION OF PATHWAYS

- A. Comply with requirements in Division 26 Section "Raceway and Boxes for Electrical Systems." for installation of conduits and wireways.
- B. Install manufactured conduit sweeps and long-radius elbows whenever possible.
- C. Install metal conduits with grounding bushings and connect with grounding conductor to grounding system.

3.2 FIRE ALARM WIRING INSTALLATION

- A. Comply with NECA 1 and NFPA 72.
- B. Wiring Method: Install wiring in metal raceway according to Section 260533 Raceway and Boxes for Electrical Systems.
  - 1. Install plenum cable in environmental air spaces, including plenum ceilings.
  - 2. Fire alarm circuits and equipment control wiring associated with the fire alarm system shall be installed in a dedicated raceway system. This system shall not be used for any other wire or cable.
- C. Wiring Method:
  - 1. Cables and raceways used for fire alarm circuits, and equipment control wiring associated with the fire alarm system, may not contain any other wire or cable.
  - 2. Fire-Rated Cables: Use of 2-hour, fire-rated fire alarm cables, NFPA 70, Types MI and CI, is permitted.
  - 3. Signaling Line Circuits: Power-limited fire alarm cables may be installed in the same cable or raceway as signaling line circuits.
- D. Wiring within Enclosures: Separate power-limited and non-power-limited conductors as recommended by manufacturer. Install conductors parallel with or at right angles to sides and back of the enclosure. Bundle, lace, and train conductors to terminal points with no excess. Connect conductors that are terminated, spliced, or interrupted in any enclosure associated with the fire alarm system to terminal blocks. Mark each terminal according to the system's wiring diagrams. Make all connections with approved crimp-on terminal spade lugs, pressure-type terminal blocks, or plug connectors.
- E. Cable Taps: Use numbered terminal strips in junction, pull, and outlet boxes, cabinets, or equipment enclosures where circuit connections are made.
- F. Color-Coding: Color-code fire alarm conductors differently from the normal building power wiring. Use one color-code for alarm circuit wiring and another for supervisory

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circuits. Color-code audible alarm-indicating circuits differently from alarm-initiating circuits. Use different colors for visible alarm-indicating devices. Paint fire alarm system junction boxes and covers red.

- G. Risers: Install at least two vertical cable risers to serve the fire alarm system. Separate risers in close proximity to each other with a minimum one-hour-rated wall, so the loss of one riser does not prevent the receipt or transmission of signals from other floors or zones.
- H. Wiring to Remote Alarm Transmitting Device: 1-inch (25-mm) conduit between the fire alarm control panel and the transmitter. Install number of conductors and electrical supervision for connecting wiring as needed to suit monitoring function.

### 3.3 CONTROL-CIRCUIT CONDUCTORS

#### A. Minimum Conductor Sizes:

- 1. Class 1 remote-control and signal circuits, No. 14 AWG.
- 2. Class 2 low-energy, remote-control and signal circuits, No. 16 AWG.
- 3. Class 3 low-energy, remote-control, alarm and signal circuits, No. 12 AWG.

### 3.4 CONNECTIONS

- A. Comply with requirements in Section 28 1300 Access Control for connecting, terminating, and identifying wires and cables.
- B. Comply with requirements in Section 28 2300 Video Surveillance for connecting, terminating, and identifying wires and cables.
- C. Comply with requirements in Division 28 Section "PLC Electronic Detention Monitoring and Control Systems" for connecting, terminating, and identifying wires and cables.
- D. Comply with requirements in Division 28 Section "Fire Detection and Alarm" for connecting, terminating, and identifying wires and cables.

### 3.5 FIRESTOPPING

- A. Comply with requirements in Division 07 Penetration Firestopping.
- B. Comply with TIA/EIA-569-A, Firestopping Annex A.
- C. Comply with BICSI TDMM, "Firestopping Systems" Article.

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3.6 GROUNDING

- A. For communications wiring, comply with EIA/TIA-607-B and with BICSI TDMM, "Grounding, Bonding, and Electrical Protection" Chapter.
- B. For low-voltage wiring and cabling, comply with requirements in Division 26 Section "Grounding and Bonding for Electrical Systems."

3.7 IDENTIFICATION

- A. Identify system components, wiring, and cabling complying with TIA/EIA-606-B. Comply with requirements for identification specified in Section 26 0553 Identification for Electrical Systems.

3.8 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. End-to-end cabling will be considered defective if it does not pass tests and inspections.
- C. Prepare test and inspection reports.

END OF SECTION 28 0513

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SECTION 28 0526

GROUNDING AND BONDING FOR ELECTRONIC SAFETY AND SECURITY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
  - 1. Grounding conductors.
  - 2. Grounding connectors.
  - 3. Grounding busbars.

1.3 DEFINITIONS

- A. Signal Ground: The ground reference point designated by manufacturer of the system that is considered to have zero voltage.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 CONDUCTORS

- A. Manufacturers: Subject to compliance with requirements,
  - 1. Harger Lightning and Grounding.
  - 2. Panduit Corp.
  - 3. Tyco Electronics Corp.
  - 4. Or approved equivalent
- B. Comply with UL 486A-486B.

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- C. Insulated Conductors: Stranded copper wire, green or green with yellow stripe insulation, insulated for 600 V, and complying with UL 83.
  - 1. Ground wire for custom-length equipment ground jumpers shall be No. 6 AWG, 19-strand, UL-listed, Type THHN wire.
- D. Bare Copper Conductors:
  - 1. Solid Conductors: ASTM B 3.
  - 2. Stranded Conductors: ASTM B 8.
  - 3. Tinned Conductors: ASTM B 33.
  - 4. Bonding Cable: 28 kcmils (14.2 sq. mm), 14 strands of No. 17 AWG conductor, and 1/4 inch (6.3 mm) in diameter.
  - 5. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
  - 6. Bonding Jumper: Tinned-copper tape, braided conductors terminated with two-hole copper ferrules; 1-5/8 inches (41 mm) wide and 1/16 inch (1.6 mm) thick.

## 2.2 CONNECTORS

- A. Irreversible connectors listed for the purpose. Listed by an NRTL as complying with NFPA 70 for specific types, sizes, and combinations of conductors and other items connected. Comply with UL 486A-486B.
- B. Manufacturers: Subject to compliance with requirements of contract Documents as judged by the Security Design Engineer, provide by one of the manufactures listed. If note listed, submit as substitution according to conditions of the Contract and Division 01 Section "Substitution Procedures".
- C. Basis-of-Design Product: Subject to compliance with requirements, provide or comparable product by one of the following:
  - 1. Burndy; Part of Hubbell Electrical Systems.
  - 2. Chatsworth Products, Inc.
  - 3. Harger Lightning and Grounding.
  - 4. Panduit Corp.
  - 5. Tyco Electronics Corp.
  - 6. Or approved equivalent
- D. Compression Wire Connectors: Crimp-and-compress connectors that bond to the conductor when the connector is compressed around the conductor. Comply with UL 467.
  - 1. Electroplated tinned copper, C and H shaped.
- E. Busbar Connectors: Cast silicon bronze, solderless type mechanical connector; with a long barrel and two holes spaced on 5/8- or 1-inch (15.8- or 25.4-mm) centers for a two-bolt connection to the busbar.

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- F. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

2.3 GROUNDING BUSBARS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following.
- B. Basis-of-Design Product: Subject to compliance with requirements, provide or comparable product by one of the following:
1. Burndy; Part of Hubbell Electrical Systems.
  2. Chatsworth Products, Inc.
  3. Harger Lightning and Grounding.
  4. Panduit Corp.
  5. Tyco Electronics Corp.
  6. Or approved equivalent
- C. Grounding Busbars: Predrilled rectangular bars of hard-drawn solid copper, 1/4 by 2 inches 6.3 by 50 mm) in cross section, length as indicated on Drawings. The busbar shall be for wall mounting, shall be NRTL listed as complying with UL 467, and shall comply with J-STD-607-B.
1. Predrilling shall be with holes for use with lugs specified in this Section.
  2. Mounting Hardware: Stand-off brackets that provide at least a 2-inch (50-mm clearance to access the rear of the busbar. Brackets and bolts shall be stainless steel.)
  3. Stand-off insulators for mounting shall be Lexan or PVC. Comply with UL 891 for use in 600 V switchboards, impulse tested at 5000 V.
- D. Rack and Cabinet Grounding Busbars: Rectangular bars of hard-drawn solid copper, accepting conductors ranging from No. 14 to No. 2/0 AWG, NRTL listed as complying with UL 467, and complying with J-STD-607-B. Predrilling shall be with holes for use with lugs specified in this Section.
1. Cabinet-Mounted Busbar: Terminal block, with stainless-steel or copper-plated hardware for attachment to the cabinet.
  2. Rack-Mounted Horizontal Busbar: Designed for mounting in 19- (483- mm) equipment racks. Include a copper splice bar for transitioning to an adjoining rack, and stainless-steel or copper-plated hardware for attachment to the rack.
  3. Rack-Mounted Vertical Busbar: 72 or 36 inches (1827 or 914 mm long, with) stainless-steel or copper-plated hardware for attachment to the rack.

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PART 3 - EXECUTION

3.1 INSTALLATION

- A. Comply with IEEE 1100, "Recommended Practice for Power and Grounding Electronic Equipment."
  - 1. Ground cable shields, drain conductors, and equipment to eliminate shock hazard and to minimize ground loops, common-mode returns, noise pickup, cross talk, and other impairments.
  - 2. Bond shields and drain conductors to ground at only one point in each circuit.
- B. Signal Ground:
  - 1. For each system, establish the signal ground and label that location as such.
  - 2. Bond the signal ground to the alternating-current (ac) power system service by connecting to one of the following listed locations, using insulated No. 6 AWG, stranded, Type THHN wire:
    - a. Grounding bar in an electrical power panelboard if located in the same room or space as the signal ground.
    - b. Telecommunications grounding busbar.
- C. Comply with NECA 1.

3.2 APPLICATION

- A. Conductors: Install solid conductor for No. 8 AWG and smaller and stranded conductors for No. 6 AWG and larger unless otherwise indicated.
- B. Grounding and Bonding Conductors:
  - 1. Install in the straightest and shortest route between the origination and termination point, and no longer than required. The bend radius shall not be smaller than eight times the diameter of the conductor. No one bend may exceed 90 degrees.
  - 2. Install without splices.
  - 3. Support at not more than 36-inch (900-mm) intervals.

3.3 CONNECTIONS

- A. Stacking of conductors under a single bolt is not permitted when connecting to busbars.

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- B. Assemble the wire connector to the conductor, complying with manufacturer's written instructions and as follows:
  - 1. Use crimping tool and the die specific to the connector.
  - 2. Pre-twist the conductor.
  - 3. Apply an antioxidant compound to all bolted and compression connections.
- C. Shielded Cable: Bond the shield of shielded cable to the signal ground. Comply with TIA/EIA-568-C and TIA/EIA-568-C when grounding screened, balanced, twisted-pair cables.
- D. Rack- and Cabinet-Mounted Equipment: Bond powered equipment chassis to the cabinet or rack grounding bar. Power connection shall comply with NFPA 70; the equipment grounding conductor in the power cord of cord- and plug-connected equipment shall be considered as a supplement to bonding requirements in this Section.

3.4 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Tests and Inspections:
  - 1. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.
- C. Grounding system will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports.

END OF SECTION 28 0526

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SECTION 28 0533

RACEWAYS AND BOXES FOR ELECTRONIC SAFETY AND SECURITY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 in Volume 1 of Package 6 and Volume 0, apply to this Section.
- B. Section 280500 - Common Work Results For Electronic Safety and Security

1.2 SUMMARY

- A. Section includes raceways, fittings, boxes, enclosures and cabinets for electrical wiring.
- B. Substitutions: Substitute products will be considered only under the terms and conditions of Section 280500 - Common Work Results For Electronic Safety and Security.

1.3 REFERENCES

- A. American National Standards Institute (ANSI)
- B. National Electrical Manufacturers Association (NEMA)
- C. Underwriters Laboratories, Inc. (UL)
- D. National Fire Protection Association (NFPA)

1.4 SUBMITTALS

- A. Make submittals in accordance with Section 280500 - Common Work Results For Electronic Safety and Security. Submit product data only for surface raceways and fittings, wireways, enclosures and cabinets.

1.5 COORDINATION

- A. Coordinate layout and installation of raceways and boxes with other construction elements to ensure adequate headroom, working clearance, and access.

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PART 2 - PRODUCTS

2.1 ELECTRIC METALLIC TUBING (EMT)

- A. Hot dip galvanized, electrogalvanized or sherardized, steel tubing, ANSI C80.3, UL 797.
- B. Fittings: NEMA FB1 UL 514B, steel or malleable iron, compression or set screw. Indentor, drive-on, die cast or pressure cast fittings not permitted.
- C. Conduit Bodies and Fittings Manufacturers: American Electric; Bridgeport, Construction Materials Group, Crouse-Hinds; Div. of Cooper Industries, Emerson Electric Co.; Appleton Electric Co., Hubbell, Inc.; Killark Electric Manufacturing Co., Lamson & Sessions; Carlon Electrical Products, O-Z/Gedney; Unit of General Signal, Scott Fetzer Co.; Adalet-PLM, Spring City Electrical Manufacturing Co., Link Seal, Thomas & Betts.

2.2 EXPANSION FITTINGS

- A. Malleable iron, hot dip galvanized allowing 4" (100mm) (+/- 2" (50mm)) conduit movement. OZ/Gedney AX Series or equivalent by manufacturer listed in 2.1.D.

2.3 RACEWAY PENETRATION SEALS

- A. Thruwall and Floor Seals: New construction - OZ/Gedney FSK Series. Existing construction - OZ/Gedney CSM Series or equivalent by manufacturer lists in 2.1.D.

2.4 OUTLET JUNCTION AND PULL BOXES

- A. Interior Wiring:
  - 1. Outlet and Pull Boxes. Pressed steel, zinc coated with plaster ring where applicable. NEMA OS1, UL 514A.
  - 2. Large Junction and Pull Boxes. Fabricated sheet steel, zinc coated or baked enamel finish, with return flange and screw retained cover.
  - 3. Concrete and Masonry. Specifically designed boxes for casting in concrete or mounting in masonry walls for that purpose.
  - 4. Mounting. Provide boxes with fan side box support Caddy J1A series or Caddy quick mount H series.



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PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine surfaces to receive raceways, boxes, enclosures, and cabinets for compliance with installation tolerances and other conditions affecting performance of raceway installation. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 WIRING METHODS

- A. Interior: Use the following wiring methods:
  - 1. Exposed: Electric Metallic Tubing.
  - 2. Concealed: Electric Metallic Tubing.
  - 3. Connection to Vibrating Equipment (including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): Flexible Metal Conduit, (except in wet or damp locations, use Liquidtight Flexible Metal Conduit) with 90° loop, maximum 6 feet long.

3.3 INSTALLATION

- A. Provide raceways concealed in construction unless noted otherwise or unless specifically authorized by the Architect.
- B. Install raceways level and square and at proper elevations. Provide not less than 6'-6" (200cm) headroom. Where raceways are installed in exit pathways provide not less than 7'-0" headroom. Do not block access to junction boxes, valves, mechanical equipment or prevent removal of ceiling panels, etc.
- C. Complete raceway installation before starting conductor installation.
- D. Use raceway fittings compatible with raceways and suitable for use and location.
- E. Install exposed raceways parallel to or at right angles to nearby surfaces or structural members and follow the surface contours.
  - 1. Run parallel or banked raceways together, on common supports where practical.
  - 2. Make bends in parallel or banked runs from same centerline to make bends parallel. Use factory elbows only where elbows can be installed parallel; otherwise, provide field bends for parallel raceways.
- F. Join raceways with fittings designed and approved for the purpose and make joints tight. Use bonding bushings or wedges at connections subject to vibration. Use bonding jumpers where joints cannot be made tight.

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- G. Terminations: Where raceways are terminated with locknuts and bushings, align raceways to enter squarely and install locknuts with dished part against the box. Where terminations are not secure with 1 locknut, use 2 locknuts: 1 inside and 1 outside the box. Provide bushings on all raceways 1-1/2" (40mm) and larger.
- H. Where raceways are terminated with threaded hubs, screw raceways or fittings tightly into the hub so the end bears against the wire protection shoulder. Where chase nipples are used, align raceways so the coupling is square to the box and tighten the chase nipple so no threads are exposed.
- I. Install pull wires in empty raceways. Use No. 14 AWG zinc-coated steel or monofilament plastic line with not less than 200-lb (90-kg) tensile strength. Leave at least 12 inches (300 mm) of slack at each end of the pull wire.
- J. Size raceways not sized on the drawings per manufacturers shop drawings, applicable standards or other section of this specification.
- K. Maintain 12" (300mm) minimum clearance to high temperature (greater than 90°C) surfaces.
- L. When construction involves masonry work, assemble and install raceways at the same time as the wall is erected. Avoid surface cut masonry units whenever such units are to remain unplastered or uncovered in completed construction.

3.4 HANGERS FOR RACEWAYS

- A. Raceways 1" and larger: Provide lay-in pipe hangers on 1/4" (6mm) or larger all threaded rods attached to metal ceiling inserts or to structural members at not greater than 10'-0" (3m) on center and within 12" (300mm) of each change in direction.
- B. When more than two raceways will use the same routing, group together on a channel trapeze support system supported by 3/8" (9.5mm) (minimum) threaded rods attached to metal ceiling inserts or structural members. Size supports for multiple raceways for 25% future capacity.
- C. Suspended ceiling systems: Do not attach raceways to ceiling suspension system hangers. Raceways 3/4" (20mm) and smaller serving equipment located within ceiling cavity or mounted on or supported by the ceiling grid system may be supported by dedicated #12 ga. galvanized, soft annealed mild steel wire hangers. Two raceways maximum per hanger. Attach raceways with clips manufactured for the purpose.

3.5 EXPANSION FITTINGS

- A. Provide expansion fittings for raceways crossing expansion joints, building separation walls, and seismic joints. Provide bonding jumper.

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3.6 STUB-UP CONNECTIONS

- A. Extend conduits through concrete floor for connection to freestanding equipment. Install with an adjustable top or coupling threaded inside for plugs set flush with the finished floor. Extend conductors to equipment with rigid steel conduit; flexible metal conduit may be used 6 inches (150 mm) above the floor. For future equipment connections install threaded plugs flush with floor.

3.7 OUTLET AND JUNCTION BOXES

- A. Firmly anchor boxes directly or with concealed bracing to building studs or joists. Boxes must be so attached that they will not "rock" or "shift" when devices are operated.
- B. Flush Mounting: Install front edge (box or plaster ring) even with the finished surface of the wall or ceiling, except for those mounted above accessible ceilings or where drawings indicate surface mounting is permitted.
- C. Do not mount flush boxes back-to-back. Provide 6" (150mm) minimum horizontal separation between closest edges of the boxes. Option: Use sound isolation pads or other sound proofing method acceptable to Architect.
- D. When boxes are installed in fire resistive walls and partitions provide 24" (600mm) horizontal separation between boxes on opposite sides of a wall in accordance with IBC 712.3.2. In addition, limit penetrations to 16 square inches (103 square centimeters) per penetration and not to exceed a total of 100 square inches per 100 square feet (9.3 square meters) of wall area. Option: Apply fire stop putty pads acceptable to the fire marshal.

3.8 CONNECTION TO EQUIPMENT

- A. Provide outlet boxes of sizes and at locations necessary to serve equipment furnished under this or other Divisions and provide final connections to all equipment.
- B. Outlet box required if equipment has pigtail wires for external connection, does not have space to accommodate circuit wiring or requires a wire with insulation rating different from circuit wiring used.
- C. Study equipment details to assure proper coordination.

3.9 BLANK COVERS

- A. Provide blank covers or plates to match coverplates specified in Section 26 27 26 Wiring Devices over all boxes that do not contain devices or are not covered by equipment.

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3.10 JUNCTION OR PULL BOXES

- A. Pull and junction boxes: Install as shown, or as necessary to facilitate pulling of wire and to limit the number of bends within code requirements.
- B. Permanently accessible.
- C. The drawings do not necessarily show every pull or junction box required. Add all required boxes.

3.11 COLOR CODING

- A. Color Code all junction boxes installed in accessible ceiling spaces and exposed in unfinished areas using spray paint on the box and entire cover in the following manner:

Electronic Safety and Security	Gray
Intercom	White

END OF SECTION 28 05 33

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SECTION 28 1300

ACCESS CONTROL SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Section 28 0500 – Common Work Results for Electronic Safety & Security
- C. Section 28 0533 – Raceways and Back Boxes For Electronic Safety and Security
- D. Section 28 2300 – Video Surveillance System

1.2 SUMMARY

- A. This section includes specifications for a complete integrated building Access Control System Section Includes:
  - 1. This section includes specifications for a complete integrated building Access Control system. The System shall include:
    - a. Computer software.
    - b. System Server
    - c. Workstation Clients
    - d. Badge Production Equipment
    - e. Sub-control panels/door controllers with spare capacity
    - f. Intelligent field interface panels
    - g. Card readers
    - h. Door position indicators
    - i. Request-to-exit devices
    - j. Access credentials
    - k. Cards: quantity
    - l. Power supplies for electric strikes and locks
    - m. Electrical connections
- B. Related Work:
  - 1. Electric Door Locks, Electric Door Switches, Division 8.
  - 2. Video Surveillance Division 28.
  - 3. PLC Electronic Door Control System Division 28
  - 4. Structured Cabling, Division 27
  - 5. Owner Provided Switches

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1.3 SYSTEM DESCRIPTION

1. Provide a fully functional Access Control System that is integrated into system that is currently deployed.

1.4 CODES AND STANDARDS

- A. Refer to Section 28 0500 - Common Work Results for Electronic Safety and Security, for applicable codes.
- B. Refer to Section 28 0513-Conductors and Cables for Electronic Security
- C. The system shall be listed by Underwriters' Laboratories, Inc., for meeting the requirements of UL-294, "Standards for Access Control System Control Units".
- D. National Fire Protection Associations 101
- E. Comply with TIA/EIA 606-B, "Administration Standard for Commercial Telecommunications Infrastructure."

1.5 SUBMITTALS

- A. Provide submittal information in accordance with Section 280500 - Common Work Results for Electronic Safety and Security and supplementary requirements described in this specification.
- B. Product data Section 28 0500 - Common Work Results For Electronic Safety and Security including but not limited to:

Master Controllers	Historical Data Log Equipment
Elevator Control Interface	Printers
Card Readers	Door Controllers
Cards	Control Wiring

- C. Data Sheets for all Access Control Components.
- D. Shop Drawings
  1. Floor Plans: Prepare CAD based shop drawings to show device locations, raceway routing and sizes, and color coded wiring between devices.
  2. Riser. Provide diagram showing vertical wiring between components.
  3. Control Schematics. Provide a control schematic showing interface circuits for each piece of equipment, termination and connection diagrams including wire numbers.

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4. Release of CAD Files: Contractor may request to utilize Sparling CAD files for assistance in producing shop drawings. Request shall be made by signing Sparling's "Agreement for Release of CAD Files" letter.
5. Wiring Diagrams. For signal, and control wiring. Show typical wiring schematics including the following:
  - a. Controllers.
  - b. Entry credential readers/keypads and electrical door hardware.
  - c. Duress buttons.
  - d. Interface to:
    - 1) CCTV System.
    - 2) Intrusion Protection System.
    - 3) Emergency Phones.

E. Cable Administration Drawings: As specified in "Identification"

F. Shop Drawings

1. Floor Plans: Prepare CAD based shop drawings to show device locations, raceway routing and sizes, and color coded wiring between devices.
2. Riser. Provide diagram showing vertical wiring between components.
3. Control Schematics. Provide a control schematic showing interface circuits for each piece of equipment, termination and connection diagrams including wire numbers.
4. Recessed Mounted Card Reader. Provide card reader cut out size and mounting information to the appropriate subcontractor.
5. Release of CAD Files: Contractor may request to utilize Sparling CAD files for assistance in producing shop drawings. Request shall be made by signing Sparling's "Agreement for Release of CAD Files" letter.

## 1.6 CONTRACT DRAWINGS

- A. The contract drawings indicate the general nature of the system layout, but do not show all components required. Raceways, routing and wiring are not shown on the drawings. Contractor shall provide per system requirements and shop drawings.
- B. Contractor shall coordinate outlet box requirements with system supplier. Notify Architect prior to installation if conflicts occur between required box depth and wall thickness.

## PART 2 - PRODUCTS

### 2.1 GENERAL

- A. Equipment

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1. Equipment shall match the existing (Hirsch, Altronix) Access Control System.
2. The descriptions herein outline the functions of the Access Control System; location of devices shall be as shown on the shop drawings. Provide all equipment necessary for a complete and fully operational system.

B. System Operation

1. Entrances. During access hours (operator adjustable time zone), the entrances shall be unlocked. During service hours, the door shall electrically unlock for an adjustable time of 1 to 15 seconds when a valid authorized access card is inserted into the card reader. During off hours if the door is kept open for more than 30 seconds, as monitored by the door switch, an alarm shall sound at the central control unit. The alarm shall print time and location.

2.2 ACCESS CONTROL SYSTEM

A. Intelligent System Controller

1. Provide system control board in sufficient quantities to support all access controlled doors in contract documents
2. Provide Reader upgrade licenses in sufficient quantities to support all access controlled doors in contract documents.
3. Operation: The system controller shall control remote card readers and elevator interface panels as follows:
  - a. Control shall poll each remote device for card activity and system supervision.
  - b. Controller shall compare the system number and unique ID number of the individual card with the time and card reader location. When card use is found to be valid the controller shall control the remote devices to permit access to the door or to enable elevator floor call buttons as required. User shall be required to manually select floor call button within a user programmable time period in order for the elevator to respond.
  - c. Controller shall record activity on peripherals as determined by user segregation. Activity shall include:
    - 1) Card number.
    - 2) Time and date.
    - 3) Reader identification.
    - 4) Successful (Valid) transaction or reason for denial i.e. lost card, invalid authorization, or invalid time.
    - 5) System supervision (Tamper or equipment failure).
    - 6) Door status switches timeout or intrusion.
4. Restricted Access: System shall provide multiple levels of operator program protection and individual operator password assignment. System shall print operator sign on and sign off times.

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5. Off Line Storage: System shall be capable of storing an image of the data file on diskette as a backup that can be relocated in the event of system failure.
6. Historical Data Logger: Provide the capability of storing system transactions on-line for a minimum of six months. Transactions stored shall include valid activity, invalid activity, tamper, intrusion and system supervisory alarms. Each transaction shall also include the date, time, reader identification, and card number. System will provide menu driven logging routine to include selective recovery of transaction data based on:
  - a. Single or multiple card numbers.
  - b. Date and time of day.
  - c. Card reader identification.
  - d. Type of transaction (Valid, Lost, etc.)
  - e. Type and location of alarm (tamper or intrusion). System shall provide additional menu driven logging routines for recovery of card database information to include:
    - 1) Sequential logging by card number.
    - 2) Alphabetical logging by tenant.
    - 3) System wide alphabetical logging.
    - 4) Logging by authorization level.
    - 5) Search for cardholder name.
7. Life Safety Interface: Life Safety fire alarm subcontractor will supply dry contact signal from the life safety fire alarm panel indicating fire alarm condition. Access Control subcontractor shall wire to contact and provide the following fire alarm functions:
  - a. Unlock all stairwells and exterior doors.
  - b. Open grills.

System shall automatically resume normal operation on reset of fire alarm signal.
8. Power failure mode: 24 hour memory retention. After return of normal power system shall automatically restart.
9. Programming. Programming coded access information from cards in conjunction with keyboard and printer, to allow Owner to update system without requiring manufacturer's assistance beyond normal training period. Include programming instructions with shop drawings and operating manuals. Time zone programming shall be separate for each floor. Also the passenger elevators shall be separate from the freight elevator. Entry doors shall have separate time zone capacity.
10. Line monitor supervision. Each time a reader is polled by the Controller the reader shall respond with a message. The Controller shall provide a visual indication and shall cause an alarm message to be printed if a compromising of a communication line occurs.
11. Voiding lost or stolen cards.

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12. Changing authorization code to remove old codes and passwords and to accept new ones.
  13. Elevator Interface. Providing signals to the elevator interface panel (near elevator controller or on elevator cab) to enable floor call button(s).
  14. System shall have the capability of storing information for each access card such as: tenant name, company, status, authorized locations. Operator shall be able to print logs by: numerical card number, tenant name, company, status, single or multiple authorized locations.
  15. Response Time. Control functions shall have a time response of one second maximum for each transaction. Maximum time response in the event of simultaneous transaction requests from as many as four different card readers shall not exceed one second per transaction.
- B. Elevator Control. Shall consist of an elevator control interface for each elevator. Provide all connections and wire required for elevator interface. Elevator card reader shall be mounted behind return panel and shall contain an acknowledge light to indicate a permitted access. Elevator control interface shall be located in the elevator control room.
- C. Card Readers:
1. Coordinate Manufacturer with Owner
  2. HID Indala
    - a. Read Range Up to 5"
    - b. Input Voltage 4-16 VDC at reader
    - c. Color Black, Blue (Dark Grey Background)
    - d. Tamper-proof and weatherproof for all locations
- D. Cards: Cards shall not bear name of manufacturer. Furnish 200 cards to Owner.
- E. Panic Switch
1. Sentrol 3040 Series
    - a. Nominal Voltage 12 V DC @ 6 mA
    - b. Current Max 8 mA
    - c. Operational Voltage 7 V DC to 15 V DC
    - d. Temperature Range 0 ° to 110 ° F (-17.8 ° C to 43.3 ° C)
    - e. Dimensions 1.77" W x 2.90" L x 0.76" H
    - f. (4.50 cm W x 7.37 cm L x 1.93 cm H)
    - g. Housing Material ABS plastic
    - h. Form C: 3040 only
    - i. Voltage 30 V
- F. Door Switch
1. GE Magnetic Contacts
    - a. Form A: (R)1078, 1078W, 1078C, 1078CT, 1078CTW
      - 1) Voltage 100V AC/DC max.
      - 2) Current 0.5 A max.

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- 3) Power 7.5 W max.
- b. Form C: 1076, 1076W, 1076D, 1076C(D), 1076CW, 1076CH
  - 1) Voltage 30V AC/DC max.
  - 2) Current 0.25 A max.
  - 3) Power 3.0 W max.
- G. Panic and Door Release Buttons
  1. Honeywell 296 R
  2. SPST
  3. Latching or Momentary
  4. Or Equivalent
- H. Request to Exit PIR
  1. DS160/DS161
    - a. POWER REQUIREMENTS 12 to 30 VAC or VDC, 8 mA nominal standby current; 39 mA @ 12 VDC in alarm.
    - b. RELAY OUTPUT Two Form "C" Contacts each rated 1A @ 30 VAC or VDC for resistive loads.
    - c. RELAY LATCH TIME Adjustable form 0.5 seconds to 64 seconds.
    - d. TIMER MODE Programmable resettable (accumulative) or non-resettable (counting) mode.
    - e. POWER LOSS DEFAULT Programmable fail-safe or fail-secure modes.
    - f. STORAGE & OPERATING
    - g. TEMPERATURE -20° to +120°F
    - h. TEST FEATURES Externally visible activation LED.
    - i. DIMENSIONS 1.80 in. H., by 6.75 in. W., by 1.75 in. D. (4.5 cm H., 17.1 cm W., 4.4 cm D).
    - j. COVERAGE Dependent on Mounting Height - Typically 8 ft. by 10 ft. (2.4 m by 3 m).
    - k. MOUNTING Surface mount (ceiling or wall).
- I. Electric Lock Power Supply
  1. ALTV1224DC
    - a. 24VDC output.
    - b. 4 amp of total continuous supply current output.
    - c. 3.5 amp total max. per output.
    - d. Eight (8) fuse protected outputs.
    - e. Filtered and electronically regulated outputs.
    - f. 115VAC 50/60Hz, 1.45 amp input.
    - g. Surge suppression.
    - h. AC/DC power LED indicator.
    - i. Power On/Off switch.
    - j. Battery Backup
    - k. Power supply should be dedicated to the access control system and not shared with the electric door operator.

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2.3 CIRCUITRY

- A. All wiring shall be contained in steel raceways. Wiring insulation shall be one of the types required by NEC 725-4 and shall be consistently color coded throughout the system. All terminations shall be T & B "Sta-Kon" (or equivalent) spade type lugs where connected at screw type terminals. Wiring in terminal cabinets shall be neatly arranged and bundled with Tyrap (or equivalent). Provide numbered wire markers on each terminal end of all wires, (pressure sensitive or sleeve type).

2.4 WIRE AND CABLE

- A. General: Provide wire and cable, including communication media.
- B. Communication Cables:
  - 1. Communication cable shall be a minimum of 22 AWG and shall conform to REA PE20 for indoor cable.
- C. Control Wiring:
  - 1. Control wiring for digital functions shall be 18 AWG minimum with 600-volt insulation.
  - 2. Control wiring for analog functions shall be 18 AWG minimum with 600-volt insulation, twisted and shielded, 2- or 3-wire to match analog function hardware.

2.5 CONTROL TRANSFORMERS

- A. 120V primary, fused secondary at 24 volts, VA rating as required driving door devices connected. Provide enclosure for all transformers as required for environmental conditions.

2.6 CONTROL RELAY

- A. General: Control relay contacts shall be rated for the application, with a minimum of two sets of Form C contacts, enclosed in a dust proof enclosure. Relays shall have silver-cadmium contacts with a minimum life span rating of one million operations. Operating time shall be 20 milliseconds or less, with release time of 10 milliseconds or less. Relays shall be equipped with coil transient suppression limiting transients to nondamaging levels.
- B. Time Delay Relays: Time delay relay contacts shall be rated for the application with a minimum of two sets of Form C contacts enclosed in a dust proof enclosure. Relays shall have silver-cadmium contacts with a minimum life span rating of one million operations. Relays shall be equipped with coil transient suppression devices to limit transients to nondamaging levels. Delayed contact opening or closing shall be

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adjustable from one to 60 seconds with a minimum accuracy of plus or minus 2 percent of setting.

- C. Latching Relays: Latching relay contacts shall be rated for the application with a minimum of two sets of Form C contacts enclosed in a dust proof enclosure. Relays shall have silver-cadmium contacts with a minimum life span rating of one million operations. Operating time shall be 20 milliseconds or less, with release time of 10 milli- seconds or less. Relays shall be equipped with coil transient suppression devices to limit transients to nondamaging levels.
- D. Reed Relays: Reed relays shall be encapsulated in a glass-type container housed in a plastic or epoxy case. Contacts shall be rated for the application. Operating and release times shall be one milli- second or less. Reed relays shall have a minimum life span rating of 10 million operations.
- E. Solid-State Relays: Input-output isolation shall be greater than 1000 megohms with a breakdown voltage of 1500V RMS or greater at 60 Hz. The contact life shall be 10 million operations or greater. The ambient temperature range shall be minus 20 degrees to plus 140 degrees F. Input impedance shall not be less than 500 ohms. Relays shall be rated for the application. Operating and release time shall be one millisecond or less. Transient suppression shall be provided as an integral part of the relay to limit transients to nondamaging levels.

### PART 3 - EXECUTION

#### 3.1 SYSTEM SUPPLIER AND/OR SUBCONTRACTOR REQUIREMENTS

- A. Provide and/or supervise all wiring, wire terminations and connections.
- B. Provide all required cabling.
- C. Provide surge protection on each individual device terminated on the panel.
- D. Label all wiring at termination points.
- E. Place a termination diagram in each panel identifying equipment currently terminated and the location on or the equipment terminated
- F. Provide and/or supervise all equipment installation.
- G. Perform and/or supervise all testing during and after installation.
- H. Certify in writing to the Architect (copy to Engineer) at completion stating that system has been inspected, tested and is complete and fully operational in accordance with contract documents.

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- I. Duress Buttons will be linked to access control system. Refer to the drawing and flag notes for associated button and doors. Verify functionality with owner.

3.2 GENERAL

- A. Install components in accordance with the specifications, submittals, manufacturer's instructions and local codes and standards.
- B. Coordinate with owner for all programming and functionality requirements.
- C. Coordinate with other trades for installation of access control system interfaces with work by others.
- D. No equipment shall be delivered to the jobsite until shop drawings have been reviewed. A reviewed shop drawing set shall be continuously available at the jobsite during construction.
- E. Auxiliary Controls. Conductors and power supplies of sufficient size shall be installed to minimize voltage drop consistent with the proper operation of all devices. Limited energy circuits shall be routed separately from line voltage circuits as required by Code (NEC Article 725).
- F. Provide all required cable, equipment, programming for a fully functional Access Control system,

3.3 WIRING

- A. Provide all wiring complete per system requirements, including 10% spare conductors not less than two (2). Install all conductors in raceway, unless noted otherwise. Provide numbered wire markers on each terminal end of all wires, in accordance with shop drawings using permanent pressure sensitive or sleeve type markers.
- B. Provide all 120 volt circuits on the emergency power distribution system.

3.4 OPERATION AND MAINTENANCE MANUALS

- A. Operating Manuals. Provide in accordance with Section 28 0500 - Common Work Results for Electronic Safety and Security. Manuals shall contain a preventive maintenance program and service instructions for components of the system as a whole and each component, function and operation in detail. Manuals shall be written to aid in training of new security and operating personnel and as guide clarifying operational procedures.
- B. Maintenance Manuals. Provide in accordance with Section 280500 - Common Work Results for Electronic Safety and Security. Manuals shall contain a preventive maintenance program and service instruction for all components of the system.

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Manuals shall include illustrations, mounting instructions, wiring diagrams, parts lists, operating instructions and a trouble-shooting chart for the system, including a list of troubles, causes and recommended remedies. Include wiring diagram showing all components.

- C. Spare Parts List. Submit list of spare parts and components of critical items for consideration of purchase by Owner.

3.5 TESTING

- A. The completed system shall be tested and after one subsequent week (minimum) "on-line" operation demonstrated to operate satisfactorily in the presence of the Architect and Owner. Tests shall include the following:
  - 1. An operation of each card reader.
  - 2. Operation of each elevator.
  - 3. Operation of all features of the systems under all time zones and manual operation.
  - 4. Operation of all safety features of the systems.
  - 5. Operation of system under power failure conditions.
  - 6. Operation of system under central control unit failure.

3.6 INSTRUCTION

- A. Security Personnel Instruction. Provide a minimum of 4 hours training program for security personnel. Total time shall be scheduled in sessions to be coordinated with building management. Training program shall be conducted by a qualified installation engineer, fully familiar with the entire system as it pertains to this project. The sessions shall be clarified by the use of operating manuals.
- B. Maintenance Personnel Instruction. Provide a minimum of 4 hours training. Total time shall be scheduled in sessions to be coordinated with building management. Training program shall be conducted by qualified installation engineer, fully familiar with the entire system as it pertains to this project. The sessions shall demonstrate all operation modes and all operation functions. Demonstrations shall be clarified by the use of operating and maintenance manuals.

3.7 MAINTENANCE AND SERVICE

- A. General Requirements: Provide all services, materials, and equipment necessary for the successful operation of the entire system for a period of one year after completion of the operational acceptance test. Provide necessary material required for the work. Minimize impacts on facility operations when performing scheduled adjustments and nonscheduled work.

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- B. Description of Work: The adjustment and repair of system includes all computer equipment, software updates, transmission equipment, card readers, and all control devices. Provide the manufacturer's required adjustments and all other work necessary.
- C. Emergency Service: The Owner will initiate service calls when the system is not functioning properly. Qualified personnel shall be available to provide service to the complete system. Furnish the Owner with a telephone number where the service supervisor can be reached at all times. Service personnel shall be at the site within 24 hours after receiving a request for service. Restore the control system to proper operating condition within 3 days.

END OF SECTION 28 1300

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SECTION 28 2300

VIDEO SURVEILLANCE SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Coordinate this Section with the following Sections:
  - 1. Section 27 1500 – Horizontal Communications Cabling
  - 2. Section 28 0500 - Common Work Results For Electronic Safety and Security.
  - 3. Section 28 1300 - Access Control System

1.2 SUMMARY

- A. Section Includes
  - 1. Cameras
  - 2. Monitors
  - 3. Video management system
  - 4. Server
  - 5. Storage
  - 6. POE power
- B. Substitutions:
  - 1. Certain items of equipment are specified herein by manufacturer and model number to indicate the quality and functional performance required from the system and its components. Substitutions of equal equipment beyond the alternatives listed will be permitted only with the written permission of the engineer.
  - 2. Substitute products will be considered only under the terms and conditions of Section 28 0500 - Common Work Results For Electronic Safety and Security.

1.3 REFERENCES

- A. American National Standards Institute (ANSI).
- B. National Electrical Manufacturer's Association (NEMA).

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1.4 SYSTEM DESCRIPTION

- A. The video surveillance system shall provide visual surveillance of the rooms and spaces noted. The cameras shall be fixed mount unless called out specifically on the drawings.
- B. Provide all necessary camera licenses for additional cameras.

1.5 SUBMITTALS

- A. General: Make submittals in accordance with Section 28 0500 - Common Work Results For Electronic Safety and Security.
- B. Product Data: Submittals shall include a compilation of manufacturer's catalogs or specifications sheet of major systems components. Items being provided shall be clearly marked. Any variations of the proposal from the specifications shall be clearly indicated in the submittal's table of contents.
- C. Shop Drawings: Submit block diagrams indicating the proposed connections of all equipment to be furnished, control facilities, and equipment racks. Indicate materials, construction, layouts and quantities. These drawings must be approved by the engineer before the contractor commences fabrications or installations. Submit for review prior to installation. Include complete system plans showing device layout, wire routing, termination, and connection diagrams.
- D. Qualifications:
  - 1. Provide proof of being in the video surveillance contracting business for the preceding five (5) years.
  - 2. Provide certification of successful training by the equipment manufacturer of the camera equipment and the video management system.
- E. Operations and Maintenance Manuals.
  - 1. Furnish one complete set of operating instruction service maintenance manuals for the equipment employed in the systems. This shall include internal schematics and wiring diagrams. The information in the manuals and on the drawings shall be sufficiently detailed to allow a technician of normal competence to understand, install, operate, maintain, calibrate and repair the equipment.
  - 2. Furnish simplified as-built block diagrams of the system giving the essentials of the installation and their functional relations with all numbered inputs, outputs and wires printed on the diagrams. One copy of the system diagram shall be mounted, framed behind glass with the equipment racks. Furnish a chart of line connections inside the rear door of each rack.
- F. Warranty and contract information.

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1.6 QUALITY ASSURANCE

- A. All equipment shall be furnished and installed by a certified factory installer with proven experience in the design and installation of systems of this type.
- B. Construct the system following good engineering practices and in accordance with applicable codes and safety precautions.
- C. Periodically inspect portions of the system installed by other contractors to minimize potential interference problems.
- D. All materials and equipment shall be new and shall conform to the applicable requirements of the Underwriter's Laboratories and with the American National Standards Institute.

1.7 WARRANTY

- A. All equipment shall be guaranteed to be free of defective components or faulty workmanship for a period of one year from the date of final acceptance. If any materials prove to be defective within the above period, they shall be replaced within two days at no expense to the owner. The contractor will provide a 1 hour response via phone and 4 hour on site response during the warranty period.

1.8 MAINTENANCE

- A. The contractor shall provide, at his expense, maintenance service for a period of one year after final acceptance of the installation. All service calls shall be answered within twenty-four (24) hours by the sound system contractor.

PART 2 - PRODUCTS

2.1 GENERAL

- A. The equipment manufacturers and model numbers specified herein are meant to provide a standard of quality. It is the responsibility of the bidder to ensure that his proposed product meets or exceeds the quality and performance of the specified model.

2.2 FIXED CAMERA

- A. Coordinate with Owner Camera manufacturer (Siquira)
- B. Camera
  - 1. Video compression H.264 (MPEG-4 Part 10/AVC)
  - 2. Video streaming Multiple, individually configurable streams in H.264
  - 3. Alarm triggers Intelligent video, external input

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4. Power over Ethernet IEEE 802.3af

2.3 CCTV MONITOR

- A. Monitor
  1. Application: Desk mount
  2. Resolution: 1920 x 1080
  3. Screen Size: 21"
  4. Interface Type: D-Sub, DVI, HDMI, RS232C, S-Video, BNC

2.4 VIDEO MANAGEMENT SYSTEM (VMS)

- A. Coordinate with Owner existing system software
- B. System Description
  1. The Network VMS shall consist of the following major components:
    - a. Client Viewer.
    - b. Network Video Recorder (NVR) Server
- C. Client Viewer
  1. Provide full video monitoring and control for multi-site applications and for multiple-server installations requiring 24/7 surveillance.
  2. Provide a fully integrated GUI (Graphical User Interface) that supports within the same application the following features:
    - a. Scalability
      - 1) Provide support for an unlimited number of cameras using multiple NVR servers
    - b. Touch Screen Controls
      - 1) Support touch-screen controls, menus and video navigation. Through the touch-screen interface the end-user shall be able to navigate menus directly from the video viewing monitor without the aid of a keyboard or mouse.
    - c. NVR Management
      - 1) System shall simultaneously manage several NVR servers over multiple sites.
    - d. Intelligent Menus and Controls
      - 1) Provide intelligent menus that automatically appear and disappear as needed by the operator to only show those controls necessary to perform the end-user function.
    - e. Kinetic / Horizontal Timeline
      - 1) Provide a user interface to allow for kinetic (i.e., via the momentum and speed of mouse movement) manipulation of a graphical timeline representation of recorded video.
    - f. Instant Video Playback and Analysis
      - 1) Provide for instant video playback and analysis of video content/events by providing a spectrum of video thumbnails over a period of time for quick end-user analysis.
    - g. Integrated Event Management

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- 1) Provide integrated event management including automation of event push video, pop-up events, and alerts without the need of additional software modules or add-on software.
- h. Mapped Based Navigation
  - 1) Provide a map-based navigation of cameras and/or camera groups.
- i. Integration of Data for Multiple-Users
  - 1) Provide the ability to share and store common bookmarks and event handling data across multiple users for the purposes of collaborative investigation regarding video of interest.
- j. Interactive Carousel
  - 1) Provide fully interactive video carousel functionality, where a series of video camera views shall be presented to the end-user as a rotating carousel.
- k. Exporting Clips – The Client Viewer shall provide multiple methods to export video clips including:
  - 1) The ability to export a video segment via clicking on start and stop times (via icons) of recorded video using a timeline.
  - 2) The ability to export a video segment via the use of the tool bar.
3. View Setup/Editing Utility.
  - a. Edit Views – Camera Views and Groups shall be organized as folders and the GUI shall provide an intuitive interface to select and change views and groups in a file folder manner. The Edit Views menu shall allow the options to add/delete shared or private views, add/delete groups, and perform other folder management functions. Camera matrix view setup options shall include: 1 x 1, 1 + 3 wide, 2 x 2, 1 + 5, 2 + 4 wide, 1 + 7, 1 + 8 wide, 3 x 3, 2 + 8, 4 x 3 wide, 4 x 4, 5 x 5, 6 x 6, 7 x 7, and 8 x 8 camera views. Edit Views shall provide utilities to configure either Shared Views or Private Views as follows:
    - 1) Shared Views – The Client Viewer shall provide both the viewing and setup for Shared Views. The Shared Views shall be stored on the NVR and accessed by the end-user based on their log-on.
    - 2) Private Views – The Client Viewer shall provide the capability for each end-user to create their own Private Views.
    - 3) Export options shall include the ability to export to print, individual frames, and create bookmarks (on the timeline).
    - 4) The ability to Export multiple camera feeds into a single video database
4. Log-on and Authentication
  - a. The Client Viewer log-on shall provide the option to select either Basic or Windows based authentication.
    - 1) Basic Authentication – The Client Viewer shall support logon using an account database which requires user name and password credentials.
    - 2) Windows Authentication – The Client Viewer shall support Microsoft Active Directory Support – The Client Viewer shall support logon using the NTLM (NT LAN Manager) challenge handshake with Microsoft Domain Controllers in conjunction with a local Microsoft Windows user account database.

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- D. NVR SERVER (Existing)
1. Multiple NVR Servers shall provide video recording for the Network VMS. The NVR Server shall consist of the following software components which may be resident on a single server, or installed on multiple servers within an overall Network VMS:
    - a. Recording and Image server.
    - b. Administrator Application.
    - c. PDA Server.
  2. The Network VMS shall support multiple NVR Servers. Each of the NVR Servers shall be assignable as either a master or a slave NVR Server.
  3. The NVR Server shall be used for recording video feeds and for communicating with cameras and other devices.
  4. The system shall support an unlimited number of NVR Servers.
  5. The NVR Server shall support the use of pre and post recording on motion/event recording. The pre and post recording time period shall be selectable in seconds.
  6. Logging – The Network VMS shall provide:
    - a. Overall System log
    - b. Event log
  7. Audit Video Compression Format - The NVR Server shall support H.264, MPEG-4 (both ASP and SP), and MJPEG video compression formats for the video stream from all devices including analog cameras connected to encoders, DVRs, and IP cameras connected to the system.
  8. Multi-Stream Support
    - a. The NVR Server shall support H.264 / MPEG-4 / MJPEG optimized multi-streaming.
  9. Independent (throttled) Client Streams:
    - a. The system shall allow a single video stream from a device to be independently recorded at one specified frame rate by the NVR Server, and viewed by Client Views at a different Frame rate setting.
  10. Storage and Archiving - Each NVR Server shall have a default storage area. A storage area is a directory where the database content, primarily recordings from the connected cameras is stored. Recordings from the connected cameras shall be stored in individual camera databases. The system shall allow an unlimited amount of storage to be allocated for each connected device. The system shall allow archiving to be enabled on a per camera basis and allow the user to define which archiving drive shall be used for each camera. Provide 30 days storage.
  11. NAT Firewall Support - The system shall support port forwarding, which shall allow clients from outside of a Network Address Translation (NAT) firewall to connect to NVR Servers without using a VPN.
  12. Supported Devices
    - a. The system shall support devices from the following manufacturers at a minimum: ACTi, Advantech, AgileMesh, Appro, Arecont Vision, Axis Communications, Baxall, Bosch, Canon, CBC Ganz, Convision, Digimerge, Discrete, D-Link, DVTel, Etrovision, Extreme CCTV, FLIR Systems, GE Security, Hitron, Hunt, Infinova, Intellinet, Ipix Corporation, ipx, IQinvision / IQeye, JVC, Linudix, Lumenera, Mobotix (including support of MxPEG), Panasonic, Pelco, Pantax, Philips, Pixord, Polar, Samsung, Samsung Techwin, Sanyo, Sony, Speco, Stardot, Toshiba, Toshiba Teli, Vantage, Veo, Verint, Videology, Vivotek, Webgate, Xview.

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- E. PDA (Personal Digital Assistant) Server and Client
    - 1. The Network VMS shall include support for add-on PDA Servers and PDA Clients to allow for viewing using a remote wireless PDA.
  
  - F. Network Topology
    - 1. The Network VMS System shall support the use of separate or common networks, VLANS or switches for connecting cameras to the NVR servers/clients. This shall provide physical network separation between the camera and servers/clients.
  
  - G. Virtual Computing
    - 1. The Network VMS System shall support the use of VMware to run NVR servers and client applications on virtual computers, servers, and networks.
- 2.5 NVR Server System Requirements
- 1. Coordinate with owners existing Raid server platform
  - 2. The following are the minimum requirements for the computers running the NVR Server:
    - a. Processor Six Core 2.4Ghz processor
    - b. Memory 8GB 667MHz (4X2GB), Single Ranked DIMMs
    - c. Hard Drives Enterprise level Hard Drives RAID1
    - d. Enterprise level Hard Drives
    - e. Hard Drive Controller PERC SAS RAID Controller, 2x4 Connectors, Int, PCIe, 256MB cache
    - f. Optical Drive DVDRW +/- ROM Drive
    - g. Network DUAL ONBOARD BROADCOM 5708 1GBE NETWORKING
    - h. Video Embedded ATI ES1000
    - i. Operating System Windows Server 2008 Standard Edition Includes 5 CALs
    - j. Enterprise Support: Business Hrs. 5x10 Hardware Only Tech Phone Support, 3 Year
    - k. \*4 Year Manufacturer Mail In Warranty On All Hard Drives
    - l. Features Universal Sliding Rapid/Versa Rails, includes Cable Management Arm
    - m. Redundant Power Supply
    - n. Electronic Documentation and Open Manage DVD Kit
    - o. Form Factor 2U – Rack Mount Chassis
- 2.6 Work Station
- a. Processor: 2.4GHz 6 core processor x 2
  - b. Memory: 4GB 1333Mhz (2 x 2GB)
  - c. Hard Drives: 250GB SATA 7200 RPM single Hard Drive
  - d. Hard Drive Controller:
  - e. RAID Controller (SATA/SAS Controller) Onboard
  - f. Optical Drive: DVD +/- RW Drive
  - g. Network: On-Board Dual Gigabit Network Adapter
  - h. Video: Dual ATI V4800 1024MB Triple Head
  - i. Operating System: Windows 7 pro

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- j. Service Hardware Warranty Plus Onsite Service 3 Year
- k. Enterprise Support: Business Hours (5X10) Next Business Day, Onsite Service Diagnosis, 3 Year
- l. Features Standard I/O Ports:
  - 1) (11) USB 2.0 (two on front panel, six on back panel, three internal)
  - 2) (2) IEEE 1394a (one front, one rear)
  - 3) (1) serial
  - 4) (1) parallel
  - 5) (2) PS/2
  - 6) (1) RJ-45
  - 7) (1) ESATA port on back panel
- m. Stereo line-in and headphone line-out on back panel
- n. Microphone and headphone connector on front panel
- o. Dimensions With feet: 8.5" x 22.26" x 22.3" (21.59cm x 56.54cm x 56.6cm)
- p. Form Factor: Tower Mount

- 2.7 48 POE SWITCH (Cisco Catalyst 2960-XR. Dual power supply)
- a. High-performance, 48 port Fast Ethernet wire-speed solution which is ideal for
  - b. resilient stacking, cost-effective wiring closet solutions, desktop connectivity and high-speed network backbone traffic aggregation.
  - c. Secure switching using edge authentication via 802.1x, private VLANs, Voice
  - d. VLANs, Protocol VLANs, and SNMPv3. Robust security capabilities provided through
  - e. Flow-based. IP, and MAC ACLs, port-based MAC security, RADIUS and TACACS+ remote authentication, SSL/SSH encryption, and IP-based management access filtering.
  - f. Supports open industry standards including advanced Quality of Service (L2, L3-
  - g. aware), Multiple Spanning Trees, STP and IP multicast support, Dynamic Link
  - h. Aggregation (LACP), dynamic VLAN configurations, port mirroring and Rapid
  - i. Spanning Tree Protocol
  - j. Versatile remote management uses an industry-standard CLI, an embedded web interface or an SNMP-based management application.
  - k. Virtual Cable Tester TM by Marvell for diagnosing copper connectivity and detecting problems and fiber transceiver diagnostics for troubleshooting transceiver problems.
  - l. Lifetime Limited Warranty
  - m. 48 10/100BASE-T auto-sensing Fast Ethernet switching ports



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- n. Additional 2 Copper GbE ports PLUS 2 optional Fiber GbE via SFP transceivers
- o. Integrated Copper GbE ports provide resilient stacking
- p. Auto-negotiation for speed, duplex mode and flow control
- q. Auto MDI/MDIX
- r. Port mirroring
- s. Broadcast storm control
- t. Switch Fabric Capacity 17.6 Gb/s
- u. Forwarding Rate 13.1 Mpps
- v. Up to 8,000 MAC Addresses
- w. Spanning Tree (IEEE 802.1D) and Rapid Spanning Tree (IEEE 802.1w) with Fast Link
- x. support
- y. Multiple Spanning Trees (IEEE 802.1s)
- z. External redundant power support with Power Connect EPS-470 (sold separately)
- aa. Virtual Cable Tester provided by Marvell™ for providing cable diagnostics
- bb. Optical transceiver diagnostics
- cc. VLAN support for tagging and port-based as per IEEE 802.1Q
- dd. Up to 256 VLANs supported
- ee. Dynamic VLAN with GVRP support
- ff. Voice VLAN
- gg. Protocol VLANs
- hh. Private VLAN Edge Support
- ii. 802.1x Auto VLAN
- jj. Layer 2 Trusted Mode (IEEE 802.1p tagging)
- kk. Layer 3 Trusted Mode (DSCP)
- ll. 4 Priority Queues per Port
- mm. Static IP multicast
- nn. IGMP Querier for IP Multicast Support

PART 3 - EXECUTION

3.1 INSTALLATION

- A. The video surveillance system shall be complete and fully functional. It will be the responsibility to provide install and program all required equipment for the system to be fully functional.
- B. It shall be the responsibility of the contractor to cooperate with representatives of the Owner in order to achieve well-coordinated progress and satisfactory results. Schedule all work to prevent conflicts with other activities in the building. Execute without claim for extra payment moderate moves or changes as are necessary to accommodate other equipment, or to preserve symmetry and pleasing appearance.

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- C. Coordinate the exact location of all devices prior to installation with the general and electrical contractors.
- D. Provide all required cable for a fully functional system.
- E. The contractor will be responsible for all signal cable routing, termination, connection and testing associated with equipment required to provide a fully operational and functioning video surveillance system. This includes cable and routing to other rooms associated with and connected to the video surveillance system.
- F. All cabling will be run in conduit.
- G. Rack mount all equipment unless otherwise indicated. Dress all cabling into equipment rack with proper strain relief and secure with cable ties to the side of the rack opposite the AC power strip. When installation is complete cables should be secured and neatly organized in rack or panel locations and label must be visible.
- H. Label each end of all cables with number and identification legend clearly identifying the connection point for cable end. Labels will be self laminating type compatible with Brady DAT-151-292.
- I. Provide proper video terminations at all times. Do not use a video "T" in place of a proper video distribution amp to route a signal to more than one location. Terminate all video signals into 75 ohms at the final device. If a video signal path passes through more than one device, each device will have looping input capability or a video distribution amplifier must be used to distribute the signal to all required devices.
- J. Maintain signal integrity at all times. During installation, pay attention to open grounds, broken shields, and other possible causes of poor video quality. Inspect all wiring after installation and make corrections as necessary when deficiencies are noted.

3.2 TESTING

- A. On completion of the system installation, demonstrate that proper signal level and quality have been maintained through all signal paths. All test equipment will be provided and calibrated by the video surveillance contractor.
- B. An RS-170A test signal generator shall be the signal source for all signal measurements. Test signals will be inserted at the first entry point to the video projection system and distributed downstream to the remainder of the system.
- C. Using a waveform monitor and vector scope, the signal will be monitored through all signal paths that may affect the integrity of the original signal by changing levels, clamping, phase, or any other artifact relating to proper signal alignment. At all test points the signal will conform to proper EIA RS-170A standards.
- D. Signals must comply with the manufacturer's specification for each piece of equipment under test. If discrepancies between the test results and the manufacturer's

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specifications are noted, this will be brought to the attention of the consultant and appropriate corrective action taken.

- E. The signal will be observed for AC hum or non-video related noise that is either visible in the displayed picture or detectable on the scope. The video surveillance contractor will be responsible for correcting any discrepancies relating to signal quality.
- F. All adjustments to equipment will be made by a qualified technician.
- G. Notify the architect a minimum of 48 hours prior to testing so that he may, at his discretion; furnish representatives to witness the testing procedure and results.
- H. Submit copies of the test results as described above prior to final acceptance and training. Include copies of the test results in the O&M manuals. Include the names of the individuals performing and witnessing the tests, and the manufacturer's name and model number of the test equipment used. Include a block diagram of the test setup for each test.
- I. Cameras will be setup and adjusted to accommodate the different lighting conditions present in the room. Output of the camera will conform to RS-170A standards.

3.3 DEMONSTRATION/INSTRUCTION

- A. At the satisfactory completion of the system demonstration and acceptance testing, the contractor shall conduct a minimum two hour instruction session of the Owner's designated personnel. The session shall be conducted by a Contractor's representative thoroughly familiar with the system. System O&M manuals will be transmitted to the Architect prior to scheduling the instruction session. The training session will include:
  - 1. General operation of the system.
  - 2. Specific operation of all user-accessible equipment.
  - 3. Explanation of the system warranty and the process for the owner to follow during the warranty period for system malfunctions.

END OF SECTION 28 2300

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SECTION 28 3100

DIGITAL ADDRESSABLE FIRE-ALARM SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

- A. This performance specification provides the minimum requirements for the Life Safety System. The work provided shall include, but not limited to furnishing all permits, equipment, materials, delivery, labor, documentation, testing and services necessary to design and furnish and install a complete, operational system Fire Alarm System.
- B. At the time of bid, all exceptions taken to these Specifications, all variances from these Specification and all substitutions of operating capabilities or equipment called for in these Specification shall be listed in writing and forwarded to the Engineer. Any such exception, variances or substitutions that were not listed at the time of bid and are identified in the submittal, shall be grounds for immediate disapproval without comment.

1.2 RELATED DOCUMENTS:

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.3 REFERENCES

- A. All work and materials shall conform to all applicable Federal, State and local codes and regulations governing the installation.
- B. Fire alarm system, equipment, installation, and wiring materials and methods used shall comply with the following codes and standards:
  - 1. System components proposed in this specification shall be UL listed for its intended use.
    - a. UL 864 (9<sup>th</sup> Edition) Control Units for Fire-Protective Signaling Systems (UOJZ), and Smoke Control Service (UUKL)
    - b. UL 2572 Control and Communication Units for Mass Notification Systems
    - c. UL 268 Smoke Detector for Fire Protective Signaling Systems
    - d. UL 268A Smoke Detectors for Duct Applications
    - e. UL 521 Heat Detectors for Fire Protective Signaling Systems
    - f. UL 464 Audible Signaling Appliances
    - g. UL 1971 Signaling Devices for the Hearing Impaired
    - h. UL 38 Manually Actuated Signaling Boxes
    - i. UL 1480 Speakers for Fire Alarm, Emergency, and Commercial and Professional Use
    - j. UL 1481 Power Supplies for Fire Protective Signaling Systems
    - k. UL-1638 Signaling Appliances – Private Mode Emergency and General Utility Signaling
  - 2. California State Listings as follows.
    - a. California State Fire Marshall (CSFM) Listed
    - b. OSHPD Special Seismic Certification Preapproval (OSP)

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3. California Adopted Codes referenced as follows.
  - a. 2013 California Building Code
  - b. 2013 California Fire Code
  - c. 2013 California Mechanical Code
  - d. 2013 California Electrical Code
  - e. NFPA 72 - 2013 National Fire Alarm Code®, As amended by CA code
  - f. NFPA 92 - 2012 Standard for Smoke Control Systems
  - g. Americans with Disabilities Act (ADA)
4. Current County or City Amendments to 2013 California Codes

1.4 SYSTEM DESCRIPTION

- A. The System supplied under this specification shall utilize node-to-node, direct wired, multi priority peer-to-peer network operations. The system shall utilize independently addressed, input/output modules, audio amplifiers, and voice communications if applicable and as described in this specification. The peer-to-peer network shall contain multiple nodes consisting of the command center, main controller, remote control panels, and LCD panels. Each panel shall be an equal, active functional member of the network, which is capable of making all local decisions and generating network tasks to other panels in the event of panel failure or communications failure between panels. Master/slave system configurations shall not be considered as equals.

1.5 PERFORMANCE REQUIREMENTS

- A. New EST3 Fire Alarm Control Panel (FACP-1F) to match hospital standard and interface with existing IRC3 network shall be installed as shown.
- B. The scope of work shall consist of the following minimum requirements.
  1. Control Panels and Annunciators
    - a. New Fire Alarm Control Panel (FACP-1F) shall be provided as shown on plans.
    - b. The new control panel (FACP-1F) and annunciator shall interface with existing IRC3 FACP and annunciate at existing panel, remote annunciators, and central monitoring station.
  2. Initiating Devices
    - a. All initiating devices shall be new addressable devices as specified. Any conventional initiating devices utilized shall have individual addressable monitor modules provided for each conventional device for unique addressing and annunciation.
    - b. Smoke detectors shall be added as follows.
      - 1) All public and private areas and all rooms.
      - 2) Additional smoke detectors may be required to ensure proper detection at the following locations.
        - (a) Magnetically held open or automatic-closing doors.
        - (b) one-hour fire-resistive occupancy separations.
        - (c) Above each fire alarm control panel or booster power supply.
    - c. Manual pull stations shall be added as follows.

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- 1) At all exits from the building.
  - 2) Additional manual pull stations shall be provided so that the travel distance to the nearest manual pull station will not be in excess of (200 ft) measured horizontally on the same floor.
- d. Duct Detectors shall be added as follows.
- 1) Downstream of the air filters and ahead of any branch connections in air supply systems having a capacity greater than 944 L/sec (2000 ft<sup>3</sup>/min)
  - 2) At each story prior to the connection to a common return and prior to any recirculation or fresh air inlet connection in air return systems having a capacity greater than 7080 L/sec (15,000 ft<sup>3</sup>/min) and serving more than one story.
  - 3) Smoke detectors shall not be required for fan units whose sole function is to remove air from the inside of the building to the outside of the building.
  - 4) Smoke and combination Smoke/Fire Dampers.
    - (a) Duct smoke detectors are required for each damper.
  - 5) Remote LED's w/ test stations shall be provided for all duct detectors located above ceilings or out of sight.
- e. Heat Detectors shall be added as follows.
- 1) Near shower rooms or other areas that produce steam.
3. Notifications Devices
- a. Chimes shall be added as follows.
- 1) Shall be added throughout public and private spaces to achieve 10db above ambient as needed to alert staff and meet current code requirements.
- b. Fire Alarm Strobes shall be added in public use areas and common use areas including but not limited to:
- 1) Restrooms and Similar Uses: Public, Staff, Patient (serving other than individual patient rooms), locker rooms and dressing rooms.
  - 2) Corridor System and Similar Uses: Public, Staff and Service Corridors, Vestibules and Passageways.
  - 3) Multipurpose Rooms and Similar Uses: Auditoriums, Dining Rooms, Cafeterias, Outdoor Patios & Courts that require exiting through the building and are an occupied portion of the building.
  - 4) Lobbies and Similar Uses
  - 5) Meeting Rooms and Similar Uses: Conference rooms, Waiting rooms, Reception rooms/areas, Lounges and Chapels.
  - 6) Any Other area for common use with an occupant load of at least seven (7) and similar uses: Office rooms/areas.
  - 7) Rooms used for sleeping and Similar Uses, (Not to include Patient Rooms): Sleeping rooms and suites for persons with hearing impairments. Application of this requirement shall be by sleeping room/suite type (e.g. doctors sleeping, family sleeping, etc.)

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- (a) Strobes that are required in sleeping areas shall be located within 16' of pillow and have a minimum intensity of 110cd. For strobes located less than 24" from ceiling the minimum intensity shall be 117cd.
  - 8) Any other area for common use.
  - 9) Additional strobes shall be added in ADA rooms as needed.
  - 10) Sized Per ADA coverage and NFPA72
  - 11) Combination Audible/Visual appliances may be used as needed.
  - 12) Areas having more than 2 strobes in the field of view shall be synchronized
4. Booster Power Supplies shall be provided as required. Power Supplies shall be initiated by Synchronized Signal Modules. Synchronization by means of a common pair of wires chaining power supplies shall not an acceptable means of synchronization between units.
5. Fan and Damper control as follows.
- a. Interface and provide air-handling systems shutdown control. An addressable control relay shall be provided for each air handler unit.
  - b. Interface and provide non-managed smoke damper shutdown. Provide addressable control relays at each electrical panel where smoke dampers are powered.
6. Other device/controls shall be added as follows.
- a. Interface with any door lock\card accesses release circuits. An addressable control relay shall be provided at each lock location obstructing the emergency exit path. Stairwell door locks may have one common control.
  - b. Provide and Interface with magnetic door holder release circuits including WON doors. Provide addressable control relays as required.
  - c. Magnetic door holders shall be provided as part of this section at all cross-corridor doors and as required per code.

1.6 SEQUENCE OF OPERATIONS

- A. General Alarm Operation: Upon alarm activation of any area smoke detector, duct smoke detector, heat detector, manual pull station, sprinkler waterflow, the following functions shall automatically occur:
- 1. The internal audible device shall sound at the control panel, annunciator or command center.
  - 2. The LCD Display shall indicate all applicable information associated with the alarm condition including zone, device type, device location and time/date.
  - 3. All system activity/events shall be documented on the system printer.
  - 4. Any remote or local annunciator LCD/LED's associated with the alarm zone shall be illuminated.
  - 5. The following notification signals and actions shall occur simultaneously:

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- a. A signal shall be sounded on fire floors (zones). The signal shall be a Chime tone.
  - b. Activate visual strobes on the fire floors (zones). The visual strobe shall stop operating when the "Alarm Silence" is pressed.
6. Transmit signal to the building automation system (if applicable) and/or shutdown all HVAC units serving the floor of alarm.
  7. Transmit signal to the 24/7 PBX room with point identification.
  8. Transmit signal to the central station with point identification.
  9. Activate automatic smoke control sequences (if applicable).
  10. All stairwell/exit doors shall unlock throughout the building.
  11. All self-closing fire/smoke doors held open shall be released.
  12. All automatic events programmed to the alarm point shall be executed and the associated outputs activated.
- B. Supervisory Operation: Upon supervisory activation of any sprinkler valve supervisory switch, fire pump off-normal, clean agent fire suppression system trouble, the following functions shall automatically occur:
1. The internal audible device shall sound at the control panel, annunciator or command center.
  2. The LCD display shall indicate all applicable information associated with the supervisory condition including; zone, device type, device location and time/date.
  3. All system activity/events shall be documented on the system printer.
  4. Any remote or local annunciator LCD/LED's associated with the supervisory zone shall be illuminated.
  5. Transmit signal to the central station with point identification.
- C. 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, annunciator or command center.
  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. All system activity/events shall be documented on the system printer.
  4. Any remote or local annunciator LCD/LED's associated with the trouble zone shall be illuminated.
  5. Transmit signal to the central station with point identification.



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D. Monitor Activation: Upon activation of any device connected to a monitor circuit (fire pump/emergency generator status), 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. All system activity/events shall be documented on the system printer.
3. Any remote or local annunciator LCD/LED's associated with the status zone shall be illuminated.

1.7 SYSTEM DESIGN PARAMETERS

A. Standby power

1. The standby power supply shall be an electrical battery with capacity to operate the system under maximum supervisory load for four (4) hours and capable of operating the system for five (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.

B. 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 units' primary powers supply has failed and the battery capacity is at its lowest point. An end of useful battery life starting value of 20.4 Volts 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 (16 Volts) should be used.
2. The point-to-point Ohm's Law voltage drop calculations of all alarm system circuits shall not exceed

C. Spare Capacity

1. The system shall be engineered to accommodate 20% spare capacity on each individual loop, and 20% spare on system power supplies.

D. Circuiting Guidelines

1. Initiating Device Circuits

- a. Where necessary, conventional initiating device circuits (i.e. waterflow switches, valve supervisory switches, fire pump functions, etc.) shall be Class B (Style "A" or "B").

2. Notification Appliance Circuits

- a. All notification appliance circuits shall be Class B (Style "Y"). The notification circuits shall be power limited. Non-power limited circuits are not acceptable.

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3. Signaling Line Circuits: Addressable Analog Devices
  - a. The signaling line circuit connecting to addressable/analog devices including, detectors, monitor modules, control modules, isolation modules, intrusion detection modules and notification circuit modules shall be Class B (style 4).
  - b. Each addressable analog loop shall be circuited so device loading is not to exceed 80% of loop capacity in order to leave for space for future devices.
  - c. A single fault on a pathway connected to the addressable devices shall not cause the loss of more than 50 addressable devices.
4. Signaling Line Circuits: Data & Audio for FACP & Annunciator Network
  - a. The signaling line circuit connecting network panel/nodes, annunciators, command centers, shall be Class A (style 7). The media shall be copper except where fiber optic cable is specified on the drawings.

1.8 SUBMITTALS – FOR REVIEW/APPROVAL

A. General

1. It is the responsibility of the contractor to meet the entire intent and functional performance detailed in these specifications.
2. The proposed equipment shall be subject to the approval of the Architect/Engineer/Owner.
3. Approved submittals shall only allow the contractor to proceed with the installation and shall not be construed to mean that the contractor has satisfied the requirements of these specifications.

B. Product Data

1. Provide list of all types of equipment and components provided. This shall be incorporated as part of a Table of Contents, which will also indicate the manufacturer's part number, the description of the part, and the part number of the manufacturer's product datasheet on which the information can be found.
2. Provide manufacturer's ORIGINAL printed data sheets with the printed logo or trademark of the manufacturer for all equipment. Photocopied and/or illegible product data sheets shall not be acceptable.
3. Indicated in the documentation will be the type, size, rating, style, and catalog number for all items proposed to meet the system performance detailed in this specification.
4. CSFM listing sheet for each component
5. OSHPD Special Seismic Certification Preapproval (OSP)

C. Shop Drawings

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1. 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. Complete system bill of material with peripheral device back box size information, part numbers, device mounting height information
  - c. Detailed system operational description. Any Specification differences and deviations shall be clearly noted and marked.
  - d. 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 if allowed by AHJ.
  - e. Complete 1/8" = 1'-0 scale floor plan drawing locating all system devices and elevation of all equipment at the Fire Command Station. 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.
  - f. All drawings shall be reviewed and signed off by an individual having a minimum of a NICET 3 certification in fire protection engineering technology, subfield of fire alarm systems.
  - g. 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.
  - h. Complete voltage drop calculations that clearly indicate the quantity of devices, the device part numbers, the supervisory current draw, the alarm current draw, voltage drop and totals for all categories.
  - i. System (Load & Battery) calculations shall be provided for each system power supply and control panel, providing power for a notification appliance circuit, auxiliary control circuit or any circuit that draws power from any system power supply. Battery calculations shall also reflect all control panel component, remote annunciator, and auxiliary relay current draws.
  - j. All seismically qualified equipment must be submitted with design drawings and required calculations that indicate the mounting methods implemented to achieve the compliance with these requirements including the following.
    - 1) Dimensioned Outline Drawings of Equipment Units: Identify center of gravity and locate and describe mounting and anchorage provisions.

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- 2) Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- 3) Dimension specifications for additional equipment required to meet these requirements.

k. Any additional requirements if required by AHJ for approval.

D. General Submittal Requirements

1. Installer's NICET 3 Certification
2. Letter or Certificate from the fire alarm manufacturer stating that the fire alarm contractor is an authorized distributor of the specified product.
3. Submit a copy of the system supplier's training certification for the specified product issued by the manufacturer of the integrated life safety system.
4. Equipment submittals and other documentation shall be incorporated bound with the information indexed and tabbed for quick reference.

1.9 CLOSEOUT SUBMITTALS

- A. Minimum two (2) copies of the closeout documents shall be delivered to the building owner's representative at the time of system acceptance.
- B. Provide the name, address and telephone of the authorized factory representative.
- C. As-Built Drawings
  1. Drawings consisting of: a scaled plan of building showing the placement of each individual item of the Integrated Life Safety System equipment as well as raceway size and routing, junction boxes, and conductor size, quantity, and color in each raceway.
  2. All drawings must reflect point to point wiring, device address and programmed characteristics as verified in the presence of the engineer and/or the end user unless device addressing is electronically generated, and automatically graphically self-documented by the system.
  3. All drawings shall be provided in standard .DXF or AutoCAD format.
- D. Operation & Maintenance Data:
  1. Manufacturer's data sheets for all equipment supplied.
  2. Manufacturer's Operation & Maintenance Manual
  3. A filled out Record of Completion as defined or similar to those provided in NFPA 72.
  4. Abbreviated operating instructions for mounting at fire alarm control panel.
- E. Software

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1. Two electronic record copies of site-specific software on non-volatile, non-erasable, non-rewritable media shall be provided to owner. A copy shall be stored and secured on site.
2. Printed Device list w/ Labels and Device/Serial Numbers

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. All panels and peripheral devices shall be of the standard product of single manufacturer and shall display the manufacturer's name of each component. The catalog numbers specified under this section are those of **EST by Edwards, a UTC Climate, Controls & Security Company** and shall constitute the type, product quality, material and desired operating features.

2.2 GENERAL

- A. All equipment and components shall be the manufacturer's current model. The materials, appliances, equipment and devices shall be tested and listed by a nationally recognized approval agency for use as part of a protected premises (fire alarm) system.
- B. The contractor shall provide, from the acceptable manufacturer's current product lines, equipment and components, which comply, with the requirements of these specifications. Equipment or components, which do not provide the performance and features, required by these specifications are not acceptable, regardless of manufacturer.
- C. All System components shall be the cataloged products of a single supplier. All products shall be UL listed by the manufacturer for their intended purpose.
- D. All control panel assemblies and connected field appliances shall be both designed and manufactured by the same company, and shall be tested and cross-listed as to ensure that a fully functioning system is designed and installed.

2.3 FIRE ALARM CONTROL PANEL (FACP-1F)

- A. General, EST3, CSFM 7165-1657:0186
  1. The fire alarm control panel or panels and all system devices (Audible-Visuals, Visuals, pull stations, smoke and heat detectors, etc. shall be all under one label "UL/UOJZ listed and approved" for the use of fire alarm systems in this area of the United States of America.
  2. The operating controls shall be located behind locked door with viewing window. All control modules shall be labeled, and all zone locations shall be identified.
  3. The main controller 3-CPU 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, LCD/LED annunciation nodes, and workstations. 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 a nodes. When utilizing a network and multiple wiring faults occur, the network shall re-configure into many

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sub-networks and continue to respond to alarm events from every panel that can transmit and receive network messages.

4. The Main Controller 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, and support communication interface standard protocol (CSI) devices such as color computer annunciators and color graphic displays.
5. Each controller shall contain a RS232 printer/programming port for programming locally via an IBM PC. When operational, each controller shall support a printer through the RS232 port and be capable of message routing.
6. The programmer shall be able to download all network and firmware applications from the configuration computer to all the network panels from a single location on the system.
7. The panels shall have the ability to add an operator interface control/display at each node that shall annunciate, command and control system functions.
8. 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. Passwords shall protect any changes to system operations.
9. 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.

B. Signaling Line Circuits

1. The main controller 3-CPU shall be supervised, site programmable, and of modular design supporting up to 125 detectors and 125 remote modules per addressable Signaling line Circuit (SLC). The CPU 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. DACT

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1. The system shall provide off premise communications capability (DACT) for transmitting system events to multiple Central Monitoring Station (CMS) receivers.
2. The system shall be capable of providing the CMS(s) 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. User Interface

1. Main Control & Display

- a. The main display shall be a large 168 character LCD with normal, alarm, trouble, supervisory, disabled point and ground fault indicators.
- b. The interface 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 be intermixed to eliminate operator confusion. A "Details" switch shall provide additional information about any device highlighted by the operator.
- c. 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.
- d. The internal audible signal shall have different programmable patterns to distinguish between alarm, supervisory, trouble and monitor conditions.
- e. The annunciator shall contain the following controls:
  - 1) System Reset Switch with Indicator
  - 2) System Alarm Silence Switch with Indicator
  - 3) System Panel Silence Switch with Indicator
  - 4) Programmable Switch with Indicator
  - 5) Details Switch
  - 6) System Message Queue Scroll Switches.
  - 7) 10-Digit Keypad to Enable/Disable System and Functions.
- f. 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.
- g. An authorized operator shall be capable of performing test functions within the installed system.

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2. Additional Annunciation & Control

- a. The system shall be capable to receive, monitor, and annunciate signals from individual devices and circuits installed throughout the building.

E. Internal Modular Power Supply

1. System power supply(s) shall provide multiple power limited 24 VDC 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.

F. 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 particular detector.
3. The system shall provide a report that gives a listing of the sensitivity of all of 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 of the firmware revision listings for all of the installed network components in the system.

2.4 ANNUNCIATORS

A. General



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1. The system shall have the capacity to support 64 network annunciators or EST3 network panel nodes.

2.5 INTELLIGENT ADDRESSABLE DETECTORS

A. General

1. Each remote device shall have a microprocessor with non-volatile memory to support its functionality and serviceability. Each device 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 System 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 have an integral microprocessor 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. Detectors not capable of making independent alarm decisions shall not be acceptable. 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. Systems using central intelligence for alarm decisions shall not be acceptable.
5. The detector shall continually monitor any changes in sensitivity due to the environmental effects of dirt, smoke, temperature, aging and humidity. The information shall be stored in the integral processor and transferred to the analog loop controller for retrieval using a laptop PC or the SIGA-PRO Signature Program/Service Tool.
6. Each detector shall have a separate means of displaying communication and alarm status. A bicolor 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 five (5) sensitivity settings.

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9. Each detector 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.
  10. The intelligent analog detectors shall be suitable for mounting on any Signature Series detector mounting base.
  11. The Fire alarm system shall have the ability to set individual smoke detectors for alarm verification. Detector in the alarm verification mode shall indicate, by point in a text format at the main control and at the remote LCD annunciators.
- B. Photoelectric Smoke Detector, SIGA2-PS, CSFM 7272-1657:299
1. Provide intelligent photoelectric smoke detectors SIGA2-PS. The 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. Each unit shall have the capability of adding optional field-replaceable carbon monoxide sensor/daughterboard module
  4. The photo detector shall be rated for ceiling installation at a minimum of 30 ft (9.1m) centers and be suitable for wall mount applications.
  5. The photoelectric smoke detector shall be suitable for direct insertion into air ducts up to 3 ft (0.91m) high and 3 ft (0.91m) wide with air velocities up to 5,000 ft/min. (0-25.39 m/sec) without requiring specific duct detector housings or supply tubes.
  6. 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 photo detector 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
    - c. Installation Attitude: no limit
- C. Fixed Temp/Rate of Rise Heat Detector, SIGA2-HRS, CSFM 7270-1657:288
1. Provide intelligent combination fixed temperature/rate-of-rise heat detectors SIGA-HRS. The heat detector shall have a low mass thermistor heat sensor and operate at a fixed

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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. Systems using central intelligence for alarm decisions shall not be acceptable.
3. The intelligent heat detector shall have a nominal fixed temperature alarm point rating of 135°F (57°C) and a rate-of-rise alarm point of 15°F (9°C) per minute.
4. Each unit shall have the capability of adding optional field-replaceable carbon monoxide sensor/daughterboard module
5. The heat detector shall be rated for ceiling installation at a minimum of 50 ft (15.2m) centers and be suitable for wall mount applications.

D. Standard Detector Bases, SIGA-SB, CSFM 7300-1657:120

1. Provide standard detector mounting bases SIGA-SB suitable for mounting on North American 1-gang, 3½" or 4" octagon box and 4" square box. The base shall, contain no electronics, support all Signature Series detector types and have the following minimum requirements:
  - a. Removal of the respective detector shall not affect communications with other detectors.
  - b. 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.
  - c. The base shall be capable of supporting one (1) Signature Series SIGA-LED Remote Alarm LED Indicator. Provide remote LED alarm indicators where shown on the plans.

E. Duct Detector, SIGA-SD, CSFM 3242-1657:223

1. Provide intelligent addressable photoelectric duct smoke detectors SIGA-SD. The analog photoelectric detector shall 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. The information shall be stored in the integral processor and transferred to the analog loop controller for retrieval using a laptop.
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°F to 158°F (-29°C to 70°C)
  - b. Humidity: 0-93% RH, non-condensing
  - c. Air velocity: 100 to 4000 ft/min

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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 2.0A at 30VDC
7. Provide Key-activated Remote Test station w/ integral remote alarm indicator SD-TRK where detectors must be accessed by ladder. (CSFM 7300-1657:226)

2.6 CONVENTIONAL INITIATING DEVICES

A. General

1. All initiating devices shall be UL Listed for Fire Protective Service.
2. All initiating devices shall be of the same manufacturer as the Fire Alarm Control Panel specified to assure absolute compatibility between the devices and the control panels, and to assure that the application of the initiating devices is done in accordance with the single manufacturer's instructions.

2.7 INTELLIGENT ADDRESSABLE MODULES

A. General

1. Each remote device shall have a microprocessor with non-volatile memory to support its functionality and serviceability. Each device 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. It shall be possible to address each Intelligent Signature Series module without the use of DIP or rotary switches. Devices using DIP switches for addressing shall not be acceptable. The personality of multifunction modules shall be programmable at site to suit conditions and may be changed at any time using a personality code downloaded from the Analog Loop Controller. Modules requiring EPROM, PROM, ROM changes or DIP switch and/or jumper changes shall not be acceptable. The modules shall have a minimum of 2 diagnostic LEDs mounted behind a finished cover plate. A green LED shall flash to confirm communication with the loop controller. A red LED shall flash to display alarm status. The module shall be capable of storing up to 24 diagnostic codes, which can be retrieved for troubleshooting assistance. Input and output circuit wiring shall be supervised for open and ground faults.

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4. 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, SIGA-CT1, CSFM 7300-1657:121
1. Provide intelligent single input modules SIGA-CT1 for monitoring of PIV's, Fan Status, Tamper Switches, Flow Switches, Generator & Fire Pump Status, Preaction System Alarm or Trouble or any other dry contact 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 North American 2 ½" (64mm) deep 1-gang boxes and 1 ½" (38mm) deep 4" square boxes with 1-gang covers.
  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, SIGA-CT2, CSFM 7300-1657:121
1. Provide intelligent dual input modules SIGA-CT2 for monitoring of sets of PIV's, Fan/Damper Status, Tamper Switches, Flow Switches, Generator & Fire Pump Status, Preaction System Alarm or Trouble 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 North American 2 ½" (64mm) deep 1-gang boxes and 1 ½" (38mm) deep 4" square boxes with 1-gang covers.
  4. The dual 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)
- D. Signal Module, SIGA-CC1, CSFM 7300-1657:121

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1. Provide intelligent single input signal modules SIGA-CC1 for activation of booster power supplies, audible/visual circuits, speaker circuits or for monitoring and communication of phone jacks.
  2. The Single Input (Single Riser Select) 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 North American 2 ½" (64mm) deep 2-gang boxes and 1 ½" (38mm) deep 4" square boxes with 2-gang covers, or European 100mm square boxes.
  4. The single input signal module shall support the following operations:
    - a. Audible/Visible Signal Power Selector (Polarized 24 Vdc @ 2A, 25Vrms @50w or 70 Vrms @ 35 Watts of Audio)
    - b. Telephone Power Selector with Ring Tone (Fire Fighter's Telephone)
  5. When selected as a telephone power selector, the module shall be capable of generating its own "ring tone".
- E. Synchronized Signal Module, SIGA-CC1S, CSFM 7300-1657:121
1. Provide intelligent single input signal modules SIGA-CC1S for activation of booster power supplies and/or audible/visual circuits that require synchronization.
  2. The Single Input (Single Riser Select) 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 North American 2 ½" (64mm) deep 2-gang boxes and 1 ½" (38mm) deep 4" square boxes with 2-gang covers, or European 100mm square boxes.
  4. The single input signal module shall support the following operations:
    - a. Audible/Visible Signal Power Selector (Polarized 24 Vdc @ 2A, 25Vrms @50w or 70 Vrms @ 35 Watts of Audio)
    - b. Telephone Power Selector with Ring Tone (Fire Fighter's Telephone)
  5. Provides UL1971 auto-sync output for synchronizing multiple notification appliance circuits
- F. Control Relay Module, SIGA-CR, CSFM 7300-1657:121
1. Provide intelligent control relay modules SIGA-CR 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 2 amps @ 24 Vdc to control external appliances or equipment shutdown.
  3. The control relay shall be rated for pilot duty and releasing systems.

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4. The position of the relay contact shall be confirmed by the system firmware.
5. The control relay module shall be suitable for mounting on North American 2 ½" (64mm) deep 1-gang boxes and 1 ½" (38mm) deep 4" square boxes with 1-gang covers.

G. Isolator Module, SIGA-IM, CSFM 7300-1657:121

1. Provide addressable isolator modules at the locations shown on the drawings.
2. The module shall be suitable for mounting on North American 2½" (64mm) deep 1-gang boxes and 1½" (38mm) deep 4" square boxes with 1-gang covers.
3. In the event the Class A signaling line circuit on which the intelligent isolator module is installed is shorted, each module shall open the SLC. Isolator modules shall then sequentially reconnect the isolated circuit segments until only the segment with the short is left out of the circuit, leaving the balance of the circuit operational.

H. Manual Pull Station, SIGA-278, CSFM 7150-1657:129

1. The manual station shall be suitable for mounting on North American 2 ½" (64mm) deep 1-gang boxes and 1 ½" (38mm) deep 4" square boxes with 1-gang covers.

2.8 NOTIFICATION APPLIANCES

A. General

1. All fire alarm appliances shall be UL Listed for Fire Protective Service.
2. All appliances shall be of the same manufacturer as the Fire Alarm Control Panel specified to insure absolute compatibility between the appliances and the control panels, and to insure that the application of the appliances are done in accordance with the single manufacturers' instructions.
3. Any appliances, which do not meet the above requirements, and are submitted, for use must show written proof of their compatibility for the purposes intended. Such proof shall be in the form of documentation from all manufacturers which clearly states that their equipment (as submitted) are 100% compatible with each other for the purposes intended.

B. Wall Strobes, Genesis G1 Series, CSFM 7125-1657:218

1. Provide wall mounted CLEAR lens strobes with "FIRE" markings.
2. The strobe shall be UL1971 listed have selectable 15, 30, 75 or 110 candela settings.
3. The strobe (15, 30, 75, 110) candela rating shall be view from the side window to verify the setting.
4. It shall be possible to change the strobe setting without removing the device from the wall
5. All strobes shall be synchronization to within 10 milliseconds for an indefinite period shall not require the use of separately installed remote synch modules.

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6. The strobe shall be a low profile design and shall not protrude more than 1" off the wall. In-out screw terminals shall be provided for wiring.
  7. The strobe shall be suitable for wall mounting and shall mount in a standard North American 1-gang box. All mounting hardware shall be captive and there shall be no mounting screws visible after the device is installed.
- C. Wall Chimes, Genesis G1 Series, CSFM 7135-1591:231
1. The chime shall provide an 79 dBA sound output at 10 ft. when measured in reverberation room per UL-464.
  2. The chime can also be set for low dB output with a jumper cut that reduces chime output by about 5 dB.
  3. The chime shall have a selectable steady or synchronized temporal output.
  4. It shall be a low profile design and shall not protrude more than 1" off the wall. In-out screw terminals shall be provided for wiring.
  5. It shall be suitable for wall mounting and shall mount in a standard North American 1-gang box. All mounting hardware shall be captive and there shall be no mounting screws visible after the device is installed.
- D. Wall Chime-Strobes, Genesis G1 Series, CSFM 7125-1591:220
1. Provide wall mounted CLEAR lens strobes with "FIRE" markings.
  2. The strobe shall be UL1971 listed have selectable 15, 30, 75 or 110 candela settings.
  3. The strobe (15, 30, 75, 110) candela rating shall be view from the side window to verify the setting.
  4. It shall be possible to change the strobe setting without removing the device from the wall
  5. All strobes shall be synchronization to within 10 milliseconds for an indefinite period shall not require the use of separately installed remote synch modules.
  6. The chime shall provide an 79 dBA sound output at 10 ft. when measured in reverberation room per UL-464.
  7. The chime can also be set for low dB output with a jumper cut that reduces chime output by about 5 dB.
  8. The chime shall have a selectable steady or synchronized temporal output.
  9. It shall be a low profile design and shall not protrude more than 1" off the wall. In-out screw terminals shall be provided for wiring.
  10. It shall be suitable for wall mounting and shall mount in a standard North American 1-gang box. All mounting hardware shall be captive and there shall be no mounting screws visible after the device is installed.



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2.9 ACCESSORY EQUIPMENT

A. Multi-Voltage Control Relays, MR Series, CSFM 7300-1004:101

1. General

- a. Provide remote control relays connected to supervised ancillary circuits for control of fans, dampers, door releases, etc.
- b. Relay contact ratings shall be SPDT and rated for 10 amperes at 115 Vac.
- c. A single relay may be energized from a voltage source of 24 Vdc, 24 Vac, 115 Vac, or 230 Vac.
- d. A red LED shall indicate the relay is energized.
- e. A metal enclosure shall be provided.

2. MR-100 Series

- a. Relay contact ratings shall be SPDT and rated for 10 amperes at 115 Vac.

3. MR-200 Series

- a. Relay contact ratings shall be DPDT and rated for 10 amperes at 115 Vac.

B. Booster Power Supplies, BPS6A/BPS10A, CSFM 7300-1657:229

1. Unit shall be a self contained with 24Vdc 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 10 Amp or 6.5 Amp models and 110 Vac or 220Vac.
3. On board LED indicators for each resident 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.

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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.

### PART 3 EXECUTION

#### 3.1 INSTALLATION CONDITIONS

- A. All equipment and components shall be installed in strict compliance with each manufacturer's recommendations. Consult the manufacturer's installation manuals for all wiring diagrams, schematics, physical equipment sizes, etc. before beginning system installation.
- B. The entire system shall be installed in a workmanlike manner, in accordance with approved manufacturer's wiring diagram.
- C. All fire alarm system wiring shall be in conduit. All system wiring shall be in accordance with manufacturer's recommendations and installed in an approved raceway.

#### 3.2 CONDUCTORS

- A. All circuits shall be rated power limited in accordance with NEC Article 760.
- B. All new system conductors shall be of the type(s) specified herein.
  1. 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.
  2. All wiring shall be color-coded throughout.
  3. Signaling Line Circuits
    - a. Shall be 18 AWG minimum multi-conductor jacketed twisted cable or as per manufacturer's requirements.
    - b. Circuit Integrity (CI) Cable: Provide as required to meet NFPA or Local Code requirements.
    - c. CI Cable shall meet article 760, power limited fire alarm service.
  4. Initiating Device Circuits
    - a. 24 VDC IDC or Auxiliary function circuits shall be 18 AWG minimum or per manufacturer's requirements.
  5. Notification Appliance Circuits –
    - a. Speaker: Twisted pair, not less than No. 16 AWG or as recommended by the manufacturer.

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- b. Horn-Strobe or Strobe: Non-Twisted pair, not less than No. 14 AWG or as recommended by the manufacturer.
6. 120 VAC circuits
- a. Minimum 10 AWG for panel power circuits. Minimum 12 AWG for all other circuits.
  - b. Sharing of neutrals is prohibited. Each circuit shall have its own dedicated neutral conductor.
7. Fiber Optic Cable
- a. Only glass filament cable permitted. Plastic filament fiber optic cables are not acceptable.
  - b. Multimode shall be 62.5/125 micron fiber optic cables with ST connectors used at all equipment terminations
  - c. Single Mode shall be 8.3 micron fiber optic cables with Duplex SC connectors used at all equipment terminations

3.3 CONDUIT RACEWAY

- A. All systems and system components listed to UL864 Control Units for Fire Protective Signaling Systems may be installed within a common conduit raceway system, in accordance with the manufacturer's recommendations. System(s) or system components not listed to the UL864 standard shall utilize a separate conduit raceway system for each of the sub-systems.
- B. All system conduits shall be EMT, 3/4 -inch minimum, except for flexible metallic conduit used for whips to devices only, maximum length 6 feet, 3/4-inch diameter, minimum.
- C. All system conduits, which are installed in areas, which may be subject to physical damage or weather, shall be IMC or rigid steel, 3/4 -inch minimum.
- D. Conduits shall be sized according to the conductors contained therein. Cross sectional area percentage fill for system conduits shall not exceed 40%.
- E. 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 existing building systems, facilities or equipment, and to facilitate service and minimize maintenance.
- F. All conduits, except flexible conduit whips to devices, shall be solidly attached to building structural members, ceiling slabs or permanent walls. Conduits shall not be attached to existing conduit, duct work, cable trays, other ceiling equipment, drop ceiling hangers/grids or partition walls, except where necessary to connect to initiating, notification, or auxiliary function devices.
- G. 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.
- H. All penetration of floor slabs and firewalls shall be sleeved (1" conduit minimum) fire stopped in accordance with all local fire codes.

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- I. All junction box covers shall be painted red.

3.4 INSTALLATION REQUIREMENTS

- A. All manual pull stations shall be flush mounted. Surface mounted pull stations shall be identified and requested prior to submittal. They shall only be allowed if approved by the Engineer prior to installation.
- B. All surface mounted devices shall be provided w/ manufacturer's listed back box.
- C. All new 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.
- D. No area smoke detectors shall be mounted within 36 inches of any HVAC supply, return air register or lighting fixture.
- E. No area smoke or heat detector shall be mounted within 12 inches of any wall.
- F. All fire alarm devices shall be accessible for periodic maintenance. Should a device location indicated on the Contract Drawings not meet this requirement, it shall be the responsibility of the installing contractor to bring it, in writing, to the attention of the Project Engineer. Failure to bring such issues to the attention of the Project Engineer shall be the exclusive liability of the installing Electrical Contractor.
- G. 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.
- H. 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.
- I. Power-limited/Non-power-limited NEC wiring standards SHALL BE OBSERVED.
- J. Auxiliary relays shall be appropriately labeled on the exterior to indicate "FIRE ALARM SYSTEM" and their specific function (i.e. FAN S-1 SHUTDOWN).
- K. All AC power connections shall be to the building's designated emergency electrical power circuit and shall meet the requirements of NFPA 72 - The AC power circuit shall be installed in conduit raceway. The power circuit disconnect means shall be clearly labeled FIRE ALARM CIRCUIT CONTROL and shall have a red marking. The location of the circuit disconnect shall be labeled permanently inside the each control panel the disconnect serves.

3.5 TEST & INSPECTION

- A. All fire alarm testing shall be in accordance with NFPA 72.
- B. The system shall be pre-tested and documented prior to the final inspection by the AHJ. The owner shall be notified of the pretest 48 hours in advance and shall witness this test if desired.

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- C. The pre-test shall include the following:
1. All intelligent analog addressable devices shall be tested for current address, sensitivity, and user defined message.
  2. All wiring shall be tested for continuity, shorts, and grounds before the system is activated.
  3. Proper operation and execution of all its sequences
- D. At the final test and inspection, a factory-trained representative of the system manufacturer shall demonstrate to the Owner, his representative, and the local fire inspector all its sequence of operations and any additional tests required by the AHJ. In the event the system does not operate properly, the test may be terminated. Corrections shall be made and the testing procedure shall be repeated until it is acceptable to the Owner, his representatives and the fire inspector.

3.6 TRAINING

- A. The System Supplier shall schedule and present a documented formalized instruction for the building owner, detailing the proper operation of the installed System. One training segment shall be available at the completion of the project. A second training segment may be required within the warranty period.
- B. The instruction shall be presented in an organized and professional manner by a person factory trained in the operation and maintenance of the equipment and who is also thoroughly familiar with the installation.
- C. The instruction shall cover the schedule of maintenance required by NFPA 72 and any additional maintenance recommended by the system manufacturer.
- D. Instruction shall be made available to the Local Municipal Fire Department if requested by the Local Authority Having Jurisdiction.

3.7 EXTRA MATERIALS

- A. Provide 2% of each type of manual stations (minimum of two for each type).
- B. Provide six keys of each type.
- C. Provide 2% of each type of smoke and heat detector (minimum of two for each type).
- D. Provide 2% of each type of audible and visual indicating appliances (minimum of two for each type).

3.8 WARRANTY

- A. The contractor shall warranty all materials, installation and workmanship for one (1) year from date of acceptance, unless otherwise specified.
- B. A copy of the manufacturer's warranty shall be provided with closeout documentation and included with the operation and installation manuals.

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SECTION 31 2000

EARTH MOVING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Preparing subgrades for slabs-on-grade, walks, pavements, lawns and grasses, and exterior plants.
2. Excavating and backfilling for buildings and structures.
3. Drainage course for slabs-on-grade.
4. Base course for concrete walks and pavements.
5. Base course for asphalt paving.
6. Excavating and backfilling for utility trenches.

1.2 QUALITY ASSURANCE

A. Standard Specifications: Comply with the Standard Specifications for Public Works Construction (SSPWC), latest edition and supplements for rock materials. The Standard Specifications apply only to performance and materials and how they are to be incorporated into the Work. The legal/contractual relationship sections and the measurement and payment sections do not apply to this document.

1.3 REFERENCES

A. This specification section has been prepared using the project soils report "Geotechnical Investigation," by CHJ Consultants dated August 15, 2014 as a reference.

1.4 DEFINITIONS

A. Backfill: Soil material used to fill an excavation.

1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
2. Final Backfill: Backfill placed over initial backfill to fill a trench.

B. Base Course: Course placed between the subgrade and hot-mix asphalt or concrete paving.

C. Bedding Course: Course placed over the excavated subgrade in a trench before laying pipe.

D. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.

E. Classified Excavation: Removal and disposal of materials not defined as rock

F. Drainage Course: Course supporting the slab-on-grade that also minimizes upward capillary flow of pore water.

G. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.

## EARTH MOVING

1. Authorized Additional Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions as directed by Architect. Authorized additional excavation and replacement material will be paid for according to Contract provisions changes in the Work.
  2. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by Architect. Unauthorized excavation, as well as remedial work directed by Architect, shall be without additional compensation.
- H. Fill: Soil materials used to raise existing grades.
- I. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.
- J. Subgrade: Surface or elevation remaining after completing excavation, or top surface of a fill or backfill immediately below base, drainage fill, or topsoil materials.
- K. Unclassified Excavation: Removal and disposal of materials encountered regardless of nature of materials, including rock.
- L. Utilities: On-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.

### 1.5 PROJECT CONDITIONS

- A. Examine site, Drawings, records of existing utilities and construction, record of test borings, and subsurface exploration report available from Owner. Records of test borings are for information only and are not guaranteed to represent all conditions that will be encountered.

### 1.6 PROTECTION

- A. Soils Consultant: A geotechnical consultant shall advise on Construction techniques involved in work, including design, checking and approving of temporary bracing, sheeting, shoring, underpinning and other items pertinent to work, and encountered during prosecution of work. Consultant shall be primarily concerned with construction methods, which will prevent settlement or damage to surrounding structures, sidewalks, embankments, utilities and roads on Owner's property and adjoining properties.
- B. Existing Utilities:
1. Maintain existing utilities that are to remain in service. Before excavating over or adjacent to existing utilities, notify utility Owner to ensure protective work will be coordinated and performed in accordance with utility Owner's requirements. If existing service lines, utilities and utility structures, which are to remain in service, are uncovered or encountered during these operations, safeguard and protect from damage.
  2. Within limits of excavation, remove existing piping, subsoil drainage systems, conduit, manholes and relocated items, which are to be abandoned. Plug open ends of utilities to remain with concrete.
  3. Re-route existing subsoil drains which obstruct work around new constructions, or incorporate them into new drainage systems.

## EARTH MOVING

4. Consult Architect immediately for directions, should uncharted or incorrectly charted piping or other utilities be encountered during excavation. Cooperate with Owner and public and private utility companies in keeping their respective services, utilities and facilities in operation. If damaged, repair utilities to satisfaction of Architect and utility Owner.
- C. Existing Facilities: Protect and maintain in satisfactory manner, existing pavements, curbs, gutters, structures, conduits, fences, walls and other facilities to remain above and below grade. Restore facilities damaged by construction operations.
- D. Pumping and Draining: Excavate areas in such manner as to afford adequate drainage. Control grading in vicinity of excavated areas so ground surface will slope to prevent water running into excavated areas. Until work is completed, remove water from areas of construction that may interfere with proper performance of work or that may result in damage to the soil sub-grade and provide sumps, pumps, well points, electric power and attendance required for this purpose on a 24 hour basis if necessary. Protect construction from water during construction, including prevention of erosion of completed work during construction and until permanent drainage and erosion controls are operational. Repair adjoining properties, facilities and streets damaged due to improper protection.

## PART 2 - PRODUCTS

### 2.1 SOIL MATERIALS

- A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.
- B. Satisfactory Soils: Sand, gravel, friable earth, or non-expansive clays, subject to Testing Laboratory's approval. Fill and backfill material shall be free of organic material, slag, cinders, expansive soils, trash or rubble and stones having maximum dimension greater than six inches.
- C. Unsatisfactory Soils: Expansive and other soils as defined in the project's geotechnical investigation report.
  1. Unsatisfactory soils also include satisfactory soils not maintained within two percent of optimum moisture content at time of compaction.
- D. Base Course: Material conforming to SSPWC section 200-2.2, Crushed Aggregate Base or SSPWC section 200-2.4 Crushed Miscellaneous Base.
- E. Engineered Fill: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a one and one-half-inch sieve and not more than 12 percent passing a No. 200 sieve.
- F. Bedding Course: Crushed rock conforming to SSPWC Section 200.1-2 and Table 306-1.2.1.3 (B).
- G. Drainage Course: Narrowly graded mixture of washed, crushed stone, or crushed or uncrushed gravel; ASTM D 448; coarse-aggregate grading Size 57; with 100 percent passing a one and one-half-inch sieve and zero to five percent passing a No. 8 sieve.

### 2.2 ACCESSORIES

KPFF 114150  
2014-09-26



## EARTH MOVING

- A. Warning Tape: Acid- and alkali-resistant polyethylene film warning tape manufactured for marking and identifying underground utilities, six inches wide and four mils thick, continuously inscribed with a description of the utility. Color coding shall be according to the American Public Works Association (APWA) standards:
1. Blue – Potable water and fire suppression lines.
  2. Green – Sanitary sewer and storm drain lines
  3. Orange – Communication, alarm or signal lines
  4. Purple – Reclaimed water, irrigation, and slurry lines
  5. Red – Electrical power lines, cables, conduit and lighting lines
  6. Yellow – Gas, oil, steam, petroleum, or gaseous material lines.

### PART 3 - EXECUTION

#### 3.1 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.
- B. Preparation of subgrade for earthwork operations including removal of vegetation, topsoil, debris, obstructions, and deleterious materials from ground surface is specified in Division 2 Section "Site Clearing" or "Demolition".
- C. Protect and maintain erosion and sedimentation controls, which are specified in Division 2 Section "Site Clearing" or "Demolition," during earthwork operations.

#### 3.2 EXCAVATION

- A. Unclassified Excavation: Excavate to subgrade elevations regardless of the character of surface and subsurface conditions encountered. Unclassified excavated materials may include rock, soil materials, and obstructions. No changes in the Contract Sum or the Contract Time will be authorized for rock excavation or removal of obstructions.
1. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials.

#### 3.3 EXCAVATION FOR STRUCTURES

- A. Excavate to indicated elevations and dimensions within a tolerance of plus or minus one inch. If applicable, extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections.
1. Excavations for Footings and Foundations: Do not disturb bottom of excavation. Excavate by hand to final grade just before placing concrete reinforcement. Trim bottoms to required lines and grades to leave solid base to receive other work.

#### 3.4 EXCAVATION FOR WALKS AND PAVEMENTS

- A. Excavate surfaces under walks and pavements to indicated lines, cross sections, elevations, and subgrades.

## 3.5 EXCAVATION FOR UTILITY TRENCHES

- A. Excavate trenches to indicated gradients, lines, depths, and elevations.
- B. Excavate trenches to uniform widths to provide six-inch clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches higher than top of pipe or conduit, unless otherwise indicated.
- C. Trench Bottoms: Excavate and shape trench bottoms to provide uniform bearing and support of pipes and conduit. Shape subgrade to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits. Remove projecting stones and sharp objects along trench subgrade.
  - 1. Excavate trenches six inches deeper than elevation required in rock or other unyielding bearing material, four inches deeper elsewhere, to allow for bedding course.

## 3.6 SUBGRADE INSPECTION

- A. Proof-roll subgrade below pavements with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.
- B. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Architect, without additional compensation.

## 3.7 UNAUTHORIZED EXCAVATION

- A. Fill unauthorized excavation under foundations or wall footings by extending bottom elevation of concrete foundation or footing to excavation bottom, without altering top elevation. Lean concrete fill, with 28-day compressive strength of 2,500 pounds per square inch (psi), may be used when approved by Architect.
  - 1. Fill unauthorized excavations under other construction or utility pipe as directed by Architect.

## 3.8 STORAGE OF SOIL MATERIALS

- A. Stockpile borrow soil materials and excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
  - 1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

## 3.9 UTILITY TRENCH BACKFILL

- A. Place backfill on subgrades free of mud, frost, snow, or ice.
- B. Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.
- C. Provide four-inch-thick, concrete-base slab support for piping or conduit less than 30 inches below surface of roadways. After installing and testing, completely encase piping or conduit in a minimum of four inches of concrete before backfilling or placing roadway base.

## EARTH MOVING

- D. Place and compact initial backfill of satisfactory soil, free of particles larger than one inch in any dimension, to a height of 12 inches over the utility pipe or conduit.
  - 1. Carefully compact initial backfill under pipe haunches and compact evenly up on both sides and along the full length of utility piping or conduit to avoid damage or displacement of piping or conduit. Coordinate backfilling with utilities testing.
- E. Place and compact final backfill of satisfactory soil to final subgrade elevation.
- F. Install warning tape directly above utilities, minimum six inches above top of pipe, minimum 12 inches below finished grade, except six inches below subgrade under pavements and slabs.

### 3.10 SOIL FILL

- A. Plow, scarify, bench, or break up sloped surfaces steeper than one vertical to four horizontal so fill material will bond with existing material.
- B. Place and compact fill material in layers to required elevations as follows:
  - 1. Under grass and planted areas, use satisfactory soil material.
  - 2. Under walks and pavements, use engineered fill.
  - 3. Under steps and ramps, use engineered fill.
  - 4. Under building slabs, use engineered fill.
  - 5. Under footings and foundations, use engineered fill.

### 3.11 SOIL MOISTURE CONTROL

- A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to within two percent of optimum moisture content.
  - 1. Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain frost or ice.
  - 2. Remove and replace, or scarify and air dry otherwise satisfactory soil material that exceeds optimum moisture content by two percent and is too wet to compact to specified dry unit weight.

### 3.12 COMPACTION OF SOIL BACKFILLS AND FILLS

- A. Place backfill and fill soil materials in layers not more than eight inches in loose depth for material compacted by heavy compaction equipment, and not more than four inches in loose depth for material compacted by hand-operated tampers.
- B. Place backfill and fill soil materials evenly on all sides of structures to required elevations, and uniformly along the full length of each structure.
- C. Compact soil materials to not less than the following percentages of maximum dry unit weight according to ASTM D 1557:
  - 1. Under structures, building slabs, steps, and pavements, scarify and recompact top 24 inches of existing subgrade and each layer of backfill or fill soil material to 95 percent.
  - 2. Under walkways, scarify and recompact top 12 inches below subgrade and compact each layer of backfill or fill soil material to 95 percent.

## EARTH MOVING

3. Under lawn or unpaved areas, scarify and recompact top six inches below subgrade and compact each layer of backfill or fill soil material to 85 percent.
4. For utility trenches, compact each layer of initial and final backfill soil material to 85 percent.

### 3.13 GRADING

- A. General: Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.
- B. Site Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to required elevations within the following tolerances:
  1. Lawn or Unpaved Areas: Plus or minus one inch.
  2. Walks: Plus or minus one inch.
  3. Pavements: Plus or minus one-half inch.
- C. Grading inside Building Lines: Finish subgrade to a tolerance of one-half inch when tested with a 10-foot straightedge.

### 3.14 BASE COURSES

- A. Place base course on subgrades free of mud, frost, snow, or ice.
- B. On prepared subgrade, place base course under pavements and walks as follows:
  1. Shape base course to required crown elevations and cross-slope grades.
  2. Compact base course at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 95 percent of maximum dry unit weight according to ASTM D 1557.

### 3.15 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified independent geotechnical engineering testing agency to perform field quality-control testing.
- B. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earthwork only after test results for previously completed work comply with requirements.
- C. Footing Subgrade: At footing subgrades, at least one test of each soil stratum will be performed to verify design bearing capacities. Subsequent verification and approval of other footing subgrades may be based on a visual comparison of subgrade with tested subgrade when approved by Architect.
- D. Testing agency will test compaction of soils in place according to ASTM D 1556, ASTM D 2167, ASTM D 2922, and ASTM D 2937, as applicable.
- E. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil to depth required; recompact and retest until specified compaction is obtained.

### 3.16 PROTECTION

KPFF 114150  
2014-09-26

## EARTH MOVING

- A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.
  - B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.
  - C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.
    - 1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.
- 3.17 DISPOSAL OF SURPLUS AND WASTE MATERIALS
- A. Disposal: Remove surplus satisfactory soil and waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off Owner's property.

END OF SECTION

RIVERSIDE COUNTY REGIONAL MEDICAL CENTER  
ED REMODEL  
MORENO VALLEY, CALIFORNIA

SECTION 31 3116

TERMITE CONTROL

PART 1 - GENERAL

1.1 SUMMARY

- A. Work required for this Section includes soil treatment for termite control including supplementary Work necessary for its installation.

1.2 DEFINITIONS

- A. EPA: Environmental Protection Agency.
- B. PCO: Pest control operator.

1.3 SUBMITTALS

- A. Product Data: Treatments and application instructions, including EPA-Registered Label.
- B. Product Certificates: Signed by manufacturers of termite control products certifying that treatments furnished comply with requirements.
- C. Soil Treatment Application Report: After application of termiticide is completed, submit report for Owner's record information, including the following as applicable:
  - 1. Date and time of application.
  - 2. Moisture content of soil before application.
  - 3. Brand name and manufacturer of termiticide.
  - 4. Quantity of undiluted termiticide used.
  - 5. Dilutions, methods, volumes, and rates of application used.
  - 6. Areas of application.
  - 7. Water source for application.
- D. Warranties: Special warranties specified in this Section.

1.4 QUALITY ASSURANCE

- A. Applicator Qualifications: A PCO who is licensed according to regulations of authorities having jurisdiction to apply termite control treatment in jurisdiction where Project is located and who is experienced and has completed termite control treatment similar to that indicated for this Project and whose work has a record of successful in-service performance.
- B. Regulatory Requirements: Formulate and apply termiticides, and label with a Federal registration number, to comply with EPA regulations and authorities having jurisdiction.

1.5 PROJECT CONDITIONS

- A. Environmental Limitations: To ensure penetration, do not treat soil that is water saturated or frozen. Do not treat soil while precipitation is occurring. Comply with EPA-Registered Label requirements and requirements of authorities having jurisdiction.

HKS 12215.004  
2014-12-24  
2016-08-02

1.6 COORDINATION

- A. Coordinate soil treatment application with excavating, filling, and grading and concreting operations. Treat soil under footings, grade beams, and ground-supported slabs, before construction.

1.7 WARRANTY

- A. Special Warranty: Written warranty, signed by applicator and Contractor certifying that termite control work, consisting of applied soil termiticide treatment, will prevent infestation of subterranean termites. If subterranean termite activity or damage is discovered during warranty period, re-treat soil and repair or replace damage caused by termite infestation.
- B. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SOIL TREATMENT

- A. Termiticide: Provide an EPA-registered termiticide complying with requirements of authorities having jurisdiction, in a soluble or emulsible, concentrated formulation that dilutes with water or foaming agent, and formulated to prevent termite infestation. Use only soil treatment solutions that are not harmful to plants. Provide quantity required for application at the label volume and rate for the maximum termiticide concentration allowed for each specific use, according to the product's EPA-Registered Label.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Applicator present, for compliance with requirements for moisture content of the soil, interfaces with earth moving, slab and foundation work, landscaping, and other conditions affecting performance of termite control.
- B. Proceed with application only after unsatisfactory conditions have been corrected. Starting of Work will be construed as installers acceptance of installation conditions.

3.2 PREPARATION

- A. General: Comply with the most stringent requirements of authorities having jurisdiction and with manufacturer's written instructions for preparing substrate. Remove all extraneous sources of wood cellulose and other edible materials such as wood debris, tree stumps and roots, stakes, formwork, and construction waste wood from soil and around foundations.
- B. Soil Treatment Preparation: Remove foreign matter and impermeable soil materials that could decrease treatment effectiveness on areas to be treated. Loosen, rake, and level soil to be treated, except previously compacted areas under slabs and footings. Termiticides may be applied before placing compacted fill under slabs if recommended by termiticide manufacturer.
- C. Fit filling hose connected to water source at the site with a backflow preventer, complying with requirements of authorities having jurisdiction.

3.3 APPLYING SOIL TREATMENT

- A. General: Apply soil treatment under all enclosed structures. Comply with the most stringent requirements of authorities having jurisdiction and with manufacturer's EPA-Registered Label for products.
- B. Application: Mix soil treatment termiticide solution to a uniform consistency. Provide quantity required for application at the label volume and rate for the maximum specified concentration of termiticide, according to manufacturer's EPA-Registered Label, to the following so that a continuous horizontal and vertical termiticidal barrier or treated zone is established around and under building construction. Distribute the treatment evenly.
  - 1. Slabs-on-Grade and Basement Slabs: Under ground-supported slab construction, including footings, building slabs, and attached slabs as an overall treatment. Treat soil materials before concrete footings and slabs are placed.
  - 2. Foundations: Adjacent soil including soil along entire inside perimeter of foundation walls, along both sides of interior partition walls, around plumbing pipes and electric conduit penetrating slab, and around interior column footers, piers, and chimney bases; and along entire outside perimeter, from grade to bottom of footing. Avoid soil washout around footings.
  - 3. Adjacent Areas: Around entrance platform, porches, and equipment bases. Apply overall treatment only where attached concrete platform and porches are on fill or ground.
  - 4. Penetrations: At expansion joints, control joints, and area where slabs will be penetrated.
- C. Avoid disturbance of treated soil after application. Keep off treated areas until completely dry.
- D. Protect termiticide solution, dispersed in treated soils and fills, from being diluted until ground-supported slabs are installed. Use waterproof barrier according to EPA-Registered Label instructions.
- E. Post warning signs in areas of application.
- F. Reapply soil treatment solution to areas disturbed by subsequent excavation, grading, landscaping, or other construction activities following application.

END OF SECTION



RIVERSIDE COUNTY REGIONAL MEDICAL CENTER  
ED REMODEL  
MORENO VALLEY, CALIFORNIA

SECTION 32 1216

HOT-MIX ASPHALT PAVING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes hot-mix asphalt paving, patching, and paving overlay.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated. Include technical data and tested physical and performance properties.
- B. Job-Mix Designs: Certification, by authorities having jurisdiction, of approval of each job mix proposed for the Work.
- C. Material certificates.
- D. Log of placement of asphalt, including dates, times, temperature readings and other pertinent information.

1.3 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Manufacturer shall be registered with and approved by authorities having jurisdiction or the DOT of the state in which Project is located.
- B. Standard Specifications: Comply with the Standard Specifications for Public Works Construction (SSPWC) and the California Department of Transportation (Caltrans), latest editions and supplements for asphalt paving work. These Specifications apply only to performance and materials and how they are to be incorporated into the Work. The legal/contractual relationship sections and the measurement and payment sections do not apply to this document.
- C. Asphalt-Paving Publication: Comply with AIMS-22, "Construction of Hot Mix Asphalt Pavements," unless more stringent requirements are indicated.

1.4 PROJECT CONDITIONS

- A. Environmental Limitations: Do not apply asphalt materials if subgrade is wet or excessively damp or if the following conditions are not met:
  - 1. Tack Coat: Minimum surface temperature of 60 degrees Fahrenheit.
  - 2. Asphalt Base Course: Minimum surface temperature of 40 degrees Fahrenheit and rising at time of placement.
  - 3. Asphalt Surface Course: Minimum surface temperature of 60 degrees Fahrenheit at time of placement.
- B. Pavement-Marking Paint: Proceed with pavement marking only on clean, dry surfaces and at a minimum ambient or surface temperature of 40 degrees Fahrenheit for oil-based materials, 50 degrees Fahrenheit for water-based materials, and not exceeding 95 degrees Fahrenheit.

KPFF 114150  
2014-12-24

PART 2 - PRODUCTS

2.1 AGGREGATES

- A. Coarse and fine aggregate shall conform to SSPWC section 203-6.2.2. Mineral filler, if required, shall conform to SSPWC section 203-6.2.4.

2.2 ASPHALT MATERIALS

- A. Asphalt Binder: Paving asphalt, viscosity grade PG 64-10 conforming to Section 92 of the Caltrans Standard Specifications.
- B. Tack Coat: PG 64-10 conforming to Section 92 of the Caltrans Standard Specifications.
- C. Mixes: Hot-Mix Asphalt: Dense, hot-laid, hot-mix asphalt plant mix III-C3 PG 64-10 designed in conformance with SSPWC Section 203-6.5.

2.3 AUXILIARY MATERIALS

- A. Herbicide: Commercial chemical for weed control, registered by the EPA. Provide in granular, liquid, or wettable powder form.
- B. Pavement-Marking Paint: Latex, waterborne emulsion, lead and chromate free, ready mixed, complying with Caltrans Standard Specifications - Section 84 (Federal Specification No. TT-P-1952 for Blue, Red and Green paint; and State of California Standard Specification No. PTWB-01 for White, Yellow and Black paint) with drying time of less than 45 minutes.
  - 1. Color: As Indicated.
- C. Wheel Stops: Precast, air-entrained concrete.
  - 1. Dowels: Galvanized steel, three-fourths-inch diameter, 24-inch minimum length.

PART 3 - EXECUTION

3.1 COLD MILLING

- A. Clean existing pavement surface of loose and deleterious material immediately before cold milling. Remove existing asphalt pavement by cold milling to grades and cross sections indicated.
  - 1. Mill to a depth of two inches.

3.2 PATCHING

- A. Hot-Mix Asphalt Pavement: Saw cut perimeter of patch and excavate existing pavement section to sound base. Excavate rectangular or trapezoidal patches, extending 12 inches into adjacent sound pavement, unless otherwise indicated. Cut excavation faces vertically. Remove excavated material. Recompact existing unbound-aggregate base course to form new subgrade.
- B. Tack Coat: Apply uniformly to vertical surfaces abutting or projecting into new, hot-mix asphalt paving at a rate of 0.05 to 0.15 gallons/square yard.

## HOT-MIX ASPHALT PAVING

- C. Patching: Fill excavated pavements with hot-mix asphalt base mix and, while still hot, compact flush with adjacent surface.

### 3.3 SURFACE PREPARATION

- A. Proof-roll subbase using heavy, pneumatic-tired rollers to locate areas that are unstable or that require further compaction.
- B. Immediately before placing asphalt materials, remove loose and deleterious material from substrate surfaces. Ensure that prepared subgrade is ready to receive paving.
  - 1. Sweep loose granular particles from surface of unbound-aggregate base course. Do not dislodge or disturb aggregate embedded in compacted surface of base course.
- C. Herbicide Treatment: Apply herbicide according to manufacturer's recommended rates and written application instructions. Apply to dry, prepared subgrade or surface of compacted-aggregate base before applying paving materials.
- D. Tack Coat: Apply uniformly to surfaces of existing pavement at a rate of 0.05 to 0.15 gallons/square yard.
  - 1. Allow tack coat to cure undisturbed before applying hot-mix asphalt paving.
  - 2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.

### 3.4 HOT-MIX ASPHALT PLACING

- A. Machine place hot-mix asphalt on prepared surface, spread uniformly, and strike off. Place asphalt mix by hand to areas inaccessible to equipment in a manner that prevents segregation of mix. Place each course to required grade, cross section, and thickness when compacted.
  - 1. Spread mix at minimum temperature of 250 degrees Fahrenheit.
  - 2. Regulate paver machine speed to obtain smooth, continuous surface free of pulls and tears in asphalt-paving mat.
- B. Place paving in consecutive strips not less than 10 feet wide unless infill edge strips of a lesser width are required.
- C. Promptly correct surface irregularities in paving course behind paver. Use suitable hand tools to remove excess material forming high spots. Fill depressions with hot-mix asphalt to prevent segregation of mix; use suitable hand tools to smooth surface.

### 3.5 COMPACTION

- A. General: Begin compaction as soon as placed hot-mix paving will bear roller weight without excessive displacement. Compact hot-mix paving with hot, hand tampers or vibratory-plate compactors in areas inaccessible to rollers.
  - 1. Complete compaction before mix temperature cools to 185 degrees Fahrenheit.
- B. Breakdown Rolling: Complete breakdown or initial rolling immediately after rolling joints and outside edge. Examine surface immediately after breakdown rolling for indicated crown, grade, and smoothness. Correct laydown and rolling operations to comply with requirements.

## HOT-MIX ASPHALT PAVING

- C. Intermediate Rolling: Begin intermediate rolling immediately after breakdown rolling while hot-mix asphalt is still hot enough to achieve specified density. Continue rolling until hot-mix asphalt course has been uniformly compacted to the following density:
  - 1. Average Density: 92 percent of reference maximum theoretical density according to ASTM D 2041, but not less than 90 percent nor greater than 96 percent.
- D. Finish Rolling: Finish roll paved surfaces to remove roller marks while hot-mix asphalt is still warm.
- E. Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened.
- F. Erect barricades to protect paving from traffic until mixture has cooled enough not to become marked.

### 3.6 INSTALLATION TOLERANCES

- A. Thickness: Compact each course to produce the thickness indicated within the following tolerances:
  - 1. Base Course: Plus or minus one-half inch.
  - 2. Surface Course: Plus one-fourth inch (no minus).
- B. Surface Smoothness: Compact each course to produce a surface smoothness within the following tolerances as determined by using a 10-foot straightedge applied transversely or longitudinally to paved areas:
  - 1. Base Course: One-fourth inch
  - 2. Surface Course: One-eighth inch
  - 3. Crowned Surfaces: Test with crowned template centered and at right angle to crown. Maximum allowable variance from template is one-fourth inch.

### 3.7 PAVEMENT MARKING

- A. Do not apply pavement-marking paint until layout, colors, and placement have been verified with Architect.
- B. Allow paving to age for 30 days before starting pavement marking.
- C. Sweep and clean surface to eliminate loose material and dust.
- D. Apply paint with mechanical equipment to produce pavement markings, of dimensions indicated, with uniform, straight edges. Apply at manufacturer's recommended rates to provide a minimum wet film thickness of 15 mils.

### 3.8 WHEEL STOPS

- A. Securely attach wheel stops into pavement with not less than two galvanized steel dowels embedded at one-quarter to one-third points. Securely install dowels into pavement and bond to wheel stop. Recess head of dowel one inch beneath top of wheel stop.

3.9 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and to prepare test reports.
- B. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
- C. Remove and replace or install additional hot-mix asphalt where test results or measurements indicate that it does not comply with specified requirements.

3.10 DISPOSAL

- A. Except for material indicated to be recycled, remove excavated materials from Project site and legally dispose of them in an EPA-approved landfill.

END OF SECTION

RIVERSIDE COUNTY REGIONAL MEDICAL CENTER  
ED REMODEL  
MORENO VALLEY, CALIFORNIA

SECTION 32 1313  
CONCRETE PAVING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes exterior cement concrete pavement for the following:
  - 1. Driveways and roadways.
  - 2. Parking lots.
  - 3. Curbs and gutters.
  - 4. Walkways.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated, including admixtures.
- B. Design Mixtures: For each concrete pavement mixture.

1.3 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Manufacturer of ready-mixed concrete products who complies with ASTM C 94/C 94M requirements for production facilities and equipment.
- B. ACI Publications: Comply with ACI 301, "Specification for Structural Concrete," unless modified by requirements in the Contract Documents.
- C. All work to be performed and materials to be used shall be in accordance with the Standard Specifications for Public Works Construction, latest edition and supplements.
- D. The Contractor shall have one copy of the Standard Specifications at the job site.
- E. The Standard Specifications apply only to performance and materials and how they are to be incorporated into the Work. The legal/contractual relationship sections and the measurement and pavement sections do not apply to this document.

PART 2 - PRODUCTS

2.1 STEEL REINFORCEMENT

- A. Plain-Steel Welded Wire Reinforcement: ASTM A 185, fabricated from as-drawn steel wire into flat sheets.
- B. Reinforcing Bars: ASTM A 615/A 615M, Grade 60; deformed.
- C. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars, welded wire reinforcement, and dowels in place. Manufacture bar supports according to CRSI's "Manual of Standard Practice."

KPFF 114150  
2014-12-24

2.2 CONCRETE MATERIALS

- A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source throughout the Project:
  - 1. Portland Cement: ASTM C 150, Type II, low alkali. Supplement with the following:
    - a. Pozzolan: ASTM C618, Class F or N Fly Ash, 100 pounds maximum per cubic yard, containing one percent or less carbon. Fly ash shall not be used in excess of 15 percent by weight of total cement quantity.
- B. Combined Aggregates: Gradation "C" conforming to SSPWC Section 201-1.3.2.
- C. Water: ASTM C 94/C 94M.

2.3 CURING MATERIALS

- A. Liquid Curing Compound: ASTM C309, fugitive dye dissipating type, complying with Rule II 13 of the South Coast Air Quality Management District and Federal Air Quality Regulation 40 CFR 52.254.
- B. Moisture-Retaining Cover (Curing Sheet): ASTM C 171, non-staining polyethylene film or white burlap-polyethylene sheet.
- C. Water: Potable.
- D. Evaporation Retarder: Waterborne, monomolecular film forming; manufactured for application to fresh concrete.

2.4 RELATED MATERIALS

- A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber.
- B. Color Pigment: ASTM C 979, synthetic mineral-oxide pigments or colored water-reducing admixtures; color stable, free of carbon black, nonfading, and resistant to lime and other alkalis.
- C. Slip-Resistive Aggregate Finish: Factory-graded, packaged, rustproof, nonglazing, abrasive aggregate of fused aluminum-oxide granules or crushed emery with emery aggregate containing not less than 50 percent aluminum oxide and not less than 20 percent ferric oxide; unaffected by freezing, moisture, and cleaning materials.
- D. Pavement-Marking Paint: Latex, waterborne emulsion, lead and chromate free, ready mixed, complying with Caltrans Standard Specifications - Section 84 (Federal Specification No. TT-P-1952 for Blue, Red and Green paint; and State of California Standard Specification No. PTWB-01 for White, Yellow and Black paint) with drying time of less than 45 minutes.
  - 1. Color: As Indicated.

2.5 WHEEL STOPS

- A. Wheel Stops: Precast, air-entrained concrete.
  - 1. Dowels: Galvanized steel, three-fourths-inch diameter, 24-inch minimum length.

2.6 CONCRETE MIXTURES

- A. Prepare design mixtures, proportioned according to ACI 301, with the following properties:
  - 1. Compressive Strength (28 Days): 2,500 pounds per square inch (psi).
  - 2. Maximum Water-Cementitious Materials Ratio at Point of Placement: 0.60
  - 3. Slump Limit: Four inches, plus or minus one inch.
- B. Color Pigment: Add color pigment to concrete mixture according to manufacturer's written instructions.

2.7 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, and mix concrete materials and concrete according to ASTM C 94/C 94M. Furnish batch certificates to Architect for each batch discharged and used in the Work.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Proof-roll prepared subbase surface below concrete pavements with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding.

3.2 EDGE FORMS AND SCREED CONSTRUCTION

- A. Set, brace, and secure edge forms, bulkheads, and intermediate screed guides for pavement to required lines, grades, and elevations. Install forms to allow continuous progress of work and so forms can remain in place at least 24 hours after concrete placement.
- B. Clean forms after each use and coat with form-release agent to ensure separation from concrete without damage.

3.3 STEEL REINFORCEMENT

- A. General: Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.

3.4 JOINTS

- A. General: Form construction, isolation, and control joints and tool edgings true to line with faces perpendicular to surface plane of concrete. Construct transverse joints at right angles to centerline, unless otherwise indicated.
- B. Construction Joints: Set construction joints at side and end terminations of pavement and at locations where pavement operations are stopped for more than one-half hour unless pavement terminates at isolation joints.
- C. Isolation Joints: Form isolation joints of preformed joint-filler strips abutting concrete curbs, catch basins, manholes, inlets, structures, walks, other fixed objects, and where indicated.



## CONCRETE PAVING

- D. Control Joints: Form weakened-plane control joints, sectioning concrete into areas as indicated. Construct control joints for a depth equal to at least one-fourth of the concrete thickness to match jointing of existing adjacent concrete pavement.
- E. Edging: Tool edges of pavement, gutters, curbs, and joints in concrete after initial floating with an edging tool to a one-fourth-inch radius. Repeat tooling of edges after applying surface finishes. Eliminate tool marks on concrete surfaces.

### 3.5 CONCRETE PLACEMENT

- A. Moisten subbase to provide a uniform dampened condition at time concrete is placed.
- B. Comply with ACI 301 requirements for measuring, mixing, transporting, and placing concrete.
- C. Deposit and spread concrete in a continuous operation between transverse joints. Do not push or drag concrete into place or use vibrators to move concrete into place.
- D. Screed pavement surfaces with a straightedge and strike off.
- E. Commence initial floating using bull floats or darbies to impart an open textured and uniform surface plane before excess moisture or bleed water appears on the surface. Do not further disturb concrete surfaces before beginning finishing operations or spreading surface treatments.

### 3.6 FLOAT FINISHING

- A. General: Do not add water to concrete surfaces during finishing operations.
- B. Float Finish: Begin the second floating operation when bleed-water sheen has disappeared and concrete surface has stiffened sufficiently to permit operations. Float surface with power-driven floats, or by hand floating if area is small or inaccessible to power units. Finish surfaces to true planes. Cut down high spots and fill low spots. Refloat surface immediately to uniform granular texture.
  - 1. Burlap Finish: Drag a seamless strip of damp burlap across float-finished concrete, perpendicular to line of traffic, to provide a uniform, gritty texture.
  - 2. Medium-to-Fine-Textured Broom Finish: Draw a soft bristle broom across float-finished concrete surface perpendicular to line of traffic to provide a uniform, fine-line texture.
  - 3. Medium-to-Coarse-Textured Broom Finish: Provide a coarse finish by striating float-finished concrete surface one-sixteenth to one-eighth inch deep with a stiff-bristled broom, perpendicular to line of traffic.
- C. Slip-Resistive Aggregate Finish: Before final floating, spread slip-resistive aggregate finish on pavement surface according to manufacturer's written instructions.
  - 1. Cure concrete with curing compound recommended by slip-resistive aggregate manufacturer. Apply curing compound immediately after final finishing.
  - 2. After curing, lightly work surface with a steel wire brush or abrasive stone and water to expose nonslip aggregate.

### 3.7 CONCRETE PROTECTION AND CURING

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.

## CONCRETE PAVING

- B. Comply with ACI 306.1 for cold-weather protection.
- C. Evaporation Retarder: Apply evaporation retarder to concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 pounds/square feet x h before and during finishing operations. Apply according to manufacturers written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.
- D. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.
- E. Curing Methods: Cure concrete by moisture curing, moisture-retaining-cover curing, curing compound or a combination of these methods.

### 3.8 PAVEMENT TOLERANCES

- A. Comply with tolerances as follows
  - 1. Elevation: One-fourth inch
  - 2. Thickness: Plus three-eighths inch minus one-fourth inch
  - 3. Surface: Gap below 10-foot-long, unlevelled straightedge not to exceed one-fourth inch.
  - 4. Joint Spacing: Three inches.
  - 5. Contraction Joint Depth: Plus one-fourth inch no minus.
  - 6. Joint Width: Plus one-eighth inch, no minus.

### 3.9 PAVEMENT MARKING

- A. Do not apply pavement-marking paint until layout, colors, and placement have been verified with Architect.
- B. Allow concrete pavement to cure for 28 days and be dry before starting pavement marking.
- C. Sweep and clean surface to eliminate loose material and dust.
- D. Apply paint with mechanical equipment to produce pavement markings of dimensions indicated with uniform, straight edges. Apply at manufacturer's recommended rates to provide a minimum wet film thickness of 15 mils.

### 3.10 WHEEL STOPS

- A. Securely attach wheel stops into pavement with not less than two galvanized steel dowels embedded in holes drilled or cast into wheel stops at one-quarter to one-third points. Firmly bond each dowel to wheel stop and to pavement. Securely install dowels into pavement and bond to wheel stop. Recess head of dowel one inch beneath top of wheel stop.

### 3.11 REPAIRS AND PROTECTION

- A. Remove and replace concrete pavement that is broken, damaged, or defective or that does not comply with requirements in this Section.
- B. Protect concrete from damage. Exclude traffic from pavement for at least 14 days after placement.

CONCRETE PAVING

- C. Maintain concrete pavement free of stains, discoloration, dirt, and other foreign material. Sweep concrete pavement not more than two days before date scheduled for Substantial Completion inspections.

END OF SECTION

RIVERSIDE COUNTY REGIONAL MEDICAL CENTER  
ED REMODEL  
MORENO VALLEY, CALIFORNIA

SECTION 32 1373

CONCRETE PAVEMENT JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Expansion and isolation joints within cement concrete pavement.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Compatibility and Adhesion Test Reports: From sealant manufacturer.

1.3 QUALITY ASSURANCE

A. Preconstruction Compatibility and Adhesion Testing: Submit samples of materials that will contact or affect joint sealants to joint-sealant manufacturers for testing according to manufacturer's standard test method to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products listed in other Part 2 articles.

2.2 MATERIALS, GENERAL

A. Compatibility: Provide joint sealants, backing materials, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer based on testing and field experience.

1. Primers: Product recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

B. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

2.3 COLD-APPLIED JOINT SEALANTS

A. Type NS Silicone Sealant for Concrete: Single-component, low-modulus, neutral-curing, nonsag silicone sealant complying with ASTM D 5893 for Type NS.

## CONCRETE PAVEMENT JOINT SEALANTS

### 1. Products:

- a. CrafcO Inc.; RoadSaver Silicone.
- b. Dow Corning Corporation; 888.
- c. Or any equivalent product.

- B. Type SL Silicone Sealant for Concrete: Single-component, low-modulus, neutral-curing, self-leveling silicone sealant complying with ASTM D 5893 for Type SL.

### 1. Products:

- a. CrafcO Inc.; RoadSaver Silicone SL.
- b. Dow Corning Corporation; 890-SL.
- c. Or any equivalent product.

## 2.4 HOT-APPLIED JOINT SEALANTS

- A. Elastomeric Sealant for Concrete: Single-component formulation complying with ASTM D 3406.

### 1. Products:

- a. CrafcO Inc.; Superseal 444/777.
- b. Meadows, W. R., Inc.; Poly-Jet 3406.
- c. Or any equivalent product.

## 2.5 JOINT-SEALANT BACKER MATERIALS

- A. General: Provide joint-sealant backer materials that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by joint-sealant manufacturer based on field experience and laboratory testing.
- B. Round Backer Rods for Cold-Applied Sealants: ASTM D 5249, Type 3, of diameter and density required to control sealant depth and prevent bottom-side adhesion of sealant.
- C. Backer Strips for Cold-Applied Sealants: ASTM D 5249; Type 2; of thickness and width required to control sealant depth, prevent bottom-side adhesion of sealant, and fill remainder of joint opening under sealant.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Concrete curing requirement: The concrete must be allowed to cure and dry a minimum of seven days in good drying weather before installing sealant. An additional day of good drying weather must be allowed for each day of poor, inclement weather.
- B. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions.
- C. Joint Priming: Prime joint substrates where indicated or where recommended in writing by joint-sealant manufacturer, based on preconstruction joint-sealant-substrate tests or prior experience.

## CONCRETE PAVEMENT JOINT SEALANTS

- D. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.
- E. Install backer materials to support sealants during application and at position required to produce optimum sealant movement capability. Do not leave gaps between ends of backer materials. Do not stretch, twist, puncture, or tear backer materials. Remove absorbent backer materials that have become wet before sealant application and replace them with dry materials.
- F. Install sealants at the same time backings are installed to completely fill recesses provided for each joint configuration and to produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.
- G. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
- H. Clean off excess sealants or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved by manufacturers of joint sealants and of products in which joints occur.

END OF SECTION

RIVERSIDE COUNTY REGIONAL MEDICAL CENTER  
ED REMODEL  
MORENO VALLEY, CALIFORNIA

SECTION 33 4100

STORM UTILITY DRAINAGE PIPING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes gravity-flow, nonpressure storm drainage pipe and drainage structures outside the building.

1.2 PERFORMANCE REQUIREMENTS

- A. Gravity-Flow, Nonpressure, Drainage-Piping Pressure Rating: 10-foot head of water.

1.3 SUBMITTALS

- A. Product Data: For each type of product installed.
- B. Field quality-control test reports.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
  - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.

2.2 HUB-AND-SPIGOT, CAST-IRON SOIL PIPE AND FITTINGS

- A. Pipe and Fittings: ASTM A 74, Service class.
- B. Gaskets: ASTM C 564, rubber.
- C. Calking Materials: ASTM B 29, pure lead and oakum or hemp fiber.

2.3 CORRUGATED HIGH DENSITY POLYETHYLENE (HDPE) HDPE PIPE AND FITTINGS

- A. HDPE Drainage Pipe and Fittings, NPS 4 to NPS 10: AASHTO M252, Type S, with bell-and-spigot ends. Gasketed joints shall be soil-tight with ASTM F 477, elastometric seals.
- B. HDPE Drainage Pipe and Fittings, NPS 12 to NPS 60: AASHTO M294, Type S, or ASTM F2306 with bell-and-spigot ends. Gasketed joints shall be soil-tight with ASTM F 477, elastometric seal.

## STORM UTILITY DRAINAGE PIPING

### 2.4 PVC PIPE AND FITTINGS

- A. PVC Sewer Pipe and Fittings, NPS 15 and Smaller: ASTM D 3034, SDR 35, with bell-and-spigot ends for gasketed joints with ASTM F 477, elastomeric seals.
- B. PVC Sewer Pipe and Fittings, NPS 18 and Larger: ASTM F 679, T-2 wall thickness, with bell-and-spigot ends for gasketed joints with ASTM F 477, elastomeric seals.

### 2.5 NONPRESSURE-TYPE PIPE COUPLINGS

- A. Comply with ASTM C 1173, elastomeric, sleeve-type, reducing or transition coupling, for joining underground nonpressure piping. Include ends of same sizes as piping to be joined and corrosion-resistant-metal tension band and tightening mechanism on each end.
- B. Sleeve Materials:
  - 1. For Cast-Iron Soil Pipes: ASTM C 564, rubber.
  - 2. For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
  - 3. For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.
- C. Shielded Flexible Couplings: ASTM C 1460, elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.
- D. Ring-Type Flexible Couplings: Elastomeric compression seal with dimensions to fit inside bell of larger pipe and for spigot of smaller pipe to fit inside ring.

### 2.6 CLEANOUTS

- A. PVC Cleanouts: PVC body with PVC threaded plug. Include PVC sewer pipe fitting and riser to cleanout of same material as sewer piping.

### 2.7 CONCRETE

- A. General: Cast-in-place concrete according to ACI 318/318R, ACI 350R, and the following:
  - 1. Cement: ASTM C 150, Type II.
  - 2. Fine Aggregate: ASTM C 33, sand.
  - 3. Coarse Aggregate: ASTM C 33, crushed gravel.
  - 4. Water: Potable.
  - 5. Ballast and Pipe Supports: Portland cement design mix, 3,000 pounds per square inch (psi) minimum, with 0.58 maximum water-cementitious materials ratio.
    - a. Reinforcement Fabric: ASTM A 185, steel, welded wire fabric, plain.
    - b. Reinforcement Bars: ASTM A 615/A 615M, Grade 60, deformed steel.

### 2.8 CATCH BASINS

- A. Standard Precast Concrete Catch Basins: ASTM C 478, precast, reinforced concrete, of depth indicated, with provision for sealant joints.



## STORM UTILITY DRAINAGE PIPING

1. Base Section: Six-inch minimum thickness for floor slab and four-inch minimum thickness for walls and base riser section, and having separate base slab or base section with integral floor.
  2. Top Section: Eccentric-cone type unless flat-slab-top type is indicated.
  3. Joint Sealant: ASTM C 990, bitumen or butyl rubber.
- B. Frames and Grates: ASTM A 536, Grade 60-40-18, ductile iron designed for A-16 (heavy traffic) structural loading unless otherwise indicated. Include 24-inch ID by seven- to nine-inch riser with four-inch minimum width flange, and 26-inch- diameter flat grate with small square or short-slotted drainage openings.
1. Grate Free Area: Approximately 50 percent, unless otherwise indicated.

### PART 3 - EXECUTION

#### 3.1 PIPING APPLICATIONS

- A. Pipe couplings and fittings with pressure ratings at least equal to piping rating may be used in applications below, unless otherwise indicated.
1. Use nonpressure-type flexible couplings where required to join gravity-flow, nonpressure sewer piping, unless otherwise indicated.
    - a. Shielded flexible couplings for same or minor difference OD pipes.
    - b. Ring-type flexible couplings for piping of different sizes where annular space between smaller piping's OD and larger piping's ID permits installation.

#### 3.2 PIPING INSTALLATION

- A. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions for using lubricants, cements, and other installation requirements.
- B. Install manholes for changes in direction if shown on plan, otherwise use fittings. Use fittings for branch connections unless direct tap into existing storm drain is indicated.
- C. Install proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.
- D. Install gravity-flow, nonpressure drainage piping according to the following:
1. Install piping pitched down in direction of flow, at minimum slope of one percent, unless otherwise indicated.
  2. Install hub-and-spigot, cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook."
  3. Install PVC sewer piping according to ASTM D 2321 and ASTM F 1668.
- E. Clear interior of piping and manholes of dirt and superfluous material as work progresses.

#### 3.3 PIPE JOINT CONSTRUCTION

- A. Join gravity-flow, nonpressure drainage piping according to the following:

## STORM UTILITY DRAINAGE PIPING

1. Join hub-and-spigot, cast-iron soil piping with gasket joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.
2. Join hub-and-spigot, cast-iron soil piping with calked joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for lead and oakum calked joints.
3. Join PVC sewer piping according to ASTM D 2321 and ASTM D 3034 for elastomeric-gasket joints.
4. Join dissimilar pipe materials with nonpressure-type flexible couplings.

### 3.4 CATCH BASIN INSTALLATION

- A. Set frames and grates to elevations indicated.

### 3.5 CONNECTIONS

- A. Connect nonpressure, gravity-flow drainage piping to building's storm building drains specified in Division 22 Section "Facility Storm Drainage Piping."
- B. Make connections to existing piping and underground manholes.
  1. Use commercially manufactured wye fittings for piping branch connections. Remove section of existing pipe; install wye fitting into existing piping; and encase entire wye fitting, plus six-inch overlap, with not less than six inches of concrete with 28-day compressive strength of 3,250 pounds per square inch (psi).

### 3.6 FIELD QUALITY CONTROL

- A. Test new piping systems, and parts of existing systems that have been altered, extended, or repaired, for leaks and defects.
  1. Do not enclose, cover, or put into service before inspection and approval.
  2. Test completed piping systems according to requirements of authorities having jurisdiction.
  3. Schedule tests and inspections by authorities having jurisdiction with at least 24 hours' advance notice.
  4. Submit separate report for each test.
  5. Hydrostatic Tests: Test sewers according to requirements of authorities having jurisdiction and the following:
    - a. Allowable leakage is maximum of 50 gallons/inch of nominal pipe size per mile of pipe, during 24-hour period.
    - b. Close openings in system and fill with water.
    - c. Purge air and refill with water.
    - d. Disconnect water supply.
    - e. Test and inspect joints for leaks.
  6. Option: Test ductile-iron piping according to AWWA C600, "Hydrostatic Testing" Section. Use test pressure of at least 10 pounds per square inch gauge (psig).
  7. Air Tests: Test storm drainage according to requirements of authorities having jurisdiction, UNI-B-6, and the following:
    - a. Option: Test plastic gravity sewer piping according to ASTM F 1417.
- B. Leaks and loss in test pressure constitute defects that must be repaired.

STORM UTILITY DRAINAGE PIPING

- C. Replace leaking piping using new materials, and repeat testing until leakage is within allowances specified.

END OF SECTION