RANCHO LOS AMIGOS SOUTH CAMPUS

Parking Structure | Volume 3
Performance Criteria

Gensler

Rancho Los Amigos South Campus

Volume 3 - Parking Structure - Project Performance Criteria

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ELEMENT A – SUBSTRUCTURE

A10 FOUNDATIONS

A1010 Standard Foundations

A1010.10 Wall Foundations

A. Description: Continuous footings below load bearing walls.

B. Functional and Performance Requirements:
   1. Provide wall foundation system as required by Code to support the completed and occupied building safely without uncontrolled subsidence or other movement.
   2. Drainage: Provide method of collecting and positively draining water from below spaces below grade.
   3. Waterproofing: Provide permanent waterproofing at portions of foundation that extend below grade.

C. Applicable Components:
   1. Minimum Wall Thickness: Not less than thickness of superstructure walls supported by foundation walls, or as required for structural integrity and performance.
   2. Footings: Minimum thickness of 12 in (300 mm), or as required for structural integrity and performance.
   3. Concrete shall have a minimum compressive strength of 3000 psi with a w/c ratio limited to 0.5 and pozzolan (fly ash or silica fume) to improve durability of concrete in contact with soil.
   4. Provide adequate reinforcement for temperature and shrinkage per ACI-318.

A1010.30 Column Foundations

A. Description: Spread footings below columns.

B. Functional and Performance Requirements:
   1. Provide column foundation system as required by Code to support the completed and occupied building safely without uncontrolled subsidence or other movement.
   2. Drainage: Provide method of collecting and positively draining water from below spaces below grade.
   3. Waterproofing: Provide permanent waterproofing at portions of foundation that extend below grade.

C. Applicable Components:
   1. Footings: Minimum thickness of 12 in (300 mm), or as required for structural integrity and performance.

2. Concrete shall have a minimum compressive strength of 3000 psi with a w/c ratio limited to 0.5 and pozzolan (fly ash or silica fume) to improve durability of concrete in contact with soil.
3. Provide adequate reinforcement for temperature and shrinkage per ACI-318.

A1010.90 Standard Foundation Supplementary Components

A. Description: Below-grade waterproofing system for foundation walls (Self-adhering, bentonite, or cold fluid-applied type).

B. Functional and Performance Requirements:
   1. Waterproofing system shall have capability to resist hydrostatic head pressure exceeding pressures listed in project geotechnical report.

C. Applicable Components:
   2. Self-adhering rubberized asphalt sheet membrane; 60 mil thickness.
   3. Bentonite system (geotextile composite, HDPE composite bentonite sheets.
   4. Cold fluid applied membrane system, 90 mil DFT.
   5. Flashing strip.
   6. Drainage composite/protection course.
   7. Detailing materials (tapes, mastics, and similar products recommended by membrane manufacturer.

A40 SLABS-ON-GRADE

A4010 Standard Slabs-on-Grade

A. Description: Provide slabs-on-grade as required enclosing habitable spaces and supporting interior functions without subsidence, structural cracking, or other uncontrolled movement.

B. Functional and Performance Requirements:
   1. Slabs-on-grade comprise structural slabs that are installed over fill or at excavated and compacted grade, including all depressions in the floor, such as trenches, pits, and sumps. Slabs-on-grade also include equipment bases; under floor and perimeter drainage and moisture barriers installed integrally with floor system.
   2. Floor Flatness (FF): Provide floors on grade engineered and constructed to achieve Specified Overall Value (SOV) at 35, and Minimum Localized Value (MLV) at 30, when measured in accordance with ASTM E 1155 current edition.
   3. Floor Levelness (FF): Provide floors on grade engineered and constructed to achieve Specified Overall Value (SOV) of 25, and Minimum Localized Value (MLV) of 20, when measured in accordance with ASTM E 1155 current edition.

C. Applicable Components:
   1. Concrete shall have a minimum compressive strength of 3000 psi with a w/c ratio of 0.5 and pozzolan (fly ash or silica fume) to improve durability of concrete in contact with soil.

2. Provide minimum slab thickness of 5-inches (125 mm), with minimum reinforcement of #4 reinforcing bars at 18 inches o.c. each way, placed at mid-depth.
3. Provide adequate reinforcement for temperature and shrinkage per ACI-318.
4. Provide housekeeping concrete pads and anchor bolts for major equipment. Pads shall extend 6-inches beyond perimeter of equipment or equipment base.
5. Floor Classifications: For concrete floors on grade, comply with composition and finishing recommendations of AC1302.1 R current edition for floor classifications based on type of anticipated traffic and intended use. For Class 1: Utilize minimum 28-day compressive strength of 3000psi; maximum slump of 4 in; single troweling; nonslip finish where required. For Class 2: Provide minimum 28-day compressive strength of 3000psi; maximum slump of 4 in; light steel-troweled finish; curing methods that will not interfere with applied interior finishes

A4090 Slab-On-Grade Supplementary Components

A4090.20 Vapor Retarder

A. Description: 15 mil vapor retarder, installed under slab-on grade, over subbase layer specified in A4090.60.

B. Functional and Performance Requirements:
   1. Comply with ASTM E 1745, Class A.
   2. Maximum perm rating: 0.01.

C. Applicable Components:
   1. 15 mil high performance polyethylene vapor retarder membrane. Provide thicker membrane if required by Geotechnical Report (project Geotechnical Report, dated January 13, 2010, prepared by Mactec, Inc., is bound into the Appendices).
   2. Joint tape.

A4090.60 Subbase Layer

A. Description: Subbase layer for concrete slabs on grade.

B. Functional and Performance Requirements:
   1. 4-inch minimum thickness, per project Geotechnical Report.

C. Applicable Components:
   1. Crushed rock or sand base, as recommended in project Geotechnical Report.

A60 WATER AND GAS MITIGATION

A6010 Building Subdrainage

A6010.10 Foundation Drainage

A. Description: Subdrainage systems for foundations and underslab areas.

B. Functional and Performance Requirements:
   1. Install piping beginning at low points of system, true to grades and alignment indicated, with unbroken continuity of invert. Bed piping with full bearing in filtering material. Lay perforated pipe with perforations down.
   2. Foundation Subdrainage: Install piping pitched down in direction of flow, at a minimum slope of 0.5 percent and with a minimum cover of 36 inches, unless otherwise indicated.
   3. Underslab Subdrainage: Install piping pitched down in direction of flow, at a minimum slope of 0.5 percent.
   4. Install PE piping according to ASTM D 2321.
   5. Install PVC piping according to ASTM D 2321.
   6. Join PE pipe, tubing, and fittings with couplings for soil-tight joints according to AASHTO's "Standard Specifications for Highway Bridges," Division II, Section 26.4.2.4, "Joint Properties."
   7. Join perforated, PE pipe and fittings with couplings for soil-tight joints according to AASHTO's "Standard Specifications for Highway Bridges," Division II, Section 26.4.2.4, "Joint Properties"; or according to ASTM D 2321.
   8. Join PVC pipe and fittings according to ASTM D 3034 with elastomeric seal gaskets according to ASTM D 2321.
   9. Join perforated PVC pipe and fittings according to ASTM D 2729, with loose bell-and-spigot joints.

C. Applicable Components:
   1. Underground Subdrainage Piping: Perforated PE pipe and fittings, couplings, and coupled joints; perforated PVC sewer pipe and fittings for loose, bell-and-spigot joints.
   2. Underslab Subdrainage Piping: Perforated PE pipe and fittings, couplings, and coupled joints; perforated PVC sewer pipe and fittings for loose, bell-and-spigot joints.
   3. Perforated plastic pipe shall be either smooth wall polyvinyl chloride plastic pipe, corrugated polyvinyl chloride plastic pipe with a smooth interior surface, or corrugated polyethylene plastic tubing. Smooth wall polyvinyl chloride plastic pipe shall conform to the requirements in AASHTO Designation M 278. Corrugated polyvinyl chloride plastic pipe with a smooth interior surface shall conform to the material and structural requirements in AASHTO Designation M 278. The pipe shall have perforations located in the bottom half of the pipe, and the perforations shall consist of slots meeting the size and opening area requirements in AASHTO Designation M 252. The inside diameter and diameter tolerances shall conform to the requirements of either AASHTO Designations M

252 or M 278. Corrugated polyethylene plastic tubing shall conform to the requirements in AASHTO Designation M 252 or M 294.

4. Pipe Perforations- NPS 4: four rows of perforations per ASTM F 758, section 7.2.4., and Table 5.
5. Pipe Perforations - NPS 6 and 8: Four rows of perforations per ASTM F 758, section 7.2.4., and Table 5.
6. Pipe Perforations - NPS 10 and larger: Six rows of perforations per ASTM F 758, section 7.2.4., and Table 5.
7. Polyvinyl chloride pipe shall be connected with belled ends, or with sleeve type or stop type couplings conforming to the requirements in AASHTO Designation: M 278. Polyethylene tubing shall be connected with snap on, screw on, or wrap around fittings and couplings conforming to the requirements of AASHTO Designation: M 252 or M 294. Solvent cementing of joints will not be required.
8. 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.
9. 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.
10. Molded-Sheet Drainage Panels: Prefabricated geocomposite, 36 to 60 inches wide with drainage core faced with geotextile filter fabric.
11. Prefabricated Drainage Core: Three-dimensional, nonbiodegradable, molded PP or PS. Select prefabricated drainage core recommended by the manufacturer for the type of application specified elsewhere in the contract documents. Minimum Compressive Strength: 10,000 pound force (lbf)/square foot according to ASTM D 1621. Minimum In-Plane Flow Rate: Ten gallons per minute (gpm)/foot according to ASTM D-4716.
12. Filter Fabric: Nonwoven needle-punched geotextile, manufactured for subsurface drainage, made from polyolefins or polyesters; with elongation greater than 50 percent; Grab Elongation: 60 percent maximum according to ASTM D-4632. Apparent Opening Size: No. 70 sieve, minimum according to ASTM D-4751. Water Flow Rate: 165 gpm/square foot according to ASTM D-4491.
13. Description: Fabric of PP or polyester fibers or combination of both, with flow rate range from 110 to 330 gallons per minute (gpm)/square foot when tested according to ASTM D 4491. Structure Type: Nonwoven, needle-punched continuous filament or woven, monofilament or multifilament. Style(s): Flat and sock.
14. Backfill, drainage course, impervious fill, and satisfactory soil materials as specified in G1070 Site Earthwork.

A90 SUBSTRUCTURE RELATED ACTIVITIES

A9010 Substructure Excavation

A9010.10 Backfill and Compaction

A. Description: Excavation and backfilling for buildings and structures.

B. Functional and Performance Requirements: Refer to G1070.10, G1070.20, and the following:
   1. If applicable, extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspection.
   2. Proof-roll subgrade below the building slabs and pavements with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.
   3. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Owner, without additional compensation.
   4. Grading Inside Building Lines: Finish subgrade to a tolerance of one-half inch when tested with a 10-foot straight edge.

C. Applicable Components:
   1. Refer to G107.10 and G1070.20.

END OF ELEMENT A

ELEMENT B – SHELL

Extra Materials: Design Builder shall provide "Added Stock" materials in accordance with Project General Requirements.

B10 SUPERSTRUCTURE

B1010 Floor Construction

B1010.10 Floor Structural Frame

A. Description: Provide structural elements, above grade, capable of supporting all anticipated loads without failure or damage.
B. Functional and Performance Requirements:
    1. Provide the superstructure load-bearing structural members of capacities required by LACBC and ASCE 7
    2. Impact Resistance of Load-Bearing Members: Use materials that are not easily damaged by common hand tools.
    3. Provide fire-resistive assemblies where required, in compliance with LACBC requirements and UL Designs.

C. Applicable Components:
    1. Load-bearing cast-in-place concrete walls and columns/beams, structural precast concrete framing members, steel roof deck, and minor structural steel.

B1010.20 Floor Decks, Slabs, and Toppings

A. Description: Provide structural floor deck/slab elements, above grade, capable of supporting all anticipated loads without failure or damage, and as required by applicable Code.

B. Functional and Performance Requirements:
    1. Provide the superstructure load-bearing structural members of capacities required by LACBC and ASCE 7.
    2. Design and construct the superstructure to resist loads from weights of building including, but not limited to, construction materials, mechanical-electrical- plumbing systems, equipment; and fire protection, where required, and all other live and dead loads imposed on it.
    3. Provide fire-resistive deck/slab assemblies where required, in compliance with LACBC requirements and UL Designs.
    4. Provide a Rotary Finish with a 15-inch trowel at concrete deck areas that will see vehicle traffic.

C. Applicable Components:
    1. Cast-in-place concrete slabs.
    2. Structural precast concrete framing members.

B1010.50 Ramps

A. Description: Provide structural ramp elements, above grade, capable of supporting all anticipated loads without failure or damage, and as required by applicable Code.

B. Functional and Performance Requirements:
   1. Provide the superstructure load-bearing structural members of capacities required by LACBC and ASCE 7.
   2. Design and construct the superstructure to resist loads from weights of building including, but not limited to, construction materials, mechanical-electrical-plumbing systems, equipment; and fire protection, where required, and all other live and dead loads imposed on it.
   3. Provide fire-resistive ramp assemblies where required, in compliance with LACBC requirements and UL Designs.
   4. Provide a Rotary Finish with a 15-inch trowel at concrete ramps that will see vehicle traffic.

C. Applicable Components:
   1. Cast-in-place concrete slabs.
   2. Structural precast concrete framing members.

B1020 Roof Construction

B1020.10 Roof Structural Frame

A. Description: Provide structural elements, above grade, capable of supporting all anticipated loads without failure or damage, and as required by applicable Code.
B. Functional and Performance Requirements:
   1. Provide the superstructure load-bearing structural members of capacities required by County of Los Angeles Building Code (LACBC) and ASCE 7.
   2. Impact Resistance of Load-Bearing Members: Use materials that are not easily damaged by common hand tools.
   3. Provide fire-resistive assemblies where required, in compliance with LACBC requirements and UL Designs.

C. Applicable Components:
   1. Load-bearing cast in place concrete or structural precast concrete framing elements, structural steel framing, steel roof deck, and minor structural steel.
   2. Cast-in-place concrete slabs.

B1020.20 Roof Decks, Slabs, and Sheathing

A. Description: Provide structural roof framing elements capable of supporting all anticipated loads without failure or damage.

B. Functional and Performance Requirements:
   1. Design and construct the superstructure to resist loads from weights of building including, but not limited to, construction materials, mechanical-electrical-plumbing systems, equipment; and fire protection, where required, and all other live and dead loads imposed on it.
   2. Impact Resistance of Load-Bearing Members: Use materials that are not easily damaged by common hand tools.
   3. Provide fire-resistive deck assemblies where required, in compliance with LACBC requirements and UL Designs.
   4. Fabricate roof deck in accordance with Steel Deck Institute (SDI) Publication No. 31.

C. Applicable Components:
   1. Steel roof deck, Grade 33 minimum, with G60 galvanized coating per ASTM A653; gauge as required for structural performance, and minor structural steel.
   2. Cast in place concrete roof slabs.

B1020.30 Canopy Construction

A. Description: Provide structural canopy framing and deck elements capable of supporting all anticipated loads without failure or damage.
B. Functional and Performance Requirements:
   1. Design and construct the superstructure to resist loads from weights of building including, but not limited to, construction materials, mechanical-electrical-plumbing systems, equipment; and fire protection, where required, and all other live and dead loads imposed on it.
   2. Impact Resistance of Load-Bearing Members: Use materials that are not easily damaged by common hand tools.
   3. Provide non-combustible and fire-resistive canopy assemblies where required, in compliance with LACBC requirements and UL Designs.
   4. Fabricate canopy roof deck in accordance with Steel Deck Institute (SDI) Publication No. 31.

C. Applicable Components:
   1. Steel roof deck, Grade 33 minimum, with G60 galvanized coating per ASTM A653; gauge as required for structural performance, and minor structural steel.
   2. Structural steel framing. Fabricate and finish per AESS requirements where steel is exposed to view, from grade to 8-feet above grade.
   3. Cast in place concrete roof slabs.
   4. Structural precast concrete framing elements.
   5. Membrane roofing or metal roof panels.

B1080 Stairs

B1080.10 Stair Construction

A. Description: Steel-framed stairs with concrete-filled pan treads.
B. Functional and Performance Requirements:
    1. Minimum Standard: NAAMM Commercial Class, unless more stringent requirements are indicated.
    2. Structural Performance Requirements: Capable of resisting gravity loads, 100 pounds per square foot uniform load, and 300 pound concentrated load (applied to a 4-square inch area). Uniform and concentrated loads need not be assumed to act concurrently. Stair framing shall be capable of withstanding stresses resulting from railing loads in addition to loads specified above.
    3. Seismic Performance: Capable of withstanding the effects of earthquake forces determined per County of Los Angeles Building Code, current edition, and ASCE/SEI 7. Component Importance Factor: 1.5.
    4. Limit deflection of treads, platforms, and framing members to L/360 or 1/4 inch, whichever is less.
    5. Regulatory Requirements: Comply with the requirements of Part 1910 of the Occupational Safety and Health Standards (OSHA), the American Disabilities Act (ADA), and local regulatory requirements as applicable to stairs, handrails and the protection of openings; where regulatory requirements conflict the more stringent shall apply.

C. Applicable Components:
    1. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
    2. Steel Tubing: ASTM A 500 (cold-formed) or ASTM A 513.
    3. Steel Pipe: ASTM A 53, Type S - Seamless, Grade A suitable for close coiling or cold bending, standard weight (Schedule 40) minimum, unless otherwise indicated or required to satisfy performance requirements.
    4. Galvanized finish for exterior installations and where indicated.
    5. Galvanized Steel Sheet: ASTM A 653/A 653M, G90 (Z275) coating, either commercial quality or structural quality, Grade 33 (Grade 230), unless another grade is required for performance requirements.
    6. Concrete fill for treads, 3000 psi minimum.

B1080.50 Stair Railings

A. Description: Steel pipe railings.

B. Functional and Performance Requirements:
   1. Railings shall with stand the effects of gravity loads, uniform load of 50 lbf/foot applied in any direction, and concentrated load of 200 lbf applied in any direction. Railing infills shall be capable of resisting a concentrated load of 50 lbf applied horizontally on an area of 1 square foot.
   2. Regulatory Requirements: Comply with the requirements of Part 1910 of the Occupational Safety and Health Standards (OSHA), the American Disabilities Act (ADA), and County of Los Angeles Building Code requirements as applicable to stairs, handrails and the protection of openings; where regulatory requirements conflict the more stringent shall apply.

C. Applicable Components:
   1. Steel Pipe: ASTM A 53, Type S - Seamless, Grade A suitable for close coiling or cold bending, standard weight (Schedule 40) minimum, unless otherwise indicated or required to satisfy performance requirements.
   2. Woven-Wire Mesh: Intermediate-crimp, square pattern, 2-inch (50-mm) woven-wire mesh, made from 0.162-inch (4.1-mm) nominal diameter wire complying with ASTM B 211 (ASTM B 211M), Alloy 6061-T94.
   3. Galvanized finish for exterior installations and where indicated.

B20 EXTERIOR VERTICAL ENCLOSURE

B2010 Exterior Walls

B2010.10 Exterior Wall Veneer

A. Description: Brick veneer or precast concrete panels applied over concrete structure as a finish assembly.
B. Functional and Performance Requirements:
   1. Structural Performance: Provide exterior wall veneer systems capable of withstanding the effects of gravity loads and design wind pressure.
   2. Seismic Performance: Provide exterior wall veneer systems capable of withstanding the effects of earthquake motions determined according to ASCE 7, "Minimum Design Loads for Buildings and Other Structures," Section 9, "Earthquake Loads," and County of Los Angeles Building Code (LACBC) requirements.
   3. Comply with MNL-120 PCI Design Handbook – Precast and Prestressed Concrete, latest edition, for precast concrete panels.

C. Applicable Components:
   1. Brick Veneer: Clay face brick, ASTM C216, Grade MW, Type FBX, anchored to structure with hot-dip galvanized adjustable seismic masonry anchors. Type N mortar.
   2. Architectural precast concrete wall panels.

B2010.20 Exterior Wall Construction

D. Description: All walls above grade (Including openings) shall be designed as systems that are to resist positive and negative wind loads, air infiltration and water penetration while accommodating building movements and environmental requirements of the building's mechanical and electrical services. Wall systems shall be capable of resisting earthquake loads per ASCE 7 and LACBC criteria.
E. Functional and Performance Requirements:
    1. Wind Loads: Wall assemblies shall resist design wind loads indicated in Building Design Criteria (Structural).
    2. Impact Resistance: Wall assemblies shall resist impacts from windborne debris (propelled at up to 35 mph) and hail stones ½ inch in diameter.
    3. Select finish materials with consideration to capability to resist potential vandalism.
    4. Tilt-up Concrete Panel Standard: Grade A-Architectural, per Tilt-up Concrete Association (TCA) guide specifications, current edition.
    5. Cast-in-Place Architectural Concrete Standard: Comply with American Concrete Institute (ACI), ACI 303.1, "Specification for Cast-in-Place Architectural Concrete," current edition, and ACI 303R, "Guide to Cast-In-Place Architectural Concrete Practice."

F. Applicable Components:
    1. Cast-in-place architectural concrete; provide mockups to demonstrate quality of workmanship, and aesthetic effects.
    2. Precast concrete units, load bearing or non-load bearing over cast-in-place concrete structure.
    3. Tilt-up concrete panels with architectural form liner finish; provide mockups to demonstrate quality of workmanship, and aesthetic effects.

B2010.30 Exterior Wall Interior Skin

A. Description: Interior skin assemblies for framed exterior walls, and furred interior walls over solid substrates.
B. Functional and Performance Requirements:
    1. Comply with LACBC and UL Design requirements where interior skin forms part of a fire-resistive wall assembly.
    2. Provide furring of sufficient depth to accommodate electrical and data junction boxes and conduit.
    3. Gypsum board products at framed exterior walls: Mold and moisture-resistant core and facings per ASTM C1396.

C. Applicable Components:
    1. Metal stud furring, extended 6 inches beyond suspended ceiling.
    2. Steel Stud Exterior Walls: Gypsum board, ½ inch minimum thickness, mold and moisture resistant type per ASTM C 1396, with moisture and mold resistant core and facing surfaces.
    3. Furred Walls Over Concrete Masonry Exterior Walls: Gypsum board, ½ inch minimum thickness, mold and moisture resistant type per ASTM C 1396, with moisture and mold resistant core and facing surfaces.

B2010.80 Exterior Wall Supplementary Components

A. Description: Joint sealants, and water repellent/anti-graffiti coatings.

B. Functional and Performance Requirements:
   1. Silicone or polyurethane sealants: ASTM C 920, tested for compatibility with substrates.
   2. Clear, low sheen penetrating anti-graffiti coating system, capable of acting as a water repellent.

C. Applicable Components:
   1. Silicone or polyurethane joint sealants.
   2. Anti-graffiti coating system at all walls and doors up to an architectural break or change in materials at 10 feet or more above the nearest adjacent grade.

B2020 Exterior Windows

B2020.10 Exterior Operating Windows

A. Description: Operable aluminum windows, thermally broken.
B. Functional and Performance Requirements:
   1. Performance Class: AW, per AAMA 101, capable of resisting design wind loads indicated in Building Design Criteria (Structural).
   2. Air Infiltration: Maximum .03 cfm/sq.ft.at inward test pressure of 6.24 lbf/sq. ft., tested per AAMA 101 IS.2, Air Infiltration Test.
   3. Water Resistance: No uncontrolled water penetration shall have occurred when each aluminum window was tested in accordance with both ASTM E547 (for 4 cycles) and ASTM E331 for one 15-minute cycle at a static pressure difference of 12 lbf/sq. ft.
   4. Thermal Performance: Design, fabricate and install the aluminum windows with the assembly U-factor maximum to comply with ASHRAE 90.1 and CALGreen for the project specific geographic location of the building project when tested according to NFRC 100.
   5. Solar Heat-Gain Coefficient: Provide glass for aluminum windows with an assembly SHGC maximum to comply with ASHRAE 90.1 and CALGreen for the project specific geographic location of the building project as determined according to NFRC 200 procedures.
   6. Forced-Entry Resistance: Comply with Performance Level 10 requirements when tested according to ASTM F 588.
   7. Glass Statistical Factor: Glass thicknesses are to be confirmed by the Design-Builder and/or glass manufacturer. All glass for the size openings required will be provided in thicknesses such that the probability of breakage at the design "Wind Load" will not exceed 8 lights per 1000 lights (S.F. 2.5) based on a 3 second gust wind load duration.
   8. Class I anodized (AAMA 611) or three-coat (AAMA 2605) fluoropolymer coating on all exposed aluminum components.

C. Applicable Components:
    1. Aluminum window frames.
    2. Insulating glass units, compliant with performance requirements.
    3. Manufacturer's standard heavy duty operating hardware per AAMA 907, compliant with LACBC and ADA accessibility requirements.
    4. Sheet metal flashings, closures, and trim.

B2020.20 Exterior Fixed Windows

A. Description: Fixed aluminum windows, thermally broken.
B. Functional and Performance Requirements:
    1. Performance Class AW, per AAMA 101, capable of resisting design wind loads indicated in Building Design Criteria (Structural).
        a. Air Infiltration: Maximum .01 cfm/sq.ft.at inward test pressure of 6.24 lbf/sq. ft., tested per AAMA 101 IS.2, Air Infiltration Test.
        b. Water Resistance: No uncontrolled water penetration shall have occurred when each aluminum window was tested in accordance with both ASTM E547 (for 4 cycles) and ASTM E331 for one 15-minute cycle at a static pressure difference of 12 lbf/sq. ft.
        c. Thermal Performance: Design, fabricate and install the aluminum windows with the assembly U-factor maximum to comply with ASHRAE 90.1 and CALGreen for the project specific geographic location of the building project when tested according to NFRC 100.
        d. Solar Heat-Gain Coefficient: Provide glass for aluminum windows with an assembly SHGC maximum to comply with ASHRAE 90.1 and CALGreen for the project specific geographic location of the building project as determined according to NFRC 200 procedures.
        e. Forced-Entry Resistance: Comply with Performance Level 10 requirements when tested according to ASTM F 588.
        f. Glass Statistical Factor: Glass thicknesses are to be confirmed by the Design-Builder and/or glass manufacturer. All glass for the size openings required will be provided in thicknesses such that the probability of breakage at the design "Wind Load" will not exceed 8 lights per 1000 lights (S.F. 2.5) based on a 3 second gust wind load duration.
        g. Class I anodized (AAMA 611) or three-coat (AAMA 2605) fluoropolymer coating on all exposed aluminum components.

C. Applicable Components:
    1. Aluminum window frames.
    2. Insulating glass units, compliant with performance requirements.
    3. Sheet metal flashings, closures, and trim.

B2020.30 Exterior Window Wall

A. Description: Aluminum storefront framing, thermally broken.

B. Functional and Performance Requirements:
   1. Air Leakage: Air leakage through each entrance and storefront assembly shall not have exceeded 0.06 cfm/sq. ft. (0.3 L/s per sq. m) of fixed wall area when tested in accordance with ASTM E 283 at a static-air-pressure difference of 6.24 lbf/sq. ft.
   2. Swinging Doors: Air leakage through each swinging entrance door shall not have exceeded 1.0 cfm/sq. ft. (5.0 L/s per sq. m) of surface area when tested in accordance with ASTM E 283 at a static-air-pressure difference of 1.57 lbf/sq. ft. (75 Pa).
   3. Water Resistance: No uncontrolled water penetration shall have occurred when complete system was tested in accordance per ASTM E331 for one 15-minute cycle at a static pressure difference of 12 lbf/sq. ft.
   4. Thermal Performance: Design, fabricate and install the aluminum storefront system with the assembly U-factor maximum to comply with ASHRAE 90.1 and CALGreen for the project specific geographic location of the building project when tested according to NFRC 100.
   5. Solar Heat-Gain Coefficient: Provide glass for aluminum storefront with an assembly SHGC maximum to comply with ASHRAE 90.1 and CALGreen for the project specific geographic location of the building project as determined according to NFRC 200 procedures.
   6. Glass Statistical Factor: Glass thicknesses are to be confirmed by the Design-Builder and/or glass manufacturer. All glass for the size openings required will be provided in thicknesses such that the probability of breakage at the design "Wind Load" will not exceed 8 lights per 1000 lights (S.F. 2.5) based on a 3 second gust wind load duration.
   7. Class I anodized (AAMA 611) or three-coat (AAMA 2605) fluoropolymer coating on all exposed aluminum components.
   8. Wind Loads: The aluminum-framed entrance and storefront work, including glass, shall be designed, fabricated and installed to withstand the maximum inward and outward wind pressures as required by ASCE 7 and LACBC for the design wind pressures.
   9. Building Frame Movement: Design, fabricate and install aluminum-framed entrances and storefronts to withstand building movements including thermal movements, loading deflections, shrinkage, creep and similar movements.

C. Applicable Components:
   1. Aluminum storefront framing.
   2. Aluminum/glass storefront doors and hardware (reference B2050.10).
   3. Insulating glass units, compliant with performance requirements.

B2050 Exterior Doors and Grilles

B2050.10 Exterior Entrance Doors

D. Description: Entry doors at public areas.
E. Functional and Performance Requirements:
    1. HMMA 861 "Guide Specifications for Commercial Hollow Metal Doors and Frames."
    2. Opening force requirements per LACBC and ADA accessibility requirements.
    3. All doors require ADA compliant locking and latching hardware

F. Applicable Components:
    1. Aluminum/glass storefront type, compliant with LACBC/ADA accessibility requirements. Finish to match adjacent storefront framing.
    2. Steel Doors: Flush design, hollow metal construction, 0.053-inch steel sheet faces with G90 coating, prepared for field painting. Weep holes at bottom to allow trapped moisture to escape.
    3. Steel frames and door hardware (Reference B2050.90).

B2050.20 Exterior Utility Doors

A. Description: Exterior steel doors and frames.
B. Functional and Performance Requirements:
    1. HMMA 861 "Guide Specifications for Commercial Hollow Metal Doors and Frames."
    2. Opening force requirements per LACBC and ADA accessibility requirements
    3. Provide UL listed and labeled doors at openings in fire-resistant rated exterior walls.
    4. All doors require ADA compliant locking and latching hardware

C. Applicable Components:
    1. Steel Doors: Flush design, hollow metal construction, 0.053-inch steel sheet faces with G90 coating, prepared for field painting. Weep holes at bottom to allow trapped moisture to escape.
    2. Frames and hardware (Reference B2050.90).

B2050.30 Exterior Oversize Doors

A. Description: Overhead coiling grille at garage entrances and exits.
B. Functional and Performance Requirements:
    1. 50,000 cycle rated.
    2. Capability to resist design wind loads and wind driven debris impacts.
    3. Interface with parking control and access control systems.

C. Applicable Components:
   1. Galvanized steel or aluminum grille and hood.
   2. Steel jamb guides and support framing.
   3. Motor operator.

B2050.90 Exterior Door Supplementary Components

A. Description: Steel door frames, and door hardware
B. Functional and Performance Requirements:
   1. Opening force requirements per LACBC and ADA accessibility requirements.

C. Applicable Components:
   1. Door Hardware: BHMA A156.1, Grade 1. Provide hardware complying with DPW Door Hardware Specifications (reference Appendix No. 78). Provide locksets with removable cores, compatible with the campus keying system.
   2. Steel Door Frames: 0.053-inch steel, welded corners, with G90 coating, prepared for field painting.

B30 EXTERIOR HORIZONTAL ENCLOSURES

B3010 Roofing

B3010.50 Low-Slope Roofing

A. Description: Single ply roofing system, insulation, and flashings.
B. Functional and Performance Requirements:
   1. Installed roofing and base flashings shall withstand uplift pressures indicated in Building Design Criteria (Structural), thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Installed system shall slope to drain at minimum 3/8 inch per foot slope. Roofing and base flashings shall remain watertight.
   2. Accelerated Weathering: Roofing system shall withstand 2000 hours of exposure when tested according to ASTM G 152, ASTM G 154, or ASTM G 155.
   3. Impact Resistance: Roofing system shall resist impact damage when tested according to ASTM D 3746 or ASTM D 4272.
   4. Material Compatibility: Roofing materials shall be compatible with one another and adjacent materials under conditions of service and application required, as demonstrated by roofing manufacturer based on testing and field experience.
   5. Energy Performance: Roofing system shall have an initial solar reflectance of not less than 0.70 and an emissivity of not less than 0.75 when tested according to CRRC-1.
   6. Exterior Fire-Test Exposure: ASTM E 108 or UL 790, Class A; for application and roof slopes selected; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
   7. 20 year, no dollar limit guarantee.

C. Applicable Components:

1. PVC feltback single ply membrane, 60 mil minimum thickness, fully adhered or mechanically fastened.
2. Rigid insulation (board and tapered insulation).
3. Cover boards.
4. Walkway pads or rolls.
5. Metal flashings clad with membrane material.

B3010.90 Roofing Supplementary Components

A. Description: Sheet metal flashing and trim, equipment curbs.

B. Functional and Performance Requirements:
   1. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, G90 (Z275) coating designation; structural quality, mill phosphatized for field painting.
   2. Fabricate curbs to minimum height of 8 inches.
   3. Where slope of roof deck exceeds 1/4 inch per foot (1:48), fabricate curbs and equipment support units with height tapered to match slope to level tops of units.

C. Applicable Components:
   1. Manufactured reglets and formed sheet metal counterflashing.
   2. Miscellaneous sheet metal flashing.
   3. Prefabricated equipment curbs.

B3040 Traffic Bearing Horizontal Enclosures

B3040.10 Traffic Bearing Coatings

A. Description: Heavy Duty, traffic-bearing elastomeric waterproofing membrane system with integral wearing surface for pedestrian traffic and vehicular traffic.

B. Functional and Performance Requirements:
   1. Vehicular and pedestrian traffic on slab above enclosed spaces in garage, above pour strips and at the topmost stair landing and treads at open stairs.
   2. Provide all labor, materials, equipment and supervision to prepare the slabs and vertical surfaces, detail all cracks and joints, patch perimeter and voids and install a traffic coating system.
   3. Crack detailing to include crack face surface preparation and installation of a flexible waterproof system.
   4. Work to include preparation, patching and membrane upturn at all vertical surfaces including columns, walls, cast-in-place curbs, islands and pipe penetrations.
   5. Material thickness as per manufacturer's recommendation.
   6. Provide primers, base, intermediate and topcoat, and accessory materials that are compatible with one another and substrate under conditions of service and application, as demonstrated by manufacturer based on testing and experience.
   7. Obtain traffic coating from single source from single manufacturer.

C. Applicable Components:
    1. Membrane System: Thickness as recommended by manufacturer for service conditions, but not less than 60 mils Dry Film Thickness (DFT).
    2. Joint Sealants: Single or multi-component urethane sealants complying with ASTM C 920 as recommended by the manufacturer for substrate and joint conditions, used in sealing cracks, expansions joints, for use in forming cants and for compatibility with the traffic coating.
    3. Sheet Flashing: 50 mil minimum non-staining sheet material recommended in writing by traffic-coating manufacturer.
    4. Adhesive: Contact adhesive recommended in writing by traffic-coating manufacturer.
    5. Reinforcing Strip: Fiberglass mesh recommended in writing by traffic-coating manufacturer.

END OF ELEMENT B

ELEMENT D – SERVICES

Extra Materials: Design-Builder shall provide "Added Stock" materials in accordance with Project General Requirements

D10 CONVEYING

D1010 Vertical Conveying Systems

D1010.10 Elevators – Passenger and Service

A. Description: Where traction type elevators are installed, all hoisting machinery, power units, governors, and controllers shall be located in machinery spaces separated from the elevator hoistway. Where conveyance machinery supporting a passenger car and/or counterweight is installed, the elevator guide rail shall not be utilized as the normal structural means of support for machines and its load. All hydraulic cylinder assemblies shall be direct plunger or single stage holeless. Elevator suspension means shall be no other than Traction Steel hoist ropes.

B. Functional and Performance Requirements:
   1. Car Speed: at ±3% of contract speed under any loading condition.
   2. Car Capacity: Safely lower, stop and hold 125% of rated load.
   3. Car Stopping Zone: ±1/4" under any loading condition.
   4. Door Opening Time: 2.4 seconds from start of opening to fully open.
   5. Door Closing Time: 4.6 seconds from start of closing to fully closed.
   6. Car Floor-to-Floor Performance Time: 12.5 Seconds from start of doors closing until doors are 3/4 open (1/2 open for side opening doors) and car level and stopped at next successive floor under any loading condition or travel direction.
   7. Car Ride Quality:
      a. Horizontal acceleration within car during all riding and door operating conditions not more than 15 mg peak to peak (adjacent peaks) in the 1-10Hz range.
      b. Acceleration and Deceleration: Smooth constant and not more than 3 feet/second^2
      c. Sustained Jerk: Not more than 8 ft/second.
   8. Duty Cycle for heat load calculations and oil cooler calculations should be based on no less than a 30% duty cycle, 120 starts per hour minimum

C. Applicable Components:
   1. Capacity: 3500 pounds minimum (Passenger), 4500 pounds minimum (Service)
   2. Class loading: Passenger class A.
   3. Machine: Provide new permanent magnet (PM) gearless
   4. Machine location: overhead
   5. Supervisory control: Group automatic microprocessor based system
   6. Motor control: AC variable voltage. Variable frequency microprocessor based with digital closed loop feedback.
   7. Power characteristics: 480 volts. 3-phases, 60 hertz

8. Hydraulic Power Unit: Belt Driven 120 starts per hour or direct driven submersible power unit with oil coolers.
9. Cylinder Assembly: Provide water tight sealed assembly.
10. Entrance type (passenger): Single speed center opening.
11. Door protection: 3-dimensional infrared, full screen device, with differential timing, nudging and interrupted beam time.
12. Safety – Flex Clamp Type B
13. Guide Rails: Planed Steel
14. Car Enclosure (Passenger)
    a. Steel Shell: fabricate walls of 14-gauge sheet steel, painted. Extend from floor to canopy and heavily reinforce to withstand severe service.
    b. Front Return Panels and Integral Entrance Columns: Reinforced minimum 16-gauge stainless steel. Custom finish. Swing entire unit on substantial pivot points (minimum of 3) for service access to car operating panel(s). Locate pivot points to provide full swing of front return panel without interference with side wall finish or handrail. Secure in closed position with concealed three-point latch. Provide service compartment with recessed flush cover and cutouts for operating switches, etc.
    c. Transom: reinforced minimum 16 gauge stainless steel full width of enclosure with cutout for car position indicator. Custom finish.
    d. Car Door Panels: Reinforced minimum 18 gauge stainless steel. Custom finish.
    e. Base: Stainless steel with concealed ventilation cutouts.
    f. Interior wall finish: Custom removable panels, faced and edged with textured stainless steel.
    g. Ventilation: Exhaust blower as required, mounted to car canopy on isolated rubber grommets.
    h. Lighting: Provide custom LED fixtures with wiring and hook-up. Provide emergency lighting integral with portion of normal car lighting system. Include required transformer.
    i. Suspended Ceiling: Six section (minimum), upgraded stainless steel panels.
    j. Handrails: upgraded stainless steel as required by code.
    k. Pads and Hooks: three-piece removable pads. Two pads covering side walls and adjacent front returns and one covering rear wall. Provide cutouts to access main car operating panel.
    l. Battery powered emergency car lighting. Provide separate constant pressure test button in car service compartment. Illuminate portion of normal car lighting signal fixtures. LED Illumination.
    m. Vandal resistant assembly and car and hall pushbuttons
    n. Dual car operating panels
15. Car Enclosure: (service)
    a. Steel shell: Fabricate walls of 14-gauge sheet steel. Extend from floor to canopy and heavily reinforce to withstand severe service.
    b. Front Return Panel: Reinforced minimum 16 gauge stainless steel. Swing entire unit on substantial pivot points (minimum 3) for service access to car operating panel(s). Locate pivot points to provide full swing of front

return applied panel without interference with side wall finish or handrail. Secure in closed position with tamper proof fastenings. Provide service compartment with recessed flush cover and cutouts for operating switches, etc.

c. Transom: Reinforced minimum 16 gauge stainless steel full width of enclosure with cutout for car position indicator.
d. Car Door Panels: Reinforced minimum 18 gauge stainless steel. Same construction as hoistway door panels.
e. Base: Stainless steel with concealed ventilation cutouts.
f. Interior Wall Finish: Removable panels, faced and edged, with textured stainless steel.
g. Ventilation: Exhaust blower mounted to car canopy on isolated rubber grommets.
h. Lighting: Provide standard LED fixtures with wiring and hookup. Provide emergency lighting integral with portion of normal car lighting system. Include required transformer.
i. Suspended Ceiling: Six section (minimum), stainless steel panels.
j. Handrails: stainless steel as required by code.
k. Pads and Hooks: Three-piece removable pads. Two pads covering side walls and adjacent front returns and one covering rear wall. Provide cutouts to access main car operating panel.
l. Battery powered emergency car lighting. Provide separate constant pressure test button in car service compartment. Illuminate portion of normal car lighting
m. Elevator Contractor's vandal resistant assembly for hall and car pushbutton stations:
n. Single car operating panel
o. Loading Bars: Loading Bars: Provide loading bars, 12 inches in height, the width of the rear of the cab minus 6 inches, located with a center 12 inches above the platform, and made of no less than ½" aluminum flat bar, and secured at no less than 8 places (4 upper and 4 lower) shall be placed at the rear of the cab to protect from loading impacts.

16. Car position indicators:
    a. Single digital with car direction arrows for service elevators.
    b. Dual digital with car direction arrows for passenger elevators.
17. Communication system: self-dialing, vandal resistant, push to call, two-way communication system with emergency personnel override recall, tracking and voiceless communication
18. Make provisions for card reader and CCTV within cars
19. Gearless Traction Hoist Machines:
    a. AC induction or P.M.S.M. gearless traction type motor with auxiliary breaking means, drive sheave, and deflector sheave mounted in proper alignment on a common, isolated bedplate. Provide bedplate blocking to elevate secondary or deflector sheave above machine room floor.
    b. Provide hoist machine mounted direct drive, digital, closed-loop velocity encoder.
    c. Hoist machine installations which require block-outs through machine room floor for other than hoist ropes shall be provided with a 14-gauge

galvanized sheet metal enclosure over entire clock-out on underside of floor slab.

d. Adjust the hoist machine brakes to hold 125% of the duty load. Seal brake tension and jam nuts after they are locked up tight.

20. Controllers: Group automatic, approved microprocessor-based, group dispatch with artificial intelligence car and motion control system.
21. Governors: Centrifugal-type, car driven machine room mounted with pull-through jaws and bi-directional shutdown switches. Provide required bracketing and supports for attachment to building structure.
22. Cylinder Well: Elevator Installer shall familiarize himself with existing conditions and be responsible for drilling cylinder wells.
    a. Casing: Provide steel casing, 12 inches greater in diameter than wrapped cylinder and proper depth to retain hole and provide structural integrity of PVC casing. Provide minimum 10 gauge corrosion resistant well casing; watertight joints and closed bottom. Weld seams solid at multiple casing joints. Provide a steel ring at top of casing to be keyed into pit floor. Provide watertight seal at bottom using 2 feet 0 inches thick non-shrink concrete plug of type for installation under water where drive casing is required and closed bottom casing cannot be installed.
    b. Provide minimum 3/8 inch thick PVC or HPDE casing with watertight sealed couplings and bottom end caps. Inside diameter shall be 6 inches greater than outside diameter of cylinder. Extend PVC or HPDE above pit floor. Seal top of PVC or HPDE and provide an inspection port of 2-inch diameter by 4-inch long PVC pipe with threaded cap.
    c. Installation: Set cylinder and PVC or HPDE casing within steel casing. Backfill between hole and steel casing with natural soils the full height of hole. Backfill between PVC or HPDE casing and steel casing with clean dry pea gravel at bottom 2’-0” of casing to stabilize PVC or HPDE with casing. Plunger and cylinder shall be plumb within 1/16 inch.
23. Cylinder: Steel pipe, factory tested for 600-pounds/square inch working pressure. Sandblast or wire brush outside of cylinder to remove rust and scale. Paint with heavy coat of epoxy or mastic. Work shall be done in shop and repaired in field if coating is damaged.
24. Plunger: Use seamless steel pipe or tubing, minimum Schedule 80. Plunger shall be no more than 0.010 inch out of round and straight within 1/16 inch. Protect during shipping and installation to avoid damage. If plunger is gouged, scarred or shows visible tool marks, it shall be replaced. Finish shall be 20 micro inches or finer. Plunger top shall be isolated from car frame. Plungers with follower guides are not acceptable.
25. Packing: Provide packing, which inhibits leaking of oil with drip ring.
26. OIl: Provide hydraulic oil or approved equal specifically designed and formulated for hydraulic elevator use.
27. Piping: Minimum Schedule 80 steel pipe suitable for 600 pounds pressure. No hoses shall be used in any part of piping. Provide sound isolating couplings in oil line between jack and pumping plant. Support piping using vibration isolating mounts or hangers with integral felt or neoprene at least 1/4 inch thick. Use threaded or welded joints throughout except at the connections to power unit

and cylinder unit. Use no more than two Victaulic type connections in the machine room and two in the pit area.

28. Pit and rupture valves: : Provide in each elevator pit a gate valve to shut off oil between cylinder and pumping plant and a pressure type line rupture safety valve to shut off oil between cylinder head and pit valve. Activation of safety valve shall not void operation of lowering valve during normal operation.
29. Door operators: High speed, heavy-duty closed loop door operator capable of opening doors at no less than 2-1/2 f.p.s. Accomplish reversal in no more than 2-1/2" of door movement. Provide solid-state door control with closed loop circuitry to constantly monitor and automatically adjust door operation based upon velocity, position, and motor current. Maintain consistent, smooth and quiet door operation at all floors, regardless of door weight or varying air pressure.
30. Guide Assemblies: Roller type with rubber composition tires of polyurethane, minimum 3/4 inch wide and fully adjustable spring loaded to provide continuous contact with rail surfaces. Balance car to insure equal guide shoe pressure on all wheels and not exceed manufacturer's recommendations. Size: Nominal roller diameters shall be 6" for car and 3.5" for counterweight.

D20 PLUMBING

D2030.00 Building Support Plumbing Systems

D2030.20 Stormwater Drainage Piping

A. Description: Storm drain piping from parking deck to drain by gravity and connect into site stormwater drainage system.

B. Functional and Performance Requirements:
   1. The stormwater drainage piping for the project shall be provided in accordance with the latest codes & standards as referenced in the narrative.
   2. Storm drain piping shall run at a minimum of 2% slope.
   3. Applicable Components:
   4. Above ground storm drain piping shall be Service weight cast iron hub and spigot soil pipe and drainage fittings, or galvanized steel pipe with galvanized threaded cast iron drainage fittings, or grooved end galvanized malleable iron fittings with rubber sealing gaskets for grooved end pipe, equal to Victaulic Style 75 or 77.
   5. Underground storm drain piping shall be Hub-and-spigot, service weight cast-iron soil pipe and fittings to comply with ASTM A 74. Provide with ASTM C564 rubber gaskets.

D2030.30 Facility Stormwater Drains

A. Description: Drains for conveyance of stormwater from parking deck surfaces to storm water piping system.

B. Functional and Performance Requirements:
   1. The stormwater drainage piping for the project shall be provided in accordance with the latest codes & standards as referenced in the narrative.

C. Applicable Components:
   1. Drains for parking deck shall be ASME A112.21.2M, cast-iron body with bottom outlet. Strainer shall be flat, square, heel-proof promenade-deck type and shall be constructed from stainless steel.

D40 FIRE PROTECTION

D4010 Fire Suppression

D4010.10 Water-Based Fire Suppression

A. Description: Provide new supervised fire protection sprinkler system in new buildings.

B. Functional and Performance Requirements:
   1. All fire protection work shall be in strict accordance with the current edition of California Fire Codes, NFPA 13, 24, 72, 75 and 101, California Building Codes and all authorities having jurisdiction. Modifications to the existing fire sprinkler system shall be on a separate permit by a license C16 contractor. Modifications to the existing fire alarm system shall be on a separate permit by a UL listed contractor. Provide certification to owner and authorities having jurisdiction.
   2. The design of the Fire Protection systems is based on NFPA 13 and the design criteria established for the specific occupancy of the facility.
   3. The system shall be hydraulically calculated by a licensed fire protection engineer.
   4. Contractor shall coordinate work with all other trades and coordinate sprinkler head locations and piping with lighting fixtures, speakers and diffusers, HVAC ductwork, etc.

C. Applicable Components:
   1. Sprinkler heads: located in acoustical tile ceilings shall be installed in the center of the tile.
   2. Sprinkler heads shall be UL listed and FM approved.
   3. Provide quick-response type where required by authorities having jurisdiction including the following:
   4. Gypsum board ceiling areas: submit, supply and install product, fully concealed heads with factory finished cover plate, to match adjacent ceiling surface finish paint.
   5. Acoustical tile ceiling areas: submit, supply and install product, fully concealed heads with factory finished cover plate, to match adjacent ceiling surface finish paint. Install at center of tile.
   6. Exposed ceiling areas: supply and install building standard, pendent or upright heads.
   7. Contractor shall provide intermediate temperature sprinkler heads (175°f to 225°f) in all it rooms, machine rooms and mechanical rooms.

8. Sprinkler piping: concealed above finished ceilings and exposed in areas without finished ceiling.
9. Sprinkler drains: drained into approved receptors.

D50 ELECTRICAL

D5000 Electrical General

D5000.10 General

A. Normal power shall be served from 12KV/277V NEMA 3R pad mounted transformer which in turn shall feed 277/480V, 3 Phase, 4 Wire switchboard with demand metering with capability to be monitored from a remote location.
B. The design of electrical systems shall be such that all equipment shall be provided and installed complete with the highest degree of quality and workmanship in both the type of equipment and the quality of installation.
C. The design of the electrical system shall be such that energy efficient systems and equipment are utilized to minimize the operational and maintenance cost.
D. The design of the electrical system shall be such that if offers maximum flexibility to any future modification or remodeling without and upgrades to major electrical distribution system.
E. The entire electrical system shall be fully rated and interrupting capacity of all equipment and its components shall exceed the available short circuit current rating aby at least 10 percent. Series rating are not acceptable.
F. Provide transient voltage suppressor where feasible to equipment serving sensitive load.

D5000.20 Code and Standards:

A. All products shall conform To NEMA Standards and shall be UL Listed or CSA certified for the use of specified item.
B. When possible, similar items shall be supplied by the same manufacturer throughout the project.
C. All works shall comply with California Electrical Code (CEC), California Building Code (CBC), National Electrical Code (NEC) and all applicable national, state, county and local codes and standards.
D. American Standards for Testing of Materials (ASTM) for Electrical Protective Equipment.
E. National Fire Protection Association (NFPA) Article 70.

D5010 Facility Power Generation

D5010.10 Packaged Generator Assemblies

A. Description:
    1. Provide a diesel powered, 1800 rpm, generator set with sound attenuated weather protective housing operated by means from one or more automatic transfer switches.
    2. A 480/277V, 3-Phase, 4-Wire diesel generator system will provide emergency power to the buildings for 48 hours with a sub-base fuel tank and a day tank.

The emergency generator set will be equipped with factory installed load bank rated at 50% of the generator set capacity. The load bank will have load steps of 200KW interval with auto load controller to maintain a minimum load on the generator during under load situations. An integral generator sub-based diesel fuel storage tank will provide a minimum 48 hours fuel for continuous generator operation in case of normal power failure. A weather proof, sound attenuated enclosure with diesel particulate filter and exhaust muffler will be provided. The generator acoustic enclosure, exhaust muffler and all other needed noise control shall reduce the generator noise to levels that comply with the City noise ordinance at all adjacent property lines.

3. Provide exterior mounted connection for roll-up generator complete with non-auto transfer switch and connection to the main switchboard.

B. Functional and Performance Requirements:
   1. All life safety equipment, security, telecommunication, lighting, egress lighting, fire alarm, elevators (one per bank of elevators; passenger, freight), air conditioning (backup ventilation fan for selected rooms) and all other safety and security monitoring systems will be backed up with emergency power.
   2. The generator set shall be EPA approved and contractor shall obtain the operation certification from SCAQMD.
   3. Roll-up Generator Termination Box: Provide means for connection of a roll-up generator on the exterior of building with non-auto ATS connection to the server. Roll-up generator termination box is intermediate termination cabinet between a temporary, portable, roll-up generator and the facility being served by the portable generator. Type NEMA 3R enclosure.16 series male cam-locks connection shall be utilized. Line and load side mechanical alloy set screw lugs. Hinged bottom trap door for line conductor. UL 1773 – Termination box Marked “Suitable for use on the line side of service equipment” per UL 1773.

C. Applicable Components:
   1. Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
   2. Comply with ASME B15.1.
   3. Comply with NFPA 37.
   4. Comply with NFPA 30
   5. Comply with NFPA 99
   6. Comply with NFPA 110 requirements
   7. Comply with UL 2200
   8. Buy American Act Certification.

D5010.30 Photovoltaic Collectors

A. Description:
   1. Provide a grid tied photovoltaic system for the parking structure as well as surface parking to include crystalline photovoltaic panels, combiner boxes, inverters, and support system.

B. Functional and Performance Requirements:
   1. The PV system hardware and services must meet or exceed all applicable local, State and utility requirements, conform to the applicable code and standard, and have passed the listing and qualification tests, listed below:
   2. IEEE 1262 – Recommended Practice for Qualification of Photovoltaic Modules.
   3. PowerMark certification for PV modules.
   4. IEEE Standard 928-1986 – Recommended Criteria for Terrestrial Photovoltaic Power System.
   5. IEEE 1547 – Standard for interconnecting Distributed Resources with Electric Power System
   6. Underwriters Laboratories 1741 - UL Standard for Inverters, Converters, Controllers and Interconnection system Equipment for use with Distributed Energy Resources.
   7. Underwriters Laboratories 1703 – UL standard for Listing Photovoltaic Modules.
   8. Certification of PV Equipment – All PV modules, inverters and electrical component must be listed or recognized by an appropriate and recognized United State Safety Laboratory.
   9. Buy American Act Certification.

C. Applicable Components:
   1. Provide a comprehensive “Photovoltaic Application Analysis” with detailed description of system, application, site shading conditions and expected kw output of the roof top photovoltaic application. Utilize the Solmetric Suneye or the Solar Pathfinder shading analyzers to analyze the effects of the existing site shading conditions. Analysis must include estimated PV output in kWh per year. Coordinate rooftop application analysis with other equipment that is required to be placed on the roof to determine space available and proper solar orientation for photovoltaic equipment.
   2. The contractor work responsibilities include at a minimum: system design, equipment selection and PV system installation. System must be individually capable of providing peak power output of at least proposed PV system size, 480 volt, 3-phase, 4-wire power.
   3. Configure system to allow automatic operation without operator intervention. Design system and specify equipment to minimize maintenance requirements.
   4. Locate the inverter (s) disconnects and associated electrical equipment in an area that is accessible, weather-protected, and secure from vandalism and personal injury.
   5. Mount disconnects and over current devices in approved boxes, enclosures or panel board. Disconnects and switches must be DC rated when used in DC applications. Bond metal enclosures and boxes to the grounding conductor.
   6. Layout of modules on the roof must meet the requirements of NFPA-1 including labeling, roof access and roof pathways. Coordinate roof venting requirements with fire protection engineer.
   7. Provide permanent plaque or directory for power source.

D5010.60 Uninterruptable Power Systems (UPS)

A. Description:
   1. A 480V-120/208V, 3-phase, 4-wire UPS system with a minimum of 15 minutes battery back-up will be allocated to all electronic security system, monitoring and telecommunications. The UPS system will be supported by emergency diesel engine generator for longer sustained operation during power outage.
   2. UPS requirements and sizes will be coordinated with the County representative.
   3. Gates, security system, telecom system, and all other loads shown in architectural room data sheets shall be supplied from UPS.

B. Functional and Performance Requirements:
   1. The UPS unit shall be single input requiring only one input power feeder for normal power conversion, battery charging, automatic static bypass, and maintenance bypass.
   2. The UPS unit shall include internal VRLA batteries.
   3. Normal Operation: The critical load shall be continuously supplied by an inverter/converter or motor/generator that maintains the specified output power quality, for the specified load conditions, independent of the input power quality, up to the specified duration for sustained loss of input power. The DC storage system shall remain charged under normal conditions and shall be automatically recharged following a brief loss of input power.
   4. Automatic Bypass Operation: The critical load power shall automatically transfer from normal to bypass via a high-speed static transfer switch in the event of prolonged overload, load fault, or UPS internal failure.

C. Applicable Components:
   1. Manufacturer experience: The manufacturer shall have a minimum of 5 years history of three phase UPS designs similar to that proposed, installed and successfully operating in the field, with references that will be provided upon request.
   2. Quality System: The manufacturer shall be certified to conform to ISO 9001.

D5010.70 Transfer Switches

A. Description:
   1. Automatic transfer switch shall have a minimum inherent withstand rating not less than the available short circuit, overcurrent protective coordination study and shall conform to UL 1008 for Emergency System.
   2. Automatic Transfer Switch (ATS) will be equipped with bypass isolation in normal and emergency position.
   3. All transfer switches shall be provided with a neutral position delay feature to delay the transfer of load from generator to normal power.

B. Functional and Performance Requirements:
   1. Number of Automatic Transfer Switches (ATS's) will be allocated as follows: (1) ATS feeding all egress lighting; (1) ATS feeding all life safety equipment including smoke evacuation equipment; (1) ATS feeding security and telecommunication system; (1) ATS feeding elevators.

C. Applicable Components:
   1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
   2. Comply with NEMA ICS 1.
   3. Comply with NFPA 70-2016.
   4. Comply with NFPA 99-2016.
   5. Comply with NFPA 110-2016.
   6. Comply with UL 1008
   7. Construction: Switches shall be electrically operated and mechanically held by a single solenoid direct operating mechanism.
   8. Construction: Switches shall be sized and have mechanically braced contacts to withstand momentary surge currents during transfer and retransfer.
   9. Construction: Each switches shall be capable for manual operation by one person.
   10. Installation: Where 4-pole switches are indicated, provide 100 percent rated neutral switching capacity with fully rated (non-overlapping) contacts.
   11. Installation: Where 3-pole switches with neutral conductors are indicated, provide fully rated un-switched, solid, neutral terminal.
   12. Installation: The transfer switch shall have controls to auto-start the engine generator upon power failure and to automatically shut down the engine generator upon normal power return.

D5020 Electrical Service and Distribution

D5020.10 Electrical Service

A. Description:
   1. Electrical service to the building will be 480/277V, 3-Phase, 4-Wire system via 12KV-480/277V, 3-Phase, 4-Wire pad mounted transformer. The building electrical service will be comprised of the following transformer:
   2. Probation Building: (1) Transformer @ 12KV-480/277V, 3-Phase, 4-Wire : Service switchboard @ 480/277V, 3-Phase, 4-Wire.
   3. ISD Building: (2) Transformer @ 12KV-480/277V, 3-Phase, 4-Wire : (2) Service switchboard @ 480/277V, 3-Phase, 4-Wire.

B. Functional and Performance Requirements:
   1. An optional tie-breaker will be provided between the (2) service for ISD Building. Tiebreaker will provide flexibility to shift loads and to provide load shedding to limit building operation interruption in case one service goes down.
   2. Normal power and emergency electrical source including main and distribution facilities will be physically separated by 50’-0” minimum for each building.

C. Applicable Components:
   1. Provide medium voltage cable complete with accessories.
   2. Cable rated 15 KV, 3-phase, 60 hertz distribution system.
   3. Cable construction in accordance with ASTM and ICEA Standards, suitable for wet and dry location and underground installation.

D5020.30 Power Distribution

A. Description:
   1. Main electrical switchboard will be located within each building (ISD and Probation) dedicated main electrical switchgear room. For each building, underground secondary feeder will run from secondary transformer side to the main service switchboard of each building.

B. Functional and Performance Requirements:
   1. Power distribution from main electrical switchboard to appropriate electrical lighting panels, electrical plug loads and HVAC / Plumbing equipment.

C. Applicable Components: Main service switchboard
   1. The service switchboard include copper bus with bolt - on circuit breakers, fully bussed, fully rated, with AIC ratings to match or exceed the fault level to be provided by SCE and fully rated system. AIC rating shall conform to the approved Short Circuit and Overcurrent Protective Coordination Study.

D. Applicable Components: Low Voltage Transformers
   1. General purpose and distribution dry type transformer shall be constructed and tested in accordance with ANSI and NEMA standards.
   2. Transformer shall be low loss type with minimum efficiencies per NEMA when operated at 35 percent of full load capacity. Transformer shall be Energy Star labeled.
   3. Insulation: NEMA Class H, 115-degree C rise over a 24 hour average ambient temperature of 40 degree C and all Class H materials.
   4. Both primary and secondary windings shall be copper conductors. All bussing shall be copper.
   5. All transformer shall have the secondary neutral brought to the terminal section for the option of multiple taps. Transformers shall be equipped with six 2-1/2 percent (2 above and 2 below normal voltage) taps.
   6. Transformer for nonlinear loads shall be K-13 rated, equipped with 200 percent neutral and double sized neutral terminal.
   7. Sound levels shall meet NEMA TR-27 and not to exceed the following: 0-9 kVA: 40dB; 10-50 kVA: 45dB; 51-150 kVA: 50B; 300 kVA: 55dB; 500 kVA: 60dB
   8. Mounting: 1-15 kVA: Suitable for wall, floor mounting
   9. Mounting: 16-75 kVA: Suitable for wall, floor, or trapeze mounting
   10. Mounting: Larger the 75 kVA: Suitable for floor mounting
   11. Final connections to the transformer shall be made in rigid conduit terminating with a minimum of 12 inches and not exceeding 36 inches of flexible conduit to the transformer case below the transformer core. Wire or conduit shall not come in contract with the transformer core or its mounts.
   12. Provide vibration isolators on all floor mounted transformer.

E. Applicable Components: Panelboards
   1. Panel boards shall be fully rated with bolt on circuit breakers, copper bus, copper ground bus, and isolated ground bus. Minimum integrated short circuit as determined by Overcurrent Protective Device Coordination Study.
   2. All distribution and lighting panelboards shall be located in dedicated electrical room or closets. The only exception are panelboard for main computer room, laboratory that can be installed within that spaces.
   3. Panelboard boxes shall be galvanized sheet metal with ample gutter space in accordance with the National Electrical Code. Front door shall be of flat sheet steel finish. Doors shall be attached with concealed steel hinges and provided with a cylinder tumbler type combination catch lock and circuit directory. Boxes shall be 20" minimum wide and 5-3/4" deep.
   4. 120/208 volt protective devices shall be bolt-on. Rating and number of poles shall be indicated on the drawings. Two or three pole breakers shall have one handle. Breakers shall be rated 10,000 amperes RMS.
   5. 480/277 volt protective devices shall be bolt-on. Rating and number of poles shall be indicated on the drawings. Two or three pole breakers shall have one handle. Breakers shall be rated 14,000 amperes RMS at 480 volt.
   6. All panelboard shall be provided with 25% spare capacity in regards to load capacity and spare circuit breaker space.
   7. All panelboard shall be provided with three (3) spare conduits into the nearest accessible ceiling space for future use.
   8. All circuit breaker shall be bolt on, installed vertically at top to bottom of the panel.
   9. All busses including ground(s) and neutral shall be copper.
   10. All panel boards shall equipped with a ground bus.
   11. In addition to regular ground bus bar, provide an isolated ground bus bar for all 120/208V panelboards.

F. Applicable Components: Switchboards and Distribution Boards
   1. The entire switchboard and distribution board shall be of unit construction with all parts designed, manufactured and assembled by a single manufacturer to assure complete and proper coordination between all items.
   2. Construction and installation shall meet seismic zone requirements.
   3. Codes and Standards: The design of all current carrying devices or parts of switchboards/distribution board shall conform to the standard specified in the related sections of Underwriters Laboratories, Inc. (UL) No. UL-891 and National Electric Manufacturer's Association (NEMA).
   4. Enclosure: The switchboards / distribution boards shall be floor mounted, self-supporting, dad-front and rear, front operated, distribution type, manufactures complete with all parts, fittings and equipment, including busses, circuit breakers, barriers, terminals, wiring and connections.
   5. Enclosure: All switchboard sections shall be a minimum of 24" deep and shall be constructed of code gage steel.
   6. Enclosure: All switchboard sections shall be line up evenly, front and rear.
   7. Enclosure: All wiring gutters shall extend the full length and depth of the switchboard.
   8. Enclosure: All busses including ground and neutral shall be copper.

9. Enclosure: Switchboard / Distribution Board shall be capable to increase the number of circuit breakers for future applications. Provide at least 35 percent additional space.
10. Installation: Switchboard / distribution board shall be mounted on 4" high housekeeping pad. Size of pad shall be as required to meet the minimum edge distance requirements of anchor bolts.

G. Applicable Components: Molded Case Circuit Breaker
   1. AIC rating shall conform to the approved Short Circuit and Overcurrent Protective Coordination Study.
   2. Inverse time automatic tripping
   3. Field Adjustable Trip Circuit Breaker – Circuit breakers with frame sizes 400 amperes and larger shall have mechanism for adjusting long time, short time and instantaneous setting for automatic operation.
   4. Field-Changeable Ampere Rating Circuit Breaker – Circuit breaker with frame sizes 400 amperes and larger shall have changeable trip units.
   5. Current Limiting Circuit Breaker: Circuit breaker indicated as current-limiting have automatically-resetting current limiting elements in each pole. Let-through Current and Energy: Less the permitted for same size Class RK-5 fuse.
   6. Solid-State Circuit Breaker : Electronic sensing, timing, and tripping circuits for adjustable current settings; instantaneous trip; and adjustable short time trip; ground fault trip with integral ground fault sensing.

H. Applicable Components - Plug-In Busway
   1. Furnish and install a plug-in busway system complete with plug-in cable tap boxes, end closures, hangers and plug-in devices as indicated on the drawings.
   2. Ampere rating, voltage and phase of busway shall be as indicated on the drawings. Neutral bus shall be full capacity.
   3. The busway shall consist of aluminum bus conductor totally enclosed and supported in a sheet steel housing.
   4. The busway shall be a 5-wire system.
   5. Busway, fittings, plug-in devices and accessories shall bear the UL label.

I. Applicable Components - Short Circuit / Coordination Study and Arc Flash Hazard Analysis:
   1. The electrical contractor shall furnish a Short Circuit and Protective device coordination study and Arc Flash hazard analysis as prepared by the Electrical Engineering Firm.
   2. The studies shall include all new distribution equipment supplied by the equipment manufacturer for the project.
   3. The short circuit study and coordination study shall be performed in accordance with recommended practices and procedures set forth in ANSI/IEEE 399, ANSI/IEEE 141 and ANSI/IEEE 242.
   4. The Arch Flash Hazard Analysis shall be performed per the requirements set forth in NFPA 70E – Standard for Electrical Safety in the Workplace. The analysis shall be performed according to the IEEE 1584 equations that are presented in NFPA 70E.

D5020.70 Facility Grounding

A. Description: Electrical components shall be grounded in accordance with NEC, NFPA 70, UL standards and local jurisdiction.
B. Functional and Performance Requirements:
    1. 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.
    2. Comply with UL 467 for grounding and bonding materials and equipment and install in accordance with IEEE 142.
    3. Install grounding and bonding conductors concealed from view.
    4. All service equipment, conduit systems, supports, cabinets, equipment, fixtures, etc. and the grounded circuit conductor shall be properly grounded in accordance with the latest issue of California Electrical Code (CEC) and Los Angeles County electrical codes. Provide bonding jumpers, grounding bussing, clamps, etc. for complete grounding. All ground clamps or such devices shall be listed for such purposes. All welded connections shall be the exothermic weld type. Set screw lugs not acceptable.
    5. The grounding system shall be tested by a third party and the resistance shall be 25 ohms or less.
    6. Install grounding well pipe with cover at each rod location. Install well pipe top flush with finish grade.
    7. Install minimum 4 AWG bare copper wire in foundation footing.
    8. Install grounding electrode conductor and connect to reinforcing steel in building columns. Electrically bond steel together.
    9. Equipment Grounding Conductor: Install separate, insulated conductor within each feeder and branch circuit raceway. Terminate each end on suitable lugs, bus, or bushing.
    10. Install a continuous and complete grounding electrode system using underground cold water system and building steel. Where water piping is not available, install artificial station ground by means of driven rods or buried electrodes.
    11. Permanently ground entire light and power system in accordance with CEC, including service equipment, distribution panels, lighting panelboards, switch and starter enclosures, motor frames, grounding type receptacles, and other exposed non-current carrying metal parts of electrical equipment.
    12. Accomplish grounding of electrical system by using insulated grounding conductor installed with feeders and branch circuit conductors in conduits. Size grounding conductors in accordance with CEC. Install from grounding bus of servicing panel to ground bus of served panel, grounding screw of receptacles, lighting fixture housing, light switch outlet boxes, cable trays or metal enclosures of service equipment. Ground conduits by means of grounding bushing on termination at panelboards with installed number 12 conductor to grounding bus.
    13. Grounding electrical system using continuous metal raceway system enclosing circuit conductors in accordance with CEC.

14. Permanently attached equipment and grounding conductors prior to energizing equipment.
15. Provide ground bars in all electrical and communications rooms. Ground bars shall be copper with required insulator and stand-offs. Connect grounds for all telecommunication rooms to the main telecommunication room ground only. This ground system shall be isolated from any other grounding system except for the single connection at the main system ground.
16. All grounding conductors shall be green, except for isolated ground conductor which shall be green with yellow stripe.
17. Grounding shall be tested by an independent third party firm.

C. Applicable Components:
   1. Rigid Steel Conduit: IMC: ANSI C80.6.
   2. PVC-Coated Steel Conduit: PVC-coated rigid steel conduit. Comply with NEMA RN 1. Coating Thickness: 0.040 inch, minimum.
   3. EMT: ANSI C80.3.
   4. FMC: Zinc-coated steel or aluminum.
   5. Insulated Conductors: Copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.
   6. Install insulated equipment grounding conductors with all feeders and branch circuits.
   7. Install insulated equipment grounding conductors with the following items, in addition to those required by NFPA 70: Feeders and branch circuits; Receptacle circuits; Single-phase motor and appliance branch circuits; Three-phase motor and appliance branch circuits.
   8. Water Heater: Install a separate insulated equipment grounding conductor to each electric water heater. Bond conductor to heater units, piping, connected equipment, and components.
   9. Air-Duct Equipment Circuits: Install insulated equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners, heaters, dampers, humidifiers, and other duct electrical equipment. Bond conductor to each unit and to air duct and connected metallic piping.
   10. For telephone, alarm, voice and data, and other communication equipment, provide No. 4 AWG minimum insulated grounding conductor in raceway from grounding electrode system to each service location, terminal cabinet, wiring closet, and central equipment location

D5030 General Purpose Electrical Power

D5030.10 Branch Wiring System

A. Description:
   1. Branch wiring raceways to general purpose electrical power and receptacles include conduit and tubing, surface raceways, outlet boxes, pull and junction boxes and handholes.
   2. Underground and Under Slab: Use rigid steel conduit, intermediate metal conduit, PVC Schedule 40 or as otherwise required to complete the work. Minimum size of conduit per CEC.

3. Conduit shall not be installed in any floor slab.
4. Outdoor locations, Above Grade: Provide rigid steel conduit or EMT with raintight fitting. Provide cast metal or nonmetallic outlet, pull, and junction boxes.
5. Wet and Damp Locations: Provide rigid steel conduit or EMT with raintight fitting. Provide cast metal or nonmetallic outlet, pull, and junction boxes. Provide flush mounting outlet in finished areas.
6. Exposed Dry Locations: Provide rigid steel conduit or EMT where permitted by code. Provide sheet-metal boxes. Provide flush mounting outlet boxes in finished areas. Provide handled enclosure for large pull boxes.
7. Provide push button (on-off) controller for controllers.
8. Provide wiring for equipment chargers (240/120 ~ 36VDC) as per equipment manufacturer's recommendations.

B. Functional and Performance Requirements:
   1. Branch wiring system to comply with NFPA
   2. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
   3. Copper Conductors: Comply with NEMA WC 70. The design is based on copper conductors.
   4. Conductor Insulation: Comply with NEMA WC 70 for Types THW, THHN, THWN, THHN-THWN-2, and XHHW.
   5. Minimum Raceway Size: ½ inch for above ground installation and ¾ inch for underground installation, unless otherwise specified.
   6. All surface raceway mounted in damp or wet locations or below 8 feet above finished floor shall be RGS, IMS or EMT where allowed by code. All concealed conduit above ground in the dry location shall be EMT. All underground conduits shall be non-metallic conduit.
   7. Provide pull strings for all empty conduits.

C. Applicable Components: Raceways
   1. Conduits to be of size based on a maximum of 40% conductor fill ratio, and to be installed according to CEC.
   2. Rigid conduit, electrical metallic tubing as permitted by CEC. Flexible steel conduit shall only be used for normal system lighting whips, connections to vibrating equipment, and for seismic connections and shall not be used for the emergency system.
   3. No aluminum conduit (rigid or flexible) is permitted.
   4. All Electrical Metallic Tubing (EMT) fittings shall be steel compression type. Fittings for rigid conduit shall be threaded steel type. Connectors shall be insulated throat type.
   5. Flexible Steel Conduit: Manufacture from single strip steel, galvanized prior to conduit fabrication. Connectors and couplings shall be single screw compression or set screw type only.
   6. Flexible Liquid-tight Steel Conduit : Liquid-tight conduit shall be manufactured from a single strip steel, galvanized prior conduit fabrication, and shall be provided with an extruded polyvinyl chloride cover.

7. PVC : Heavy wall Polyvinyl Chloride Schedule 40 Conduit with solvent welded joints. Use of PVC shall be limited to underground installation at the site, encased in concrete (encasement is required for high voltage and feeder circuits cabling only).
8. Minimum size conduit per CEC.

D. Applicable Components: Wire and Cables
1. All conductors to be copper, solid for #10 AWG and smaller, stranded for #8 AWG and larger.
2. Minimum conductor size shall be No. 12 AWG.
3. All conductors larger than #4 to have Type XHHW insulation.
4. All other conductor insulation shall be Type THHN/THWN-2.
5. Factory color coding to be utilized for appropriate system voltages and phase identification.
6. All conductors shall be new and manufactured within 12 months of installation.
7. All wiring for occupancy sensor power packs (high and low voltage) to the makeup junction box shall be in conduit.

E. Applicable Components: Boxes
1. Sheet steel boxes shall be standard one-piece knock-out boxes. The minimum size shall be 4” square by 2 1/8” deep with adequate space for devices, wires and 30% spare fill capacity.
2. Telephone and intercom outlets shall be a minimum of 4-11/16” square by 2-1/8” deep.
3. Fire Alarm boxes shall be 4” square with plaster rings to suit type of devices.

F. Applicable Components: Underground Conduits and Duct Banks
1. Underground conduits without concrete encasements shall be galvanized rigid steel. PVC Schedule 40 may be used where indicated on the drawings.
2. Concrete encased underground conduits shall be installed in accordance with the recommendation set forth in NEMA Bulletin.
3. Provide concrete encasement for conduits as indicated on the drawings. The concrete shall have a minimum compressive strength of 2,500 psi and shall be color red.
4. Conduits shall terminate in end bells where duct line enter manholes or handholes.
5. Changes in direction in the duct banks shall be accomplished by using long sweep bend with a minimum radius of curvature of 25 ft. or manufactured sweeps with a 150in. radius.
6. Conduit spacers for duct banks shall be in the plastic interlocking type and shall be places at not more than 5 feet intervals along the duct bank. Spacers shall be secured to prevent movement of conduits during the pouring of concrete.
7. Use rigid steel conduit for stub-ups and risers to grade from other conduits. Cap all stub-ups for future use.

G. Applicable Components: Manholes and Handholes
1. The manhole and handholes shall be the precast type complete with traffic covers, ladders pulling irons, sumps, cable support racks, etc.

2. Manhole and handholes shall be placed on a 6" base compacted sands or gravel to assure uniform distribution of soil pressure on the floor.
3. Surfaces between sections of manholes and handholes shall be cleaned and gasketed and watertight. All outside surfaces shall be coated with an approved waterproofing compound.
4. The top of manholes and handholes shall align with the finished surface where they installed.

H. Applicable Components: Outlet and Junction Boxes
1. Provide boxes in the wiring or raceway systems wherever required for pulling of wires, making connections or mounting of devices or fixtures. Each box shall have the volume required by code for number of conductors enclosed in the box.
2. Boxes installed in wet location or outdoor shall be the cast metal hub type, complete with gaskets and covers. Boxes in other location shall be galvanized, sheet steel knock-out type.
3. Sheet steel boxes shall not be less than 4" square and 1 ½" deep. Boxes installed for concealed wiring shall be provided with suitable switch or plaster rings as required by the devices to be served. Where the boxes are surface mounted, they shall be fitted with suitable raised or blank covers.
4. Recessed boxes in stud partitions or suspended ceiling shall be supported with galvanized steel box hangers of type made specially for the purpose or attached directly to support structure members.
5. Use outlet boxes serving fixtures or devices as pull boxes wherever practicable. In finish areas, provide pull or junction boxes only as directed.
6. Unless otherwise indicated, all wall outlet boxes shall be flush mounted in areas with finish walls.
7. Use solid type ganged boxes where required for more than two devices.
8. Boxes used in concrete, masonry or tile shall be of the type designed for use in those installations.
9. Switch and plaster rind shall be such that they are flush to no more than 1/8" behind the surface of the finished wall or ceiling.
10. The mounting height of wall outlets shall be measured from the finish floor to the center of the wall outlet. Unless otherwise indicated, the mounting heights of the wall outlets as follows:

Convenience receptacle	18 inches
Switch for light control	46 inches
Receptacle over counter	48 inches
Telephone or Data outlet	18 inches
Thermostat, fire alarm manual station	48 inches

I. Applicable Components: Pull Boxes
   1. Pull boxes shall be installed in all conduit runs wherever indicated or where necessary in order to facilitate the pulling of wires or cable or as required to comply with the code requirements.
   2. All pull boxes shall be constructed of code gauge steel and sized as indicated on the drawings or required by code. Pull boxes shall be provided with removable covers secured by machine screws.
   3. All surfaces of boxes and covers, inside and out shall have a rust inhibitor prime coat and baked on gray enamel finish coat.

J. Applicable Components: Wireways
   1. Wireways shall be hinge cover and shall be constructed and installed so that electrical and mechanical continuity of the complete wireway system is secured.

K. Applicable Components: Cable Trays
   1. Cable tray shall consist of galvanized steel ladder type, NEMA Class 12C, minimum of 6 inches deep by 12 inches wide.
   2. Securely fasten cable tray to structural members.
   3. System shall use standard pre-fabricated elbows, reducers, crossover, tees, and elevation change tray as required.
   4. Provide fire barriers where cable trays penetrate fire rated building component. Fire wall penetrations must be sealed with an approved designed-tested fire stopping system installed in accordance with manufacturer's instructions.
   5. Provide a bare copper #2 AWG, insulated copper ground conductor in each cable tray. Connect each section of cable tray to the ground connector.
   6. Tray shall be supported by cantilever bracket, trapeze or individual rod suspension. Support shall be installed on five foot centers maximum. A support shall be placed within two feet on each side on any connection to a fitting.
   7. All power feeds crossing the path of the cable tray at right angles should be a minimum of 6 inches in distance from the cable tray in order to prevent problems with high speed data transmissions.
   8. A minimum of 12 inches access headroom shall be provided and maintained above the complete cable tray system. Cable trays must have adequate side access for initial cable installation and for future cable adds, moves and changes.

D5030.50 Wiring Devices

A. Description: Wiring devices includes wall switches, wall dimmers, receptacles, multioutlet assembly, device plates and decorative box cover.
B. Functional and Performance Requirements:
   1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
   2. Comply with NFPA 70-2016.
   3. All 120 volt, 1 phase, 15 and 20 ampere receptacles installed outdoors with direct grade level access, on roof and in bathrooms shall have ground fault

circuit interrupter protection for personnel. This protection shall be provided by using either ground fault circuit breakers or GFCI receptacles.

C. Applicable Components: Wall Switches
   1. Wall switches shall be fully enclosed, quite-operating flush toggle type switches for back and side wiring.
   2. NEMA WD 1, Industrial, Heavy-Duty, Specification Grade, AC only general use snap switch.
   3. Body and handle: For emergency power color to be red.
   4. Indicator Light: Lighted handle type switch. Provide red color for emergency and green color for normal power circuits.
   5. Locator Light: Lighted handle type switch; clear color handle.
   6. Voltage Rating: 120-277 volts, AC
   7. Current Rating: 20 amperes

D. Applicable Components: Manual Wall Dimmers
   1. Fluorescent dimmers shall be 120 or 277 volts as required for circuit wiring. Rating shall be based on quantity of lamps controlled.
   2. NEMA WD 1, Type 1 electronic dimmer for fluorescent and LED lamps. Coordinate ballast and driver type.
   3. Provide dimmer suitable for application
   4. Body and handle: Plastic with linear slide. For emergency power color to be red.
   5. Voltage: 120/277 volts
   6. Accessory Wall Switch: match dimmer appearance.

E. Applicable Components: Receptacles
   1. Receptacles shall be NEMA 5-20R, rated for 20A, 125 volts, heavy duty specification grade.
   2. Receptacle shall not be connected for feed through, pigtailed in box for circuit continuation.
   3. Receptacle on emergency power shall be red.
   4. GFCI Receptacle: For outdoor or within 6 feet of sink shall be ground fault circuit interrupter type. GFCI shall be 20 amperes, 120 volt, duplex, three wire grounding with test and reset button.
   5. Provide one isolated ground duplex outlet at each area where there is a telephone/data outlet. The isolated ground wire shall be used only for other isolated ground receptacle outlet and separate from other convenient receptacles ground wires. The isolated ground receptacle outlet shall be color orange.
   6. A maximum of six (6) convenience receptacles will be allowed on each 20 amp circuit. Provide dedicated circuit for all copiers, printers, microwaves, refrigerators, coffee machines, garbage disposal and vending machines. Provide dedicated circuits for laboratory equipment and equipment requested by end users.
   7. Tamper-Resistant Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, and UL 498.

8. Twist-Locking Receptacles: 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration L5-20R, and UL 498.

F. Applicable Components: Wall Plates
   1. Plate-Securing Screws: Metal with head color to match plate finish.
   2. Material for Finished Spaces: Steel with white baked enamel, suitable for field painting Smooth, high-impact thermoplastic 0.035-inch-thick, satin-finished stainless steel 0.04-inch-thick, brushed brass with factory polymer finish 0.05-inch-thick anodized aluminum 0.04-inch-thick steel with chrome-plated finish.
   3. Material for Unfinished Spaces: High-impact thermoplastic.
   4. Material for Damp Locations: Cast aluminum with spring-loaded lift cover, and listed and labeled for use in "wet locations."
   5. For receptacles with other than 120 volt, inscribe voltage available.
   6. For receptacles served by emergency circuit, inscribe “Emergency.”
   7. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with type 3R weather-resistant, die-cast aluminum with lockable cover.

G. Applicable Components : Occupancy Sensors - Wall Switch Sensor
   1. Passive-infrared type, 120/277 V, adjustable time delay up to 30 minutes, 180-degree field of view, with a minimum coverage area of 900 sq. ft.
   2. Adaptive-technology type, 120/277 V, adjustable time delay up to 20 minutes, 180-degree field of view, with a minimum coverage area of 900 sq. ft.
   3. Passive-infrared type, 120/277 V, adjustable time delay up to 30 minutes, 110-degree field of view, with a minimum coverage area of 1200 sq. ft.
   4. Dual technology, with both passive-infrared- and ultrasonic-type sensing, 120/277 V, adjustable time delay up to 30 minutes, 110-degree field of view, and a minimum coverage area of 1200 sq. ft.
   5. Passive-infrared type, 120/277 V, adjustable time delay up to 30 minutes, 150-degree field of view, with a minimum coverage area of 1200 sq. ft.

H. Applicable Components: Occupancy Sensors - Exterior Occupancy Sensors
   1. Passive-infrared type, 120/277 V, weatherproof, adjustable time delay up to 15 minutes, 180-degree field of view, and 110-foot detection range.

I. Applicable Components: Floor Service Fittings
   1. Type: Modular, flush-type, dual-service units suitable for wiring method used.
   2. Compartments: Barrier separates power from voice and data communication cabling.
   3. Power Receptacle: NEMA WD 6 configuration 5-20R.
   4. Voice and Data Communication Outlet: Two modular, keyed, color-coded, RJ-45 Category 5e jacks for UTP cable.
   5. Flush Floor type: Single core, 3 inch hole,(1) 20A duplex receptacle, device shall have cover to protect outlet, flange and outlet cover assembly shall be gray, black or brass finish.
   6. Quadruplex power outlet: Single core, 3 inch hole, (2) 15A duplex receptacle, device shall have cover to protect outlet, flange and outlet cover assembly shall be gray, black or brass finish.

7. Communication: Single core, 3 inch hole, accept up to four (4) category 5 and two (2) category 3 connectors, flange and outlet cover assembly shall be gray, black or brass finish.
8. Electrical furniture feed: Single core, 3 inch hole, furniture feed unit with (2) ½ inch and (1) ¾ inch conduit adapter, flange and outlet cover assembly shall be gray, black or brass finish.

J. Applicable Components: Poke-Through Assemblies
   1. Factory-fabricated and -wired assembly of below-floor junction box with multi-channeled, through-floor raceway/firestop unit and detachable matching floor service outlet assembly.
   2. Service Outlet Assembly: Flush type with four simplex receptacles and space for four RJ-45 jacks.
   3. Size: Selected to fit nominal 3-inch, 4-inch, 6- inch, cored holes in floor and matched to floor thickness.
   4. Fire Rating: Unit is listed and labeled for fire rating of floor-ceiling assembly.
   5. Wiring Raceways and Compartments: For a minimum of four No. 12 AWG conductors and a minimum of two four, 4-pair, Category 5e voice and data communication cables.

K. Applicable Components: Communication Outlets
   1. Telephone Outlet - Single RJ-45 jack for terminating 100-ohm, balanced, four-pair UTP; TIA/EIA-568-B.1; complying with Category 5e. Comply with UL 1863.
   2. Combination TV and Telephone Outlet: Single RJ-45 jack for 100-ohm, balanced, four-pair UTP; TIA/EIA-568-B.1; complying with Category 5e; and one Type F coaxial cable connector.

D5040 Lighting

D5040.10 Lighting Control

A. Description: Provide a complete lighting control system per the requirements and as required to complete the work. Lighting control system shall be integrated, energy saving lighting control system including Lighting Control Panels, Occupancy Sensors, and Daylighting control from a single supplier. All work is subject to the review and approval of the County's Representative.
B. Functional and Performance Requirements:
   1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Applicable Components: Outdoor Photoelectric Switches
   1. Solid state, with SPST dry contacts rated for 1800-VA tungsten or 1000-VA inductive, to operate connected relay, contactor coils, or microprocessor input; complying with UL 773A. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application. Light-Level Monitoring Range: 1.5 to 10 fc, with an adjustment for turn-on and turn-off levels within that range, and a directional lens in front of photocell to prevent

fixed light sources from causing turn-off. Time Delay: 15-second minimum, to prevent false operation.

2. Solid state, with SPST DPST dry contacts rated for 1800 VA to operate connected load, relay, or contactor coils; complying with UL 773. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application. Light-Level Monitoring Range: 1.5 to 10 fc, with an adjustment for turn-on and turn-off levels within that range. Time Delay: 30-second minimum, to prevent false operation.

D. Applicable Components: Indoor Photoelectric Switches
   1. Ceiling-Mounted Photoelectric Switch: Solid-state, light-level sensor unit, with separate relay unit mounted on luminaire, to detect changes in lighting levels that are perceived by the eye. Cadmium sulfide photoresistors are not acceptable.
   2. Sensor Output: Contacts rated to operate the associated relay, complying with UL 773A. Sensor shall be powered from the relay unit.
   3. Relay Unit: Dry contacts rated for 20-A ballast load at 120- and 277-V ac, for 13-A tungsten at 120-V ac, and for 1 hp at 120-V ac. Power supply to sensor shall be 24-V dc, 150-mA, Class 2 power source as defined by NFPA 70.
   4. Light-Level Monitoring Range: 10 to 200 fc, with an adjustment for turn-on and turn-off levels within that range.
   5. Time Delay: Adjustable from 5 to 300 seconds to prevent cycling, with deadband adjustment.
   6. Indicator: Two LEDs to indicate the beginning of on-off cycles.

E. Applicable Components: Daylight-Harvesting Switching Controls
   1. Ceiling-Mounted Switching Controls: Solid-state, light-level sensor unit, with separate power pack mounted on luminaire, to detect changes in indoor lighting levels that are perceived by the eye.
   2. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
   3. Operating Ambient Conditions: Dry interior conditions, 32 to 120 deg F.
   4. Sensor Output: Contacts rated to operate the associated power pack, complying with UL 773A. Sensor is powered by the power pack.
   5. Power Pack: Dry contacts rated for 20-A ballast load at 120- and 277-V ac, for 13-A tungsten at 120-V ac, and for 1 hp at 120-V ac. Sensor has 24-V dc, 150-mA, Class 2 power source, as defined by NFPA 70.
   6. General Space Sensors Light-Level Monitoring Range: 10 to 200 fc, with an adjustment for turn-on and turn-off levels within that range.
   7. Atrium Space Sensors Light-Level Monitoring Range: 100 to 1000 fc, with an adjustment for turn-on and turn-off levels within that range.
   8. Skylight Sensors Light-Level Monitoring Range: 1000 to 10,000 fc, with an adjustment for turn-on and turn-off levels within that range.
   9. Time Delay: Adjustable from 5 to 300 seconds to prevent cycling.
   10. Set-Point Adjustment: Equip with deadband adjustment of 25, 50, and 75 percent above the "on" set point, or provide with separate adjustable "on" and "off" set points.

11. Test Mode: User selectable, overriding programmed time delay to allow settings check.
12. Control Load Status: User selectable to confirm that load wiring is correct.
13. Indicator: Two digital displays to indicate the beginning of on-off cycles.

F. Applicable Components: Daylight-Harvesting Dimming Controls
    1. System Description: Sensing daylight and electrical lighting levels, the system adjusts the indoor electrical lighting levels. As daylight increases, the lights are dimmed. Lighting control set point is based on two lighting conditions: When no daylight is present (target level); When significant daylight is present.
    2. Ceiling-Mounted Dimming Controls: Solid-state, light-level sensor unit, with separate controller unit, to detect changes in lighting levels that are perceived by the eye. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
    3. Sensor Output: 0- to 10-V dc to operate electronic dimming ballasts. Sensor is powered by controller unit.
    4. Power Pack: Sensor has 24-V dc, Class 2 power source, as defined by NFPA 70.
    5. Light-Level Sensor Set-Point Adjustment Range: 20 to 60 fc.

G. Applicable Components: Indoor Occupancy Sensors
    1. General Description for Sensors: Wall- or ceiling-mounting, solid-state indoor occupancy sensors with a separate power pack.
    2. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
    3. Operation: Unless otherwise indicated, turn lights on when covered area is occupied and off when unoccupied; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes.
    4. Sensor Output: Contacts rated to operate the connected relay, complying with UL 773A. Sensor shall be powered from the relay unit.
    5. Power Pack: Dry contacts rated for 20-A ballast load at 120- and 277-V ac, for 13-A tungsten at 120-V ac, and for 1 hp at 120-V ac. Sensor has 24-V dc, 150-mA, Class 2 power source as defined by NFPA 70.
    6. Mounting Sensor: Suitable for mounting in any position on a standard outlet box.
    7. Relay: Externally mounted through a 1/2-inch knockout in a standard electrical enclosure.
    8. Time-Delay and Sensitivity Adjustments: Recessed and concealed behind hinged door.
    9. Indicator: LED, to show when motion is being detected during testing and normal operation of the sensor.
    10. Bypass Switch: Override the on function in case of sensor failure.
    11. Automatic Light-Level Sensor: Adjustable from 2 to 200 fc; keep lighting off when selected lighting level is present.
    12. PIR Type: Ceiling mounting; detect occupancy by sensing a combination of heat and movement in area of coverage.
    13. Detector Sensitivity: Detect occurrences of 6-inch-minimum movement of any portion of a human body that presents a target of not less than 36 sq. in..

14. Detection Coverage (Room): Detect occupancy anywhere in a circular area of 1000 sq. ft. when mounted on a 96-inch-high ceiling.
15. Detection Coverage (Corridor): Detect occupancy within 90 feet when mounted on a 10-foot-high ceiling.
16. Ultrasonic Type: Ceiling mounting; detect occupancy by sensing a change in pattern of reflected ultrasonic energy in area of coverage.
17. Detector Sensitivity: Detect a person of average size and weight moving not less than 12 inches in either a horizontal or a vertical manner at an approximate speed of 12 inches/s.
18. Detection Coverage (Small Room): Detect occupancy anywhere within a circular area of 600 sq. ft. when mounted on a 96-inch-high ceiling.
19. Detection Coverage (Standard Room): Detect occupancy anywhere within a circular area of 1000 sq. ft. when mounted on a 96-inch-high ceiling.
20. Detection Coverage (Large Room): Detect occupancy anywhere within a circular area of 2000 sq. ft. when mounted on a 96-inch-high ceiling.
21. Detection Coverage (Corridor): Detect occupancy anywhere within 90 feet when mounted on a 10-foot-high ceiling in a corridor not wider than 14 feet.
22. Dual-Technology Type: Ceiling mounting; detect occupancy in coverage area using a combination of PIR and ultrasonic detection methods in area of coverage. Particular technology or combination of technologies that controls on-off functions shall be selectable in the field by operating controls on unit.
23. Sensitivity Adjustment: Separate for each sensing technology.
24. Detector Sensitivity: Detect occurrences of 6-inch-minimum movement of any portion of a human body that presents a target of not less than 36 sq. in., and detect a person of average size and weight moving not less than 12 inches in either a horizontal or a vertical manner at an approximate speed of 12 inches/s.
25. Detection Coverage (Standard Room): Detect occupancy anywhere within a circular area of 1000 sq. ft. when mounted on a 96-inch-high ceiling.

H. Applicable Components: Switchbox Mounted Occupancy Sensors - General Requirements for Sensors
    1. Automatic-wall-switch occupancy sensor, suitable for mounting in a single gang switchbox.
    2. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application, and shall comply with California Title 24.
    3. Operating Ambient Conditions: Dry interior conditions, 32 to 120 deg F.
    4. Switch Rating: Not less than 800-VA fluorescent at 120 V, 1200-VA fluorescent at 277 V.

I. Applicable Components: Switchbox Mounted Occupancy Sensors - Wall-Switch Sensor Tag WS1
    1. Standard Range: 180-degree field of view, field adjustable from 180 to 40 degrees; with a minimum coverage area of 900 sq. ft. 2100 sq. ft.
    2. Sensing Technology: PIR Dual technology - PIR and ultrasonic.
    3. Switch Type: SP. SP, dual circuit. SP, manual "on," automatic "off."
    4. Voltage: 120 V 277 V Dual voltage, 120 and 277 V; passive-infrared dual-technology type.

5. Ambient-Light Override: Concealed, field-adjustable, light-level sensor from 10 to 150 fc. The switch prevents the lights from turning on when the light level is higher than the set point of the sensor.
6. Concealed, field-adjustable, "off" time-delay selector at up to 30 minutes.
7. Concealed "off" time-delay selector at 30 seconds, and 5, 10, and 20 minutes.
8. Adaptive Technology: Self-adjusting circuitry detects and memorizes usage patterns of the space and helps eliminate false "off" switching.

J. Applicable Components: Switchbox Mounted Occupancy Sensors - Wall-Switch Sensor Tag WS2
   1. Standard Range: 210-degree field of view, with a minimum coverage area of 900 sq. ft..
   2. Sensing Technology: PIR.
   3. Switch Type: SP. SP, dual circuit. SP, manual "on," automatic "off." SP, field selectable automatic "on," or manual "on" automatic "off."
   4. Voltage: 120 V 277 V Dual voltage, 120 and 277 V; passive-infrared dual-technology type.
   5. Ambient-Light Override: Concealed, field-adjustable, light-level sensor from 10 to 150 fc. The switch prevents the lights from turning on when the light level is higher than the set point of the sensor.
   6. Concealed, field-adjustable, "off" time-delay selector at up to 30 minutes.
   7. Concealed "off" time-delay selector at 30 seconds, and 5, 10, and 20 minutes.
   8. Adaptive Technology: Self-adjusting circuitry detects and memorizes usage patterns of the space and helps eliminate false "off" switching.

K. Applicable Components: Outdoor Motion Sensor (PIR)
   1. Performance Requirements: Suitable for operation in ambient temperatures ranging from minus 40 to plus 130 deg F, rated as raintight according to UL 773A.
   2. Operation: Turn lights on when sensing infrared energy changes between background and moving body in area of coverage; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes.
   3. Mounting:
   4. Sensor: Suitable for mounting in any position on a standard outdoor junction box.
   5. Relay: Internally mounted in a standard weatherproof electrical enclosure.
   6. Time-Delay and Sensitivity Adjustments: Bypass Switch: Override the on function in case of sensor failure.
   7. Automatic Light-Level Sensor: Adjustable from 1 to 20 fc; keep lighting off during daylight hours.
   8. Recessed and concealed behind hinged door.
   9. Detector Sensitivity: Detect occurrences of 6-inch-minimum movement of any portion of a human body that presents a target of not less than 36 sq. in..
   10. Lighting Fixture Mounted Sensor: Suitable for switching 300 W of tungsten load at 120- or 277-V ac.
   11. Individually Mounted Sensor: Contacts rated to operate the connected relay, complying with UL 773A. Sensor shall be powered from the relay unit.

12. Relay Unit: Dry contacts rated for 20-A ballast load at 120- and 277-V ac, for 13-A tungsten at 120-V ac, and for 1 hp at 120-V ac. Power supply to sensor shall be 24-V dc, 150-mA, Class 2 power source as defined by NFPA 70.
13. Indicator: LED, to show when motion is being detected during testing and normal operation of the sensor.
14. General Requirements for Sensors: Solid-state outdoor motion sensors.
15. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application, and shall comply with California Title 24.
16. PIR Dual-technology (PIR and infrared) type, weatherproof. Detect occurrences of 6-inch-minimum movement of any portion of a human body that presents a target of not less than 36 sq. in.. Comply with UL 773A.
17. Switch Rating:
18. Lighting-Fixture-Mounted Sensor: 1000-W incandescent, 500-VA fluorescent.
19. Separately Mounted Sensor: Dry contacts rated for 20-A ballast load at 120- and 277-V ac, for 13-A tungsten at 120-V ac, and for 1 hp at 120-V ac. Sensor has 24-V dc, 150-mA, Class 2 power source, as defined by NFPA 70.
20. Switch Type: SP. SP, dual circuit. SP, manual "on," automatic "off." SP, field selectable automatic "on," or manual "on" automatic "off." With bypass switch to override the "on" function in case of sensor failure.
21. Voltage: 120-V 277-V Dual voltage, 120- and 277-V type.
22. Detector Coverage:
    a. Standard Range: 210-degree field of view, with a minimum coverage area of 900 sq. ft.
    b. Long Range: 180-degree field of view and 110-foot detection range.
    c. Ambient-Light Override: Concealed, field-adjustable, light-level sensor from 10 to 150 fc. The switch prevents the lights from turning on when the light level is higher than the set point of the sensor.
    d. Concealed, field-adjustable, "off" time-delay selector at up to 30 minutes.
    e. Concealed "off" time-delay selector at 30 seconds, and 5, 10, and 20 minutes.
23. Adaptive Technology: Self-adjusting circuitry detects and memorizes usage patterns of the space and help eliminate false "off" switching.
24. Operating Ambient Conditions: Suitable for operation in ambient temperatures ranging from minus 40 to plus 130 deg F, rated as "raintight" according to UL 773A.

L. Applicable Components: Lighting Contactors
    1. Description: Electrically operated and electrically held, combination type with nonfused disconnect, complying with NEMA ICS 2 and UL 508.
    2. Current Rating for Switching: Listing or rating consistent with type of load served, including tungsten filament, inductive, and high-inrush ballast (ballast with 15 percent or less total harmonic distortion of normal load current).
    3. Fault Current Withstand Rating: Equal to or exceeding the available fault current at the point of installation.
    4. Enclosure: Comply with NEMA 250.

5. Provide with control and pilot devices as indicated on Drawings, matching the NEMA type specified for the enclosure.
6. BAS Interface: Provide hardware interface to enable the BAS to monitor and control lighting contactors.
7. Monitoring: On-off status.

M. Applicable Components: Emergency Shunt Relay
1. Description: Normally closed, electrically held relay, arranged for wiring in parallel with automatic switching contacts; complying with UL 924.
2. Coil Rating: 120 or 277 V as required.

N. Applicable Components: Conductors and Cables
1. Power Wiring to Supply Side of Remote-Control Power Sources: Not smaller than No. 12 AWG. Comply with requirements in Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."
2. Classes 2 and 3 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. 18 AWG. Comply with requirements in Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."
3. Class 1 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. 14 AWG. Comply with requirements in Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

D5040.20 Branch Wiring for Lighting

A. Description:
1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
2. Comply with NFPA 70-2016.
3. Branch wiring raceways to electrical lighting power include conduit and tubing, surface raceways, outlet boxes, pull and junction boxes.
4. Conduit shall not be installed in any floor slab.
5. Outdoor locations, Above Grade: Provide rigid steel conduit or EMT with raintight fitting. Provide cast metal or nonmetallic outlet, pull, and junction boxes.
6. Wet and Damp Locations: Provide rigid steel conduit or EMT with raintight fitting. Provide cast metal or nonmetallic outlet, pull, and junction boxes. Provide flush mounting outlet in finished areas.
7. Exposed Dry Locations: Provide rigid steel conduit or EMT where permitted by code. Provide sheet-metal boxes. Provide flush mounting outlet boxes in finished areas. Provide handled enclosure for large pull boxes.

B. Functional and Performance Requirements:
1. Branch wiring system to comply with NFPA
2. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

3. Copper Conductors: Comply with NEMA WC 70. The design is based on copper conductors.
4. Conductor Insulation: Comply with NEMA WC 70 for Types THW, THHN, THWN, THHN-THWN-2, and XHHW.
5. Minimum Raceway Size: ½ inch for above ground installation and ¾ inch for underground installation, unless otherwise specified.
6. All surface raceway mounted in damp or wet locations or below 8 feet above finished floor shall be RGS, IMS or EMT where allowed by code. All concealed conduit above ground in the dry location shall be EMT. All underground conduits shall be non-metallic conduit.
7. Provide pull strings for all empty conduits.

D5040.50 Lighting Fixtures

A. Description: Lighting fixtures for parking area and pedestrian path illumination; general building lighting.
B. Functional and Performance Requirements:
    1. LED Energy efficient

C. Applicable Components:
    1. Comply with T-24

D60 COMMUNICATIONS

D6010 Data Communications

D6010.10 Data Communications Network Equipment

A. Description:
    1. Structured cabling system
    2. The main active Data Communications Equipment will be provided according to the Responsibility Matrix within the Appendix. Active equipment for low voltage systems such as the Security video surveillance may be provided within the contract and must be approved by the Client prior to purchase. Switches will be in the form of a layer 2 managed network switch and should be capable of all standard layer 2 functions. The active and passive components of the data communications equipment will be terminated within Low Voltage Distribution Rooms, sufficiently sized to house all required low voltage systems terminations required for the zone of coverage. The structured cabling system will comprise of both Fiber and copper cables. Low voltage spaces, both inside the parking structure and the main buildings will be linked via Fiber and copper backbone connections. Category rated cables will be run between the faceplate and the low voltage termination room within continuous conduits, seismically braced as needed, and terminated on patch panels mounted on seismic racks.

B. Functional and Performance Requirements: Structured cabling system
   1. All rooms pathways and spaces will conform to applicable building codes, TIA-569-D and County Standard 902, where requirements conflict the more stringent will be followed.
   2. All structured cabling will be based in a tiered star formation with the center of the system being at the Main distribution room. A combination of Fiber and Copper cabling will interconnect the Distribution rooms located throughout the building. Rooms should be located within a floor plate so that no horizontal cable of greater than 250 linear feet from the distribution room should be possible.
   3. All low voltage termination Rooms shall be fire rated to 1 hour, be sized according to the systems it will be housing (Structured Cabling, AV, Security, paging, Radio etc). Allowances for required equipment clearances will be included within the room size planned, this includes a minimum clearance of 3 feet both in front and behind all racks and cabinets.
   4. Within Low voltage spaces floors shall be anti-static in nature, walls covered with AC grade plywood and lighting to a minimum of 500 Lux. Rooms will not require any ceiling but if a raised floor is installed within the rest of the building this should matched or greater within the Low voltage room. If there is a change in floor height within the room this should be achieved with ramp at the entrance not steps.
   5. The Entrance Room and all Distribution rooms will be temperature and humidity controlled 24/7 and power will be backed up by UPS and Generator supply.
   6. Each room will be connected to an independent grounding system, with a grounding bus bar presented within the space. All components within the low voltage system shall be ground according to TIA 607-C and all annexes.
   7. Cabling shall be terminated per T568A wiring scheme and tested to prove compliance to the ANSI/TIA 568 standards.
   8. All components of the structured cabling system, not including support infrastructure, will be supplied from a single manufacturer and be standards compliant to match the type of cable being installed.
   9. Active switches, unless supplied by the Client, for low voltage systems will have standard Layer 2 functionality and be manageable.
   10. Racks and cabinets will be a minimum of 45 RU, and include cable management, both vertical and horizontal, mountable and manageable power supply units and if required shelves to ensure a clean and effective installation.
   11. Ladder tray will be installed within distribution spaces to link racks with the levels horizontal pathway. Ladder tray will be mounted at 8’-3” AFF
   12. Wall termination cabinets, where needed, will be mounted to AC grade Plywood which will be sized to allow for future expansion.
   13. All cable terminations will be presented within the distribution room racks, Patch panels supplied will be certified for the category of cable being terminated. Fiber will be terminated within modular splice enclosures. Allowances for expansion will be included within the amount of available rack space installed.
   14. Low voltage spaces will be linked by both Fiber and copper cables to form a backbone. Copper cables will be a minimum of Cat 6 within the backbone, Fiber cables shall be a minimum of OM4.

15. Cables will be routed to the preferred pathway via overhead ladder tray within the Distribution room, vertical cable transitions of greater than 2 feet should be done with the support of cable tray fixed vertically to the wall.
16. Horizontal cabling will be a minimum of enhanced Category 6 cable, with AV and WAP's being installed with a minimum of category 6A cable.
17. All cabling within the Parking structure will be encased within continuous conduit from exiting the Distribution room to the outlet location.
18. The Structured cabling system will be covered by an all parts and labor warranty for a period of one year from completion of work and an Advanced Manufacturer system Warranty (lasting 20 years or greater) which will be certified by the cabling manufacturer directly for the client.

C. Applicable Components:
    1. Distribution Rooms will be used to house all active equipment and passive terminations. Rooms will be 1 hour Fire rated.
    2. All walls to be covered with Plywood backboard, AC grade, minimum of ¾" thick with 2 coats of fire retardant paint.
    3. A grounding bar will be provided, mounted within each Distribution space, isolated for telecommunications use only.
    4. Ladder Rack within distribution rooms with 9" rung spacing, sized for a maximum of 40% fill
    5. Building entrance protection will be supplied for all external copper connections, whether supplied by the contractor or the service provider.
    6. 45RU Racks and Cabinets suitable for mounting modular termination patch panels and sized to allow for 25% expansion. Cabinets shall include front and back doors, end side panels and any accessories required to ensure heat dissipation from active equipment.
    7. Two internally mounted PDU will be installed within each rack or cabinet
    8. Copper termination patch panels with jacks matching the type of category cable to be installed. A Horizontal cable management unit will be installed for every 48 ports of terminations or active equipment.
    9. Fiber cables should be OM4 for multimode and OS2 for single mode or greater, depending on system utilizing cable connection.
    10. Copper category cables will be enhanced category 6 as a minimum.
    11. Conduit to each internal outlet location shall be a minimum of 1" in size and connect to a back box at least 4 11/16" x 4 11/16" x 2 15/16". Outlets presented within exposed areas of the parking structure, on the roof, or on the building exterior will be terminated within weather proof enclosures.
    12. Faceplates shall be white or stainless steel and mounted as required either on a wall, within a floor box or within furniture infrastructure.
    13. Patch cables will be supplied for each termination. Within the rack or cabinet they will be white, and sized according to length required between active and passive connection. For each work area connection a minimum of 10ft patch cable shall be supplied either in white or grey.
    14. Site installation information for external device and service connectivity can be found in section G50.

D6020 Voice Communications

D6020.20 Voice Communications Terminal Equipment

A. Description: Emergency Telephones
   1. Throughout the parking structure and common areas within the parcel emergency phones shall be installed to enable quick communication at times of distress. Emergency phones will connect back to the reception desk / security office so that those seeking assistance can speak to someone easily. Units shall be wall mounted or free standing posts with built in cameras and lighting.

B. Functional and Performance Requirements:
   1. ADA compliant mounting unit.
   2. Dual button unit for both emergency and assistance calls.
   3. Integrates with VSS solution for broader view and security coverage, built in camera to provide a minimum of 170 degree viewing angle.
   4. Call status light built in
   5. Stainless steel faceplate with tamper resistant screws
   6. Mobile application support
   7. Paging compatible

C. Applicable Components:
   1. One cat 6 Category cable for connectivity.
   2. Unit faceplate with built in functionality
   3. Mounting surround for faceplate, either wall mounted or free standing post depending on location. D6060 Distributed Communications and Monitoring

D6060 Distributed Communications and Monitoring

D6060.10 Distributed Audio-Video Communications Systems

A. Description: Overhead paging will be provided for general announcements through the building, this system will be in addition to any solution provided as part of the fire life safety system. This system shall be configured to allow paging within specific zones of the building as well as full building all call announcements.

B. Functional and Performance Requirements:
   1. Inputs for the paging system shall be via the telephone system, which will require as appropriate interface to all integration and communication between the two.
   2. Paging head end equipment will be located within the low voltage distribution rooms with locations to be optimized for distribution end point distances.
   3. Paging zones will be provided with ambient noise sensors to allow automatic level control of paging volume within each zone.
   4. Paging speakers shall be selected and spaced to allow for plus or minus 6dB coverage between 400 and 4000Hz.

C. Applicable Components:
   1. Headend Units.
   2. Speakers.

3. Cable
4. Interface connection with Telephone system,
5. Noise sensors

D6060.50 Distributed Systems

A. Description:
   1. A master clock system shall be utilized within the structure providing synchronous time throughout the structure. The master clock system will be connected to a Network Time Protocol controller unit, located within the Main distribution room, which will sync with an external time source for accuracy.
   2. Distributed Antenna System (Public Safety Network (PSN)): The Public Safety Network (PSN) shall be a fully operational Emergency Responder Radio Antenna/ Repeater System. The system shall primarily support the Fire Department Radio System. Provision for supporting other public safety systems, such as the sheriff or police, the CWIRS, cell phone carriers and or any other radio system may be required and should be confirmed during design. Radio signals shall achieve a minimum of 95dBm signal strength within 95% of the areas of the building or structure.

B. Functional and Performance Requirements:
   1. Master clock system will support several types of clock from traditional clock face to digital numeric displays.
   2. The NTP controller will synchronize periodically via the internet or a satellite connection
   3. Count down or count up timers may be distributions on an as required based per department.
   4. The master clock system may also be synchronized with other metric requiring systems in order to provide accurate time keeping.

C. Functional and Performance Requirements – Distributed Antenna System (public Safety Network (PSN)):
   1. The DAS electronics shall provide outputs for monitoring by the Fire Alarm System, including but not limited to Donor Antenna Malfunction, signal booster Failure, Signal Booster Trouble and Loss of AC power. The connections shall comply with 4.4.7.1 of NFPA 72.
   2. The PSN DAS shall comply with IFC 510 (200() (2012) and NFPA 72 2013 edition.
   3. Where the In building – coverage requirements include 700-800 MHz public safety system and commercial wireless in building coverage, the two systems shall operate over a unified Passive Cable and coverage Antenna Infrastructure.
   4. The systems shall be approved and fully accepted by the local Fire Department in writing prior to contract closeout.
   5. All wiring and fiber optics shall be installed into conduit for protection.
   6. All main risers or trunks of the antenna system shall be installed with a 2 hour fire rating, either by the use of 2 hour rated cable or being housed within a 2 hour rated shaft or enclosure.

7. A minimum signal strength of -95dBm shall be provided throughout the coverage area. With a minimum signal strength of -95dBm received by the local Fire Department.
8. DAS system may utilize a radiating cable, fixed antennas or a combination of both.
9. The Donor antenna signal level shall be a minimum of 15 dB above the DAS under all operating conditions.
10. The radio system may need to support frequencies in the 150, 400, 700 and 800 MHz public safety bands.
11. Reject Filters: Notch filter sections shall be incorporated to minimize the impact of channel cellular and SMR degradation of the signal booster performance.
12. The signal booster shall include retune-able or replaceable filters to allow for any mandatory FCC changes within the NPSPAC band.

D. Applicable Components:
   1. Clock units, both traditional face type and digital type.
   2. NTP controller unit.

E. Applicable Components – Distributed Antenna Systems (Public Safety Network (PSN)):
   1. Bi-Directional Amplifiers (BDA),
   2. Fiber-Optic Master Unit
   3. Pre-manufactured cable/remote units
   4. Donor Antennas,
   5. Coverage Antennas,
   6. Coaxial Cable and Coax Connectors
   7. Splitters, Combiners, and Couplers,
   8. Dual power supplies
   9. NEMA 4 rated enclosures

D6090 Communications Supplementary Components

D6090.10 Supplementary Components

A. Description: Support systems for low voltage cabling within the parking structure include conduits, backboxes, pull boxes, junction boxes, and ladder trays. The structured cabling system will utilize such solutions to conform to the TIA 569-D standard as a minimum. All cables run outside of the IT space will be fully enclosed within conduit no matter what level they are being installed within the structure.
B. Functional and Performance Requirements:
   1. All containment will be sized based on a maximum of 40% fill ratio according to cable OD size
   2. Internal conduit will be metallic and rigid, sized for a maximum of 40% fill and no smaller than 1 ¼” in diameter. Conduit runs within the parking structure will be continuous between the lw voltage distribution room and the outlet
   3. Telecommunication Back boxes shall be a minimum of at least 4 11/16" x 4 11/16" x 2 15/16".
   4. All outlets which can be classed as exposed to the elements, are situated on the roof or on the external of the parking structure will be terminated within weather proof NEMA 5 rated enclosures.

5. Tray systems used within distribution spaces should be formed using pre-formed fittings for situations such as crossings, intersections, bends and Tee junctions. All accessories for cable transitions tray division and support should be supplied.
6. Cable runway and ladder tray will be installed within Distribution rooms and the entrance room for cable routing. Ladder tray shall be sized depending on weight load and cable distribution requirements to a maximum of 40% fill. Ladder tray shall have a maximum of 9" spacing between rungs.
7. Ladder tray should be mounted a minimum of 6" above each cabinet or rack.
8. All Cable tray pathways will be seismically braced and certified by a structural engineer.
9. All external conduit and fixtures can be found in section G50 of this specification.

C. Applicable Components:
   1. Conduit
   2. 5 square Back boxes
   3. 9" rung Ladder tray
   4. All associated fixtures and fittings

D70 ELECTRONIC SAFETY AND SECURITY

D7010 Access Control and Intrusion Detection

D7010.10 Access Control

A. Description:
   1. Provide a complete and operational building card access control system for the staff and systems areas of the building.
   2. Provide integration between access control system and parking control system
   3. System to be configured and monitored as a remote node of the ISD/Probation building system.

B. Functional and Performance Requirements:
   1. System shall be compatible with County and department systems and standards
   2. Security access system shall use a single database for access-control and credential-creation functions and be linked to existing county database.
   3. Challenge devices and credentials to include multiformat card readers, Biometric readers, keypads, and smartphone based credentials
   4. Card readers shall be multi class readers capable of reading iClass and Prox card technologies.
   5. Coordinate with door hardware required to be monitored or controlled by the security access system. The Controllers in this Section shall have electrical characteristics that match the signal and power requirements of door hardware.
   6. Coordinate with parking control systems to allow common credentials for access to the parking lot as well as the building
   7. Coordinate with VSS system to allow access to parking via license plate recognition

8. All exterior and stairwell doors to be monitored
9. Provide access controls on all IDF, electrical and mechanical rooms.
10. Alarm triggers shall be linked to VSS system to allow synchronization of alarm and video monitoring
11. Doors in the path of egress shall be connected to fire alarm system per code requirements

C. Applicable Components:
   1. System Software and all programming
   2. System hardware including central control unit, door controller(s) and all supervision components
   3. Card Readers
   4. Credentials compatible with County standards
   5. Door control equipment including all request to exit motion detector if not integrated into the lockset, door position switches, and power supplies

D7010.50 Intrusion Detection

A. Description:
   1. Intrusion detection perform monitoring and alarm functions will be integrated into the access control system.

B. Functional and Performance Requirements
   2. Parking Structure shall be configured as a zone to be monitored by the ISD/Probation building system.
   3. Supervision: System components shall be continuously monitored for normal, alarm, trouble conditions.

C. Applicable Components:
   1. Control module
   2. Door and Window Switches
   3. PIR Sensors
   4. Acoustic-type, Glass Break Sensors
   5. Control Unit with communication interface
   6. UPS
   7. Audible and Visual Alarm Devices

D7030 Electronic Surveillance

D7030.10 Video Surveillance System

D. Description: Provide video surveillance system to monitor and record activity approaching and throughout the facility.
E. Functional and Performance Requirements:
   1. System shall record all cameras at 30fps with motion and 7.5fps with no motion detected for 30 days retention time
   2. Exterior coverage zones shall include vehicle and pedestrian entrances, building perimeter and building entrances, parking entrances and exits, paystations.
   3. Interior coverage zones include lobbies, entrances to IT and building system spaces and elevator lobbies

4. Cameras shall provide 40 pixels per foot horizontal resolution at their respective areas of interest with a minimum resolution of 1Mp
5. Cameras shall be provided and configured for license plate recognition at all vehicle entrances and exits.
6. All switches and routers must confirm to ISD IT guidelines
7. VSS system shall be linked to access control system to allow synchronized monitoring of alarm conditions.

F. Applicable Components:
1. IP Cameras enclosures and mounts.
2. Network video recording servers or appliances, software and hardware.
3. All networking switches and routers required to support the system
4. Licenses for all components including remote monitoring of system

D7050 Detection and Alarm

D7050.60 Water Intrusion Detection and Alarm

A. Description:
1. System to monitor possible water egress into critical high risk locations such as the Telecommunication spaces. In larger spaces the system shall take a zonal approach and designed according to possible leak situations, i.e. under floor, within equipment drip trays etc.

B. Functional and Performance Requirements:
1. LCD display with keypad controller to be used for programming, viewing and lockout features
2. Connectivity to VSS, BMS, and UPS required for integration within building management solution.
3. Shall be capable of Spot and level detection.
4. Shall be capable of acting as an Early warning system. With multiple levels of alarm possible
5. Solution shall be fixed in place to prevent damage and migration.
6. Shall be capable of redundancy by connecting to other local zones.
7. Extended system warranty.

C. Applicable Components:
1. Microprocessor
2. Cable for cross solution connectivity
3. Leak detection tape.

END OF ELEMENT D