



PROJECT MANUAL  
INCLUDING SPECIFICATIONS  
(VOLUME 2)

FOR

**LANEY COLLEGE LOCKER ROOM  
INTERIM HOUSING**

900 FALLON ST,  
OAKLAND, CA 94607

ARCHITECT

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**DSA A#:** 01-119005  
**SVA Project Number:** 2020-40124

**June 5, 2020**

SECTION 00 00 01

SEALS PAGE

Specification Approval for:  
**LANEY COLLEGE LOCKER ROOM  
INTERIM HOUSING**



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**C-18301**



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IDENTIFICATION STAMP  
DIV. OF THE STATE ARCHITECT

APP: 01-119005 INC:

REVIEWED FOR

SS ☒ FLS ☒ ACS ☒

DATE: 12/24/2020

**END OF SECTION.**

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**END OF SECTION.**

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SECTION 01 35 15

CALGREEN ENVIRONMENTAL REQUIREMENTS

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**PART 1 - GENERAL**

1.1 SUMMARY

- A. Section Includes: Comply with CALGreen environmental requirements related to energy efficiency, water efficiency and conservation, material conservation and resource efficiency, and environmental quality.
  - 1. Comply with specific CALGreen requirements as adopted by authorities having jurisdiction and applicable to Project.

1.2 ENVIRONMENTAL REQUIREMENTS

- A. Mandatory Measures: Comply with CALGreen Mandatory Measures applicable to Project.
  - 1. Design team and construction team are each required to participate to maximum degree possible to achieve CALGreen environmental requirements.
  - 2. Contract Documents are not intended to limit alternative means of achieving environmental requirements.
    - a. Suggestions from Contractor, subcontractors, suppliers, and manufacturers for achieving environmental requirements are encouraged; team approach is also encouraged.
- B. Requirements: Construction team is required to review CALGreen requirements relative to Project related to following.
  - 1. Energy Efficiency: Comply with California Energy Commission requirements.
  - 2. Water Efficiency and Conservation: Comply with requirements for outdoor water use.
  - 3. Material Conservation and Resource Efficiency:
    - a. Provide construction waste management plan as defined by CALGreen with demolition and construction waste diverted from landfill by recycling or salvage for reuse.
- C. Planning and Design: Construction team shall coordinate with Design Team regarding Project Planning and Design methods related to CALGreen requirements related to Project design and shall comply with requirements related to construction.

1.3 QUALITY ASSURANCE

- A. Project Management and Coordination: Contractor to identify one person on Contractor's staff to be responsible for CALGreen issues compliance and coordination.

1. Responsibilities: Carefully review Contract Documents for CALGreen issues, coordinate work of trades, subcontractors, and suppliers; instruct workers relating to environmental issues; and oversee Project Environmental Goals.
    - a. Submittals: Collect, compile, verify, and maintain sufficient information for submittals indicating compliance with applicable CALGreen requirements.
  2. Meetings: Discuss CALGreen Goals at following meetings.
    - a. Pre-construction meeting.
    - b. Pre-installation meetings.
    - c. Regularly scheduled job-site meetings.
- B. CALGreen Issues Criteria: Comply with requirements listed in CALGreen and various Specification sections.

## **PART 2 - PRODUCTS**

### **2.1 MATERIALS**

- A. General Issues: Do not use materials with moisture stains or with signs of mold or mildew.
1. Moisture Stains: Materials that have evidence of moisture damage, including stains, are not acceptable, including both stored and installed materials; immediately remove from site.
  2. Mold and Mildew: Materials that have evidence of growth of molds or of mildew are not acceptable, including both stored and installed materials; immediately remove from site.

### **2.2 SUBSTITUTIONS**

- A. Substitutions Environmental Issues: Requests for substitutions shall comply with requirements specified in Section 01 25 13 Product Options and Substitutions, with following additional information required where environmental issues are involved.
1. Indicate each proposed substitution complies with CALGreen requirements.
  2. Owner and Architect reserve right to reject proposed substitutions where CALGreen information is not provided and where substitution may impact mandatory requirements or Project voluntary tier requirements.

**PART 3 - EXECUTION**

**3.1 PROTECTION**

- A. Environmental Issues: Protect interior materials from water damage; where interior products not intended for wet applications are exposed to moisture, immediately remove from site.
  - 1. Protect installed products using methods that do not support growth of molds and mildews. Immediately remove from site materials with mold and materials with mildew.

**END OF SECTION**

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SECTION 01 71 23.16

CONSTRUCTION SURVEYING

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**PART 1 - GENERAL**

1.01 WORK INCLUDED

- A. General: The Contract General Conditions and Division 1, General Requirements, including, but not limited to, summary of work, submittals and cleaning, shall form a part of these specifications with the same force and effect as though repeated herein. Work shall be done according to the Contract Documents and to the satisfaction of the Owner. That which is called for in one of the Contract Documents is binding as though called for in all.
- B. Care shall be taken to protect stakes, especially rough grade stakes, since they are used for reference throughout the construction process.
- C. The contractor shall request stakes from the Engineer when it is ready to use them and shall be responsible for their preservation for its future use. All requests shall be made in writing and faxed to the Engineer 48 hours prior to the time staking will be required.
- D. Should the work need to be restaked, for the contractor's use, the contractor shall be responsible for the cost of this restaking. Also, should the contractor destroy stakes, which are needed for improvements other than his own, it shall also be responsible for the cost of replacing the destroyed stakes.
- E. Staking will consist of the following:
  - 1. Demolition and Tree Removal:

Trees will be flagged or marked for saving or removal as specified by the Engineer and the boundary will be lathed for demolition if required. Contractor is to verify with Owner if and when perimeter fencing is to be removed.
  - 2. Rough Grade:
    - a. Top of curb cut or fill for BC, ER, EC and PRC and grade breaks on an offset to face of curb.
    - b. Building pad cut or fill stakes on an offset to pad.
  - 3. Sanitary Sewers:
    - a. The ends of sanitary laterals will be staked on an offset with a cut to flowline, within 5' of each building.
  - 4. Storm Drains:

- a. Main lines will be staked on an offset at 50' stations on tangent with a cut to the invert of the pipe. All staking will commence at the low end of a particular drainage system.
  - b. End of pipes for catch basins will be staked on an offset with a cut or fill to pipe invert.
  - c. Area drains will be staked on an offset with a cut to the invert. Owner's Engineer may adjust top of grate elevations to consider as graded building pad elevations. Therefore, contractor must verify top of grate elevations with Owner's Engineer prior to setting grate to grade.
5. Water Staking:
  - a. Mains will be constructed using face of curb stakes with cut or fill to top of curb as control.
  - b. Services to all buildings will be located at an offset with a marker for line only.
  - c. Curb and gutter control stakes will be set at hydrants for hydrant construction.
6. PG&E and Joint Trenches:
  - a. Joint trench facilities will be constructed using face of curb stakes with cut or fill to top of curb.
  - b. Curb & gutter control stakes will be set for transformer locations and for vaults larger than #5 boxes.
7. Curb and Gutter:
  - a. Curb and gutter will be staked on an offset to face of curb with a cut or fill on each stake to top of curb. Stakes will be placed for parking area curbs and valley gutters with stakes not exceeding 30' on curves in addition to all BCs, ECs, PRC's, ER's and grade breaks.
8. Storm Water Inlets:
  - a. Control for storm water curb inlets will be provided by staking horizontal and vertical location of curb and gutter at inlet locations. For inlets not in curbing, horizontal and vertical control will be provided for the inlet flow line and grate at the time storm drain is staked.
9. Building Corners:
  - a. Control for building envelopes will be provided as a set of offset stakes to actual corners. A minimum of four stakes will be provided, and one control stake in each building envelope referenced for foundation elevation control.
10. Completion Staking:

- a. Control stakes for completion including any perimeter fences will be provided on an offset at approximate 50 foot intervals.

11. Monumentation:

- a. No monuments are shown on the plans.

1.02 SPECIAL REQUIREMENTS

- A. The Engineer will provide plans which show four "as-built" elevations on each completed "building" pad for Owner's use in determining the acceptability of the work completed. This is to be done once. A minimum of 2 pads must be completed and free from obstruction prior to checking by Engineer. Additional checking for any contractor repair work required by Owner or request to check less than minimum number of pads shall be billed as additional services to contractor. As requested, Engineer shall also provide Owner with the "standard" governmental agency letter commenting on the as-graded building pad's general conformance with the approved Rough Grading Plan.

1.03 EXECUTION

- A. Control points and temporary benchmarks will be set prior to staking the project.
- B. Site engineering under this section shall be performed by a Registered Engineer, or Licensed Land Surveyor of the State of California. The Subcontractor shall furnish his own grade checker, at his expense. Report any irregularities in site dimensions or grades to the Engineer for clarification prior to the start of grading or installation of any portion of the work.

1.04 EXECUTION - SUBCONTRACTOR PROVIDED STAKING

- A. All subcontractor provided staking workmanship shall be of the best quality and meet acceptance of the Contractor.
- B. Scheduling and Coordination:
  1. Schedule: Subcontractor shall examine the schedule and check it for timing, accuracy and compatibility with his work and shall coordinate his work with the master schedule.
  2. Coordination: Subcontractor shall assist the contractor in coordination and scheduling of all work pertinent to his installation and shall inform the contractor of his requirements sufficiently to result in a well-coordinated job.
- C. Grading Control:
  1. All grading, including subgrading and finished grading of all areas, including parking areas, drives and walks, shall be controlled by such intermediate grade stakes and lines as may be necessary to insure slopes, lines and levels required by finished grade elevations indicated on drawings. Stakes shall be so spaced



that a taut line between any two will not sag or drift. Intermediate staking and layout shall be by grading subcontractor.

2. The Subcontractor shall be responsible for preserving all benchmarks, reference points, and construction stakes in the area, and he will be billed for any cost incurred in replacing any such benchmarks, reference points, or construction stakes which are destroyed as a result of his activities. Any construction stakes in addition to those specified herein will be provided to the contractor upon receipt of written request at his expense.
  3. In the event such extra staking is required, the Contractor shall have a company representative onsite to sign the field crew's assignment sheet before the staking is begun. At that time, upon request, the field crew, after conference with the office, will provide said representative with an estimate of the field time required for the services requested.
- D. Inspection and Approvals: The Contractor shall be advised and given notice and presented with copies of all records on substantial completion of this work.
- E. Clean-Up: Subcontractor shall keep his work areas in a workmanlike and safe condition and so that his rubbish, waste and debris do not interfere with the work of others. Upon completion of the work in this section, subcontractor shall remove all rubbish, waste and debris resulting from the operations off the site. Subcontractor shall remove all equipment and implements of services and leave entire area in a neat, clean acceptable condition to meet acceptance of contractor.

**END OF SECTION**

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**SECTION 02 40 00**

**DEMOLITION**

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**PART 1 - GENERAL**

**1.01 SUMMARY**

- A. Removing above-grade site improvements within limits indicated.
- B. Disconnecting, capping or sealing, and abandoning site utilities in place.
- C. Disconnecting, capping or sealing, and removing site utilities.
- D. Disposing of objectionable material.

**1.02 RELATED SECTIONS**

- A. Section 31 23 00 – Excavation and Fill.
- B. Section 31 23 33 – Trenching and Backfill.

**1.03 RELATED DOCUMENTS**

- A. California Building Code: Site Work, Demolition and Construction.
- B. California Building Code: Pipes and Trenches.

**1.04 DEFINITIONS**

- A. ANSI: American National Standards Institute.
- B. CAL-OSHA: California Occupational Safety and Health Administration.

**1.05 SUBMITTALS**

- A. Follow Submittal procedure outlined in Section 01 33 00 – Submittal Procedures.

**1.06 PROJECT CONDITIONS**

- A. Except for materials indicated to be stockpiled or to remain the Owner's property, cleared materials are the Contractor's property. Remove cleared materials from site and dispose of in lawful manner.
- B. Salvable Improvements: Carefully remove items indicated to be salvaged and store where indicated on plans or where designated by the Owner. Avoid damaging materials designated for salvage.
- C. Unidentified Materials: If unidentified materials are discovered, including hazardous materials that will require additional removal other than is required by the Contract Documents, immediately report the discovery to the Owner. If necessary, the Owner will

arrange for any testing or analysis of the discovered materials and will provide instructions regarding the removal and disposal of the unidentified materials.

## **PART 2 - PRODUCTS**

### **2.01 SOIL MATERIALS**

- A. Backfill excavations resulting from demolition operations with on-site or import materials conforming to structural backfill defined in Section 31 23 00 – Excavation and Fill.

## **PART 3 - EXECUTION**

### **3.01 PREPARATION**

- A. Protect and maintain benchmarks and survey control points during construction.
- B. Protect existing site improvements to remain during construction.

### **3.02 RESTORATION**

- A. Restore damaged improvements to their original condition, as acceptable to the Owner.

### **3.03 UTILITIES**

- A. Locate, identify, disconnect, and seal or cap off utilities indicated to be removed or abandoned.
- B. Arrange to shut off indicated utilities with utility companies or verify that utilities have been shut off.
- C. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless authorized in writing by the Owner, and then only after arranging to provide temporary utility services according to requirements indicated.
- D. Coordinate utility interruptions with utility company affected.
- E. Do not proceed with utility interruptions without the permission of the Owner and utility company affected. Notify Owner and utility company affected two working days prior to utility interruptions.
- F. Excavate and remove underground utilities that are indicated to be removed.
- G. Securely close ends of abandoned piping with tight fitting plug or wall of concrete minimum 6-inches thick.

**3.04 SITE IMPROVEMENTS**

- A. Remove existing above- and below-grade improvements as indicated and as necessary to facilitate new construction.
- B. Remove slabs, paving, curbs, and gutters, as indicated. Where concrete slabs, curb, gutter and asphalt pavements are designated to be removed, remove bases and subbase to surface of underlying, undisturbed soil.
- C. Unless the existing full-depth joints coincide with line of pavement demolition, neatly saw-cut to full depth the length of existing pavement to remain before removing existing pavement. Saw-cut faces vertically.
- D. Remove driveways, curbs, gutters and sidewalks by saw cutting to full depth. If saw cut falls within 30-inches of a construction joint, expansions joint, score mark or edge, remove material to joint, mark or edge.

**3.05 BACKFILL**

- A. Place and compact material in excavations and depressions remaining after site clearing in conformance with Section 31 23 33 – Trenching and Backfill.

**3.06 DISPOSAL**

- A. Remove surplus obstructions, demolished materials, and waste materials, including trash and debris, and legally dispose of them off the Owner's property.

**END OF SECTION**

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SECTION 02 41 10

STRUCTURE DEMOLITION

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**PART 1 - GENERAL**

1.1 SUMMARY

- A. Section Includes: Demolish existing construction as required for Project.
  - 1. Remove existing materials and equipment from site.
  - 2. Remove foundations including basement floor slabs.
  - 3. Cap and identify active utilities.
  - 4. Remove buried tanks, including related inactive service lines.
- B. Related Sections:
  - 1. Section 01 11 00: Summary of work.
  - 2. Section 01 50 00: Temporary facilities and controls.
  - 3. Section 01 50 13: Construction Waste management and Disposal.
- C. Municipal Authorities: Check with the City of Oakland for any other requirements for dismantling, removing, and capping of Municipal utilities.

1.2 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
  - 1. Do not interfere with use of adjacent buildings; maintain free and safe passage to and from.
  - 2. Prevent movement or settlement of adjacent structures, provide and place bracing or shoring and be responsible for safety and support of structures. Assume liability for movement, settlement, damage or injury.
  - 3. Cease operations and notify Architect immediately if safety of adjacent structures appears to be endangered; take precautions to properly support structures. Do not resume operations until safety is restored.
  - 4. Prevent movement, settlement or collapse of adjacent services, sidewalks, driveways and trees. Assume liability for such movement, settlement or collapse, promptly repair.
  - 5. Obtain permission from adjacent property owners when outriggers, swinging cranes or similar equipment traverse their property.
- B. Design/Build: Provide special engineering to ensure compliance with applicable codes and Contract Documents for shoring.
- C. Scheduling: Do not close or obstruct roadways without permits. Conduct operations with minimum interference to adjacent traffic.

### 1.3 SUBMITTALS

A. Action Submittals:

1. Submit demolition procedures and operational sequence to ensure Project sequencing is consistent with Owner needs.

B. Informational Submittal:

1. Submit copies of permits and notices authorizing demolition work.
2. Submit copies of certificates of severance of utility services.
3. Submit copies of permit for transport and disposal of debris.

C. Pre-Demolition Photographs: Show conditions of exiting adjacent construction and site improvements that might be misconstrued as damaged by demolition operations. Submit before work begins.

D. Design/Build Certificates: Submit certification signed by California licensed structural engineer indicating shoring compliance with code requirements.

### 1.4 QUALITY ASSURANCE

A. Sustainability Requirements: Comply with CALGreen requirements including those relative to pollution control for construction waste.

### 1.5 SITE CONDITIONS

A. Structures to be demolished shall be evacuated and their use discontinued before start of work.

B. Arrange and pay for disconnecting or removing, capping and plugging utility services; disconnect and stub off; notify affected utility company in advance and obtain approval before starting Work.

C. Place markers to indicate location of disconnected services; identify service lines and capping locations on Project Record Documents.

D. Maintain access to existing walkways, exits, and adjacent occupied facilities.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

A. Debris: Maintain possession of materials being demolished except where noted as a material for reinstallation or a material to be retained by Owner. Immediately remove debris from site.

B. Materials for Reinstallation: Carefully remove, store and protect materials indicated to be reinstalled. Contact Owner and Architect prior to beginning demolition to determine extent of other materials that might be suitable for reinstallation.

1. Inventory and record condition of items to be reinstalled.

- C. Owner Retained Materials: Contact Owner prior to beginning demolition to determine extent of materials to be retained. Carefully remove materials indicated to be retained by Owner; deliver and store where directed.
  - 1. Inventory and record condition of items to be retained by Owner.

### **PART 3 - EXECUTION**

#### **3.1 DEMOLITION**

- A. Demolish structures and appurtenances in an orderly and careful manner.
  - 1. Tanks: Remove tanks within construction area; pump out buried tanks located outside construction area, fill tanks with sand or fine gravel and cover with fill unless otherwise indicated.
- B. Perform demolition in accordance with authorities having jurisdiction.
  - 1. Do not use explosives.
- C. Keep work sprinkled to prevent dust; provide hoses and water as required for demolition. Coordinate potential availability of water from existing on-site water sources with Owner; do not use on-site water without prior written approval.
- D. Remove demolished materials from site, unless otherwise directed.
  - 1. Burning of materials on site is not permitted.
  - 2. Remove from site, contaminated, vermin infested, or dangerous materials encountered and dispose of by safe means so as not to endanger health of workers or public.
- E. Rough grade areas affected by demolition and leave level to within one percent; maintain grades and contours of site as indicated.
  - 1. Backfill over excavated areas, open pits and holes caused as a result of demolition which exceed excavation limits for project; use approved fill.
- F. Remove demolished materials, tools and equipment upon completion of work; leave site in condition acceptable to Architect.

#### **3.2 REPAIR**

- A. Repair damage to adjacent structures caused as result of demolition.
- B. Repair demolition beyond that required for Project.

**END OF SECTION**

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**SECTION 02 41 20**

**SELECTIVE BUILDING DEMOLITION**

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**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Section Includes: Selectively remove materials, systems, components, fixtures and equipment as designated and as required for completion of Project as indicated.
  - 1. Cap and identify active utilities.
- B. Related Sections:
  - 1. Section 01 11 00: Summary of work.
  - 2. Section 01 50 00: Temporary facilities and controls.
  - 3. Section 01 50 13: Construction Waste management and Disposal.
  - 4. Section 01 73 29: Cutting and patching.
  - 5. Section 02 41 10: Structure demolition.

**1.2 ADMINISTRATIVE REQUIREMENTS**

- A. Coordination:
  - 1. Do not interfere with use of adjacent building spaces not in Project; maintain free and safe passage to and from.
  - 2. Prevent movement of structural components, provide and place bracing and be responsible for safety and support of structural components. Assume liability for movement, settlement, damage or injury.
  - 3. Cease operations and notify Architect immediately if safety of structural components appears to be endangered; take precautions to properly support structures. Do not resume operations until safety is restored.
  - 4. Prevent dust from selective demolition from contaminating adjacent occupied building areas; clean construction dust from adjacent occupied area immediately upon direction of Building Manager.
- B. Design/Build: Provide special engineering to ensure compliance with applicable codes and Contract Documents for support systems.
- C. Scheduling: Do not close or obstruct roadways without permits. Conduct operations with minimum interference to adjacent traffic.

**1.3 SUBMITTALS**

- A. Action Submittals: Submit selective demolition operational sequence to ensure Project sequencing is consistent with Owner needs.
- B. Informational Submittals: Submit permits for transport and disposal of debris.



#### 1.4 QUALITY ASSURANCE

- A. Sustainability Requirements: Comply with CALGreen requirements including those relative to finish material pollution control and for construction waste.

### **PART 2 - PRODUCTS**

#### 2.1 MATERIALS

- A. Debris: Maintain possession of materials being demolished except where noted as a material for reinstallation or a material to be retained by Owner. Immediately remove debris from site.
  - 1. Immediately remove from site wet materials and materials with water stains, with mold, and with mildew.
- B. Materials for Reinstallation: Carefully remove, store and protect materials indicated to be reinstalled. Contact Owner and Architect prior to beginning demolition to determine extent of other materials that might be suitable for reinstallation.
  - 1. Inventory and record condition of items to be reinstalled.
- C. Owner Retained Materials: Contact Owner prior to beginning demolition to determine extent of materials to be retained. Carefully remove materials indicated to be retained by Owner; deliver and store where directed.
  - 1. Inventory and record condition of items to be retained by Owner.

### **PART 3 - EXECUTION**

#### 3.1 EXISTING SERVICES

- A. Disconnect or remove utility services as required for completion of Project; disconnect, stub off, and cap utility service lines not required for new construction.
  - 1. Do not remove utilities discovered during demolition but not indicated without first determining purpose for utility; coordinate with Architect and Engineers.
- B. Do not disrupt services to adjacent building areas not in Project.
- C. Place markers to indicate location of disconnected services; identify service lines and capping locations on Project Record Documents.

#### 3.2 DEMOLITION

- A. Demolish indicated appurtenances as indicated and as required for Project completion in an orderly and careful manner.
  - 1. Use methods that do not damage materials indicated to remain.
  - 2. Cut concrete and masonry using masonry saws and hand tools; provide sharp clean cuts requiring minimal patching for new construction.

3. Use impact tools only where specifically approved in advance for areas where operations do not disturb building occupancy.
- B. Perform demolition in accordance with authorities having jurisdiction.
- C. Remove demolished materials from site, unless otherwise directed.
  1. Remove from site, contaminated, vermin infested, and dangerous materials encountered and dispose of by safe means so as not to endanger health of workers or public.
- D. Remove tools and equipment upon completion of work; leave area in condition acceptable to Owner and Architect.

### **3.3 REPAIR**

- A. Repair damage to adjacent construction caused as result of this work.
- B. Repair demolition beyond that required.

**END OF SECTION**

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**SECTION 06 20 00****FINISH CARPENTRY**

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**PART 1 - GENERAL****1.1 SUMMARY**

- A. Section Includes: Provide finish carpentry with accessories as required for complete installation.
  - 1. Provide Closure panels in between relocatable buildings and between relocatable buildings and existing north fence See drawings for details.

**1.2 REFERENCES**

- A. North American Architectural Woodwork Standards 3.1 (NAAWS).

**1.3 ADMINISTRATIVE REQUIREMENTS**

- A. Coordination, Wood Jambs: Coordinate wood door jambs with Section 08 14 00 – Wood Doors for pre-hung wood doors.

**1.4 SUBMITTALS**

- A. Product Data: Submit literature for manufactured items.
- B. Shop Drawings: Indicate materials and wood species, component profiles, fastening, and joining details, finishes, and accessories.
- C. Samples: Furnish samples of each type of finish carpentry.
- D. Assurance Options: NAAWS certification and monitored compliance programs will not be required for finish carpentry.
- E. Wood Product Certification: Furnish certification indicating wood products are from FSC “well-managed” forests.

**1.5 QUALITY ASSURANCE**

- A. Sustainability Requirements: Comply with CALGreen requirements including those relative to finish material pollution control for adhesives, sealants, and caulks, and for composite wood products formaldehyde limitations.

**1.6 DELIVERY, STORAGE, AND HANDLING**

- A. Do not deliver materials until site conditions are adequate to receive work; protect items from weather while in transit.
- B. Store materials indoors, in ventilated areas with constant but minimum temperature of 60-degrees F and maximum relative humidity of 25% to 55%.

- C. Do not begin installation of finish carpentry until space is fully enclosed and mechanical systems are fully operational.
  - 1. Maintain interior installation areas at 70-degrees F and 50% to 55% relative humidity.
- D. Immediately remove from site materials with visible mold and materials with mildew.

## **PART 2 - PRODUCTS**

### **2.1 MATERIALS**

- A. System Description: Provide finish carpentry systems specified complying with North American Architectural Woodwork Standards (NAAWS) and including accessories as required for complete installation.
- B. Opaque Painted Exterior Plywood closure panels:
  - 1. Quality: NAAWS/Custom Grade.
  - 2. Wood: Clear Western Red Cedar.
  - 3. Wood: Clear Douglas Fir.
  - 4. Texture: Surfaced.
- C. Anchors, Nails and Screws: Select the material, type, size and finish required by each substrate for secure anchorage; provide toothed steel or lead expansion bolt screws for drilled-in-place anchors.
- D. Wood Filler: Color to match wood being filled.

### **2.1 FABRICATION**

- A. Fabricate finish carpentry items in accordance with specified quality standard.
- B. Use exposed fastening devices or nails only when approved and unavoidable; arrange neatly.

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Field Measurements: Take field measurements prior to preparation of shop drawings and fabrication where possible; do not delay job progress, allow for trimming and fitting.
- B. Verify surfaces are ready to receive work and field measurements are as shown on shop drawings.
  - 1. Beginning installation signifies acceptance of conditions.

- C. Ensure mechanical and electrical items affecting work are properly placed, complete, and have been inspected by applicable authorities prior to commencement of installation.
- D. Inspect each piece of finish carpentry and discard damaged and defective pieces.

### 3.2 INSTALLATION

- A. Install work consistent with specified NAAWS quality grade, plumb, level, true and straight with no distortions; shim as required, using concealed shims.
  - 1. Prime paint surfaces in contact with cementitious materials prior to installation; comply with requirements of Section 09 90 00 – Painting and Coating.
- B. Secure work to blocking with countersunk, concealed fasteners and blind nailing as required for a complete installation.
- C. Scribe and cut for accurate fit to other finished work.
- D. Install finish carpentry in single, unjointed lengths for openings and for runs less than 10'-0".
  - 1. For longer runs, use only one piece less than 10'-0" in any straight run; provide scarf joints between members.
  - 2. Stagger joints in adjacent members.
  - 3. Cope at returns and miter at corners.
- E. Accessories: Install accessories in accordance with manufacturer's recommendations in locations indicated or as directed by Architect.
- F. Acceptable Tolerances:
  - 1. Variation from True Position: Maximum 1/16" at any position and maximum 1/8" in any 10'-0" length.
  - 2. Adjoining Surfaces of Same Material: No variation permitted.
  - 3. Offset with Abutting Materials: Maximum 1/32".
- G. Preparation for Field Finishing:
  - 1. Sand work smooth and set exposed nails and screws.
  - 2. Apply wood filler in exposed nail and screw indentations and leave ready to receive site-applied finishes.
  - 3. Seal concealed and semi-concealed surfaces; brush apply only, using primer consistent with finish coats specified under Section 09 90 00 – Painting and Coating.

**LANEY COLLEGE LOCKER ROOM INTERIM HOUSING**

Peralta Community College District

**DSA SUBMITTAL**

**June 5, 2020**

**END OF SECTION**

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**SECTION 09 90 00**

**PAINTING AND COATING**

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**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Section Includes: Provide painting and finishing of exposed items and surfaces requiring field painting and finishing including shop primed items.
  - 1. Specified surface preparation, priming and coats of paint are in addition to shop-priming and surface treatment specified under other sections of work.
  - 2. Painting and finishing include field finishing of exterior and interior items not listed as "Surfaces not to be Painted" unless clearly indicated otherwise.
  - 3. Painting and finishing include field finishing of select shop finished items such as mechanical grilles and registers and shop primed items such as access panels and louvers in doors, to match adjacent surfaces.
    - a. Match adjacent surfaces in color and sheen unless otherwise indicated.
  - 4. Field paint exposed bare and covered pipes, ducts, and hangers, exposed steel and iron work, and primed metal surfaces of equipment installed under mechanical and electrical work in occupied spaces.
- B. Surfaces Not to be Painted:
  - 1. Finished items including finished metal surfaces.
  - 2. Moving parts of operating mechanical and electrical units.
  - 3. Labels: Keep equipment identification and fire rating labels free of paint.
- C. Related Sections: Shop priming of ferrous metal items is included under various Specification sections.

**1.2 SUBMITTALS**

- A. Product Data: Submit manufacturer's technical information, including paint label analysis and application instructions for each material.
- B. Samples: Submit samples for review of color and texture; provide list of material and application for each coat of each finish sample.
  - 1. Brush-Outs: Submit samples of each color and material with texture to simulate actual conditions, on hardboard.
    - a. Submit 8" by 10" samples of wood finishes on actual wood surfaces; label and identify each as to location and application.
- C. Manufacturer Certificates: Furnish certificates from each manufacturer stating materials are top quality lines and suitable for intended use on this Project.

**1.3 QUALITY ASSURANCE**

- A. Sustainability Requirements: Comply with CALGreen requirements including those relative to finish material pollution control for paints and coatings.

**1.4 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver materials to job site in original, new and unopened packages and containers bearing manufacturer's name and label, with:
  - 1. Name of material, color and sheen.
  - 2. Manufacturer's name, stock number and date of manufacture.
  - 3. Contents by volume, for major pigment and vehicle constituents.
  - 4. Thinning and application instructions.

**1.5 SITE CONDITIONS**

- A. Apply water-base paints when temperature of surfaces and surrounding air are between 50 and 90-degrees F.
- B. Do not apply paint in rain, fog or mist; or when relative humidity exceeds 85 percent; or to damp or wet surfaces.
- C. Painting may be continued during inclement weather if areas to be painted are enclosed and heated within temperature limits specified.
- D. Provide additional temporary ventilation during interior application of paints to eliminate volatile organic compound (VOC) emissions from interior spaces as quickly as possible.

**PART 2 - PRODUCTS****2.1 SYSTEMS MANUFACTURERS**

- A. Benjamin Moore & Co.
- B. Sherwin-Williams Co.
- C. Pittsburgh Paints, PPG Pittsburgh Paints, including Glidden Professional.
- D. Dunn-Edwards Corp.
- E. Kelly Moore Paint Co.
- F. Vista Paint Co.
- G. Frazee Paint Co.
- H. Substitutions: Refer to Section 01 25 00.



**2.2 MATERIALS**

- A. System Description: Provide painting and finishing of exposed items and surfaces requiring field painting and finishing including shop primed items.
  - 1. Definition: "Painting" and "coating" as used herein means systems including primers, emulsions, enamels, stains, sealers and fillers, whether used as prime, intermediate or finish coats.
- B. Regulatory Requirements:
  - 1. Volatile Organic Compound (VOC) Emissions: Furnish materials approved for use by applicable air quality management district for limitations of volatile organic compounds for architectural or special coatings as applicable.
  - 2. California Stair Stripes: Paint 2" stripes at stair nosing not otherwise marked, full tread and landing width, in accordance with California Code of Regulations, Title 24, Access Compliance requirements.
    - a. Exterior Stairs: Provide at landing and each tread in each stair run.
- C. Material Quality: Provide top line quality commercial grade (professional painter) paints; materials not bearing manufacturer's identification as their top line product shall not be acceptable.
  - 1. Primers: Provide premium grade primers recommended by paint manufacturer for substrates indicated and for finish systems specified.
  - 2. Undercoats and Barrier Coats: Provide undercoat paints produced by same manufacturer as finish coats; use only thinners approved by paint manufacturer and use only within recommended limits.
  - 3. Finish Coats: Provide finish coats capable of being washed with mild detergent without loss of color, sheen, or pigments.
    - a. Color pigments: Pure, non-fading, applicable types to suit substrates and service indicated; no lead content permitted.
  - 4. Finish Coat Coordination: Provide finish coats which are compatible with prime paints, undercoats, and barrier coats used.
    - a. Review other Specification sections in which prime paints are provided; ensure compatibility of total coatings systems.
    - b. Upon request from other trades furnish information on characteristics of finish materials proposed for use.
    - c. Provide barrier coats over incompatible primers or remove and prime as required.
    - d. Notify Architect in writing of any anticipated problems in use of specified coating systems with substrates primed by others.

- D. Colors and Finishes: Prior to commencement of painting work, Architect will furnish color chips for surfaces to be painted.
  - 1. Use of proprietary names in color selection is not intended to imply exclusion of equivalent products of other manufacturers.
  - 2. Final acceptance of colors will be from samples applied on site.
  - 3. Colors: Where color is not indicated on Drawings or Finish Schedule, provide custom color as directed by Architect.

### **PART 3 - EXECUTION**

#### **3.1 PREPARATION**

- A. Inspection: Examine areas and conditions under which painting work is to be applied.
  - 1. Start of painting work indicates acceptance of surfaces and conditions of surfaces and conditions within any area.
  - 2. Where exposed items or surfaces are not specifically mentioned in Schedules, paint same as adjacent similar materials or areas.
  - 3. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions detrimental to a durable paint film.
- B. Perform preparation and cleaning procedures in accordance with paint manufacturer's instructions and as specified for substrate condition.
  - 1. Existing Painted Finishes:
    - a. Clean existing painted surfaces and remove oil, grease, dust, stains, scale, efflorescence, mildew, mold, algae, blisters, and non-adhering paint.
    - b. Measure adhesion of existing paints using ASTM D3359 tape test; remove existing coatings where poor adhesion is indicated.
    - c. Feather edges of severely deteriorated paint where several coats are removed as part of cleaning, to provide smooth transition for new paint.
    - d. Fill holes, cracks, and defects and fill and sand smooth, ready for new paint finish.
- C. Remove hardware, accessories, and items in place and not to be painted, or provide protection prior to surface preparation and painting; after painting reinstall removed items.
- D. Clean surfaces before applying paint; remove oil and grease prior to mechanical cleaning; program cleaning so contaminants from cleaning process do not fall onto wet, newly painted surfaces.

- E. Cementitious Materials: Prepare by removing efflorescence, chalk, dirt, grease, oils, and by roughening as required to remove glaze.
  - 1. Determine alkalinity and moisture content of surfaces to be painted.
  - 2. If surfaces are found to be sufficiently alkaline to cause blistering and burning of finish paint, neutralize before application of paint.
  - 3. Do not paint over surfaces where moisture content exceeds manufacturer's printed directions.
- F. Wood: Clean wood surfaces of dirt, oil, and other foreign substances; sandpaper smooth surfaces exposed to view and dust off.
  - 1. Scrape and clean seasoned knots and apply thin coat of recommended knot sealer, before application of priming coat.
  - 2. Prime, stain, or seal wood required to be job-painted immediately upon delivery to job; prime edges, ends, faces, undersides, and backsides of wood.
  - 3. After priming, fill holes and imperfections in finish surfaces with putty or plastic wood-filler; sandpaper smooth when dry.
- G. Ferrous Metals: Touch up shop-applied prime coats wherever damaged using same type of primer as applied in shop or barrier coat compatible with finish paint.
  - 1. Bare Surfaces: Clean surfaces that are not galvanized or shop-coated, of oil, dirt, loose mill scale and other foreign substances by solvent or mechanical cleaning.
  - 2. Galvanized Surfaces: Clean free of oil and surface contaminants, using non-petroleum-based solvent; primer and touch-up primer to be zinc-rich primer.
- H. Mix painting materials in accordance with manufacturer's directions.
- I. Store materials in tightly covered containers; maintain containers used in storage, mixing and application of paint in a clean condition, free of foreign materials and residue.
- J. Stir materials before application to produce mixture of uniform density and stir as required during application; do not stir surface film into material, if necessary, strain material before using.

### 3.2 APPLICATION

- A. Apply paint in accordance with manufacturer's directions; use applicators and techniques best suited for substrate and type of material being applied.
  - 1. Apply additional coats when stains or blemishes show through final coat, until paint is a uniform finish, color and appearance.
  - 2. Provide extra attention during application to assure dry film thickness at corners and crevices is equivalent to that of flat surfaces.

3. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces; paint surfaces behind permanently fixed equipment and furniture with prime coat only.
  4. Finish doors on tops, bottoms and side edges same as faces.
  5. Paint back sides of access panels and removable or hinged covers to match exposed surfaces.
  6. Paint interior surfaces of ducts, where visible through registers or grilles, with a flat, non-specular black paint.
  7. Sand lightly between coats when recommended by system manufacturer.
- B. Scheduling Painting: Apply first coat to surfaces that have been cleaned, pretreated or prepared for painting as soon as practicable after preparation.
1. Allow time between successive coatings to permit proper drying.
  2. Do not recoat until paint feels firm and does not deform or feel sticky under moderate thumb pressure.
- C. Minimum Coating Thickness: Apply materials at not less than manufacturer's recommended spreading rate, to establish a total dry film thickness as recommended by coating manufacturer.
- D. Prime Coats: Apply to items not previously primed; recoat primed and sealed surfaces where there is evidence of suction spots or unsealed areas in first coat.
- E. Finish Coats: Provide even texture; leave no laps, irregularity in texture, skid marks, or other surface imperfections.
1. Opaque Finishes: Provide opaque, uniform finish, color and coverage; cloudiness, spotting, holidays, brush marks, runs, sags, ropiness, and other surface imperfections are not acceptable.
  2. Transparent and Stained Finishes: Produce glass smooth surface film of even luster; provide with no cloudiness, color irregularity, runs, brush marks, orange peel, nail holes, and other surface imperfections.
- F. Completed Work: Match approved samples for color, texture and coverage; remove, refinish or repaint work not accepted.

### 3.3 PAINTING SCHEDULE

- A. Exterior Work: Provide following paint systems and sheens unless otherwise indicated.
1. Metal: Semigloss sheen.
    - a. 1st Coat: Touch-up primer, prime if none.
    - b. 2nd and 3rd Coat: Exterior 100% acrylic enamel.
  2. Metal: High-performance coating specified in Section 09 96 70.

3. Plaster: Flat sheen.
    - a. 1st and 2nd Coat: Heavy body vapor permeable waterproof elastomeric acrylic coating.
  4. Plaster: Flat sheen.
    - a. Refer to Section 09 96 80 – Elastomeric Coating.
  5. Opaque Finished Wood: Semigloss sheen.
    - a. 1st Coat: Primer undercoat.
    - b. 2nd and 3rd Coat: Exterior 100% acrylic enamel.
  6. Traffic Line Paint: Manufacturer's standard sheen; colors as required by line or symbol; blue for handicapped parking spaces.
    - a. 1st and 2nd Coat: Water based acrylic/epoxy traffic line paint; other systems subject to prior approval by Architect.
- A. Interior Work: Provide following paint systems and sheens unless otherwise indicated.
1. Gypsum Board Systems: Eggshell (satin) sheen at walls, flat sheen at ceilings, semigloss sheen at toilet rooms.
    - a. 1st Coat: Universal primer.
    - b. 2nd and 3rd Coat: Interior latex or acrylic latex emulsion.
  2. Concrete: Flat sheen.
    - a. 1st Coat: Primer sealer.
    - b. 2nd and 3rd Coat: Interior latex emulsion.
- B. Sheens: Comply with ASTM D523, reflectance of paint.
1. Flat: 1-10.
  2. Satin: 15-30.
  3. Eggshell: 30-45.
  4. Semigloss: 45-75.
  5. Gloss: 75-100.

### 3.2 CLEAN-UP, PROTECTION, AND REPAIR

- A. Clean-Up: During progress of work, remove discarded paint materials, rubbish, cans and rags from site at end of each workday.
1. Clean glass and paint-spattered surfaces immediately by proper methods of washing and scraping, using care not to scratch or damage finished surfaces.
- B. Protection: Protect work of other trades, whether to be painted or not; correct damage by cleaning, repairing or replacing, and repainting, as acceptable to Architect.
1. Provide "Wet Paint" signs to protect newly painted finishes.

2. Remove temporary protective wrappings provided by others for protection of their work, after completion of painting operations.
- C. Repair: At completion of work of other trades, touch-up and restore damaged surfaces or defaced painted surfaces.

**END OF SECTION**

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SECTION 09 96 20

GRAFFITI RESISTANT COATING

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**PART 1 - GENERAL**

1.1 SUMMARY

- A. Section Includes: Provide sacrificial type graffiti resistant coatings suitable for applications to surfaces indicated to receive graffiti resistant coating.
- B. Related Sections:
  - 1. Section 09 90 00: Paints and coatings.

1.2 ADMINISTRATIVE REQUIREMENTS

- A. Coordination: Coordinate graffiti resistant coating with surfaces upon which coating is to be applied to ensure coating does not change appearance of surface and does not detrimentally impact surface.

1.3 SUBMITTALS

- A. Product Data: Furnish manufacturer's literature.
- B. Samples: Furnish samples of graffiti resistant coating applied to each type of surface required for Project.
- C. Manufacturer Certification: Submit certification by manufacturer materials supplied comply with applicable codes and Contract Documents and are compatible with substrates indicated to receive graffiti resistant coating.
- D. Maintenance Instructions: Furnish manufacturer recommendations for cleaning of graffiti and other substances from system; note specific methods for determining type of material used for graffiti (marker, spray, etc.) and cleaning methods for each.
- E. Maintenance Materials: Furnish supply of each type of cleaning material required for standard graffiti types clearly labeled regarding cleaning material type and specific applications relating to types of graffiti material cleans.

1.4 QUALITY ASSURANCE

- A. Sustainability Requirements: Comply with CALGreen requirements including those relative to finish material pollution control for paints and coatings.
- B. Field Sample: Apply minimum 50 sf of graffiti resistant coating where directed by Architect; sample installation establishes minimum workmanship standard. Approved field sample may be incorporated into Project.

**1.5 DELIVERY, STORAGE, AND HANDLING**

- A. Store materials in accordance with manufacturer recommendations in dry, ventilated, protected area with minimum temperature of 45 degrees F. and away from fires or open flames.

**1.6 PROJECT CONDITIONS**

- A. Maintain minimum surface and ambient temperature of 45-degrees F for 24 hours before, during and 24 hours after application, or until wall coating has cured.
- B. Ventilate area in which coating is being applied.
- C. Moisture content of surface, maximum of 14%; with negative alkalinity.

**1.7 MAINTENANCE**

- A. Extra Stock: Provide materials for not less than one complete cleaning and reapplication of sacrificial graffiti resistant coating.
  - 1. Deliver and store where directed by Owner prior to Substantial Completion.

**PART 2 - PRODUCTS****2.1 SYSTEMS MANUFACTURERS**

- A. American Polymer Corp (801.255.9505).
- B. Rain Guard International Products Co.
- C. ProSoCo.
- D. Substitutions: Refer to Section 01 25 00.

**2.2 MATERIALS**

- A. System Description: Provide sacrificial graffiti resistant coatings suitable for applications to surfaces indicated to receive graffiti resistant coating.
- B. Regulatory Requirements, VOC: Coating to comply with applicable air quality management district limitations on volatile organic compound (VOC) emissions for architectural or special coating as applicable.
- C. Performance Criteria:
  - 1. Coating shall show no signs of deterioration or change of appearance after graffiti removal during 10-year period after application including no ghost staining and no shadowing.
  - 2. Cleaning chemicals shall be capable of removing 100% of all types of paint and graffiti materials from treated surfaces along with graffiti resistant coating.
  - 3. Coating shall not increase dirt pick-up of substrate.



- D. Graffiti Resistant Coating: Provide sacrificial graffiti resistant coating system compatible with surfaces indicated to receive graffiti resistant coating and that does not change appearance of substrate when coating is dry.
  - 1. Coating to be water clear, non-yellowing, free of waxes and urethane.
  - 2. Chemical Resistance: Coating shall be tested for following chemicals; list is not intended to be exclusionary regarding coating ability to resist graffiti.
    - a. MEK: No effect after five days.
    - b. Carboxylic Acid: No effect after five days.
    - c. 75% Phosphoric Acid: No effect after five days.
    - d. 37% HCL: 3 hours blister.
    - e. 50% Sulfuric Acid: No effect after five days.
    - f. 20% NIT: 68 hours blister.
  - 3. Undercoating: Provide undercoating over porous surfaces where recommended by system manufacturer.
  - 4. Cleaning Materials: Non-caustic, biodegradable, and recyclable, allowing graffiti removal without use of blasting equipment, hot water, or high-pressure wash equipment.

### **PART 3 - EXECUTION**

#### **3.1 PREPARATION**

- A. Prepare surfaces in accordance with manufacturer's recommendations.
- B. Mask and protect surfaces, finishes and materials not receiving coating to provide true juncture lines and protect from overspray or damage.
- C. Remove and store finish hardware, fixture covers and accessories. Replace after coating has cured.
- D. Report defects of surfaces which could affect application of coating.
- E. Other painting and finishing shall be completed prior to application.
- F. Keep unauthorized traffic out of area in which coating is being applied.

#### **3.2 INSTALLATION**

- A. Apply coatings in accordance with manufacturer's recommendations and application instructions for each type of substrate receiving coating, by trained applicators.

#### **3.3 CLEANING**

- A. As work proceeds, clean up overspray and spatter, excess materials and rubbish.
- B. Upon completion, and after coating has cured, clean and replace finish hardware, fixtures and fittings previously removed.
- C. Repair adjacent surfaces damaged by application of graffiti resistant coating.

**END OF SECTION**

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SECTION 09 96 70

HIGH-PERFORMANCE COATING

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**PART 1 - GENERAL**

1.1 SUMMARY

- A. Section Includes: Provide high-performance coating system of urethane over epoxy primer as indicated, including surface preparation, priming and high-performance coating application.
  - 1. Location: Provide high-performance coating at exterior steel unless otherwise indicated. Coordinate priming with exterior steel specifications.
- B. Related Work:
  - 1. Section 09 90 00: Standard painting and coating systems.

1.2 SUBMITTALS

- A. Product Data: Manufacturer's technical information, including coating label analysis and application instructions for each material.
- B. Samples: Submit samples for review of color and texture; provide list of material and application for each coat of each finish sample.
  - 1. Provide samples of each color and material with texture to simulate actual conditions.
- C. Certificates: Provide certificate from each manufacturer stating material is top quality line and suitable for intended use on this Project.

1.3 QUALITY ASSURANCE

- A. Sustainability Requirements: Comply with CALGreen requirements including those relative to finish material pollution control for paints and coatings.
- B. Installer Qualifications: Minimum of five years successful experience in application of high-performance coating systems of type specified and acceptable to manufacturer of coating system.
- C. Mock-Up: Duplicate finish of approved samples in field at location as approved by Architect, one complete component or approximately 100 square feet, for approval prior to commencing work.
  - 1. Approved mock-up may be incorporated into Project.

**1.4 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver materials to job site in original, new and unopened packages and containers bearing manufacturer's name and label, with:
  - 1. Name of material, color and sheen.
  - 2. Manufacturer's name, stock number and date of manufacture.
  - 3. Contents by volume, for major pigment and vehicle constituents.
  - 4. Thinning and application instructions.

**1.5 SITE CONDITIONS**

- A. Apply high performance coating when temperature of surfaces and surrounding air are between manufacturer recommended temperatures.
- B. Do not apply high performance coating in rain, fog or mist; or when relative humidity exceeds 85-percent; or to damp or wet surfaces.

**1.6 WARRANTY**

- A. Extended Correction Period: Provide for correcting failure of high-performance coating including peeling, chipping, rusting of substrate, cracking, delamination, chalking, and loss of color and sheen.
  - 1. Period: Two years.
- B. Manufacturer's Warranty: Submit manufacturer's warranty including special manufacturer services as required for manufacturer's warranty.
  - 1. Period: 10 years.
  - 2. Manufacturer's warranty shall not detract from requirements of extended correction period nor from Owner's rights under implied and expressed warranties regardless of wording of manufacturer's warranty.

**PART 2 - PRODUCTS****2.1 SYSTEMS MANUFACTURERS**

- A. DuPont Co. Maintenance Finishes.
- B. Tnemec Company, Inc.
- C. PPG Protective & Marine Coatings.
- D. Substitutions: Refer to Section 01 25 00.

**2.2 MATERIALS**

- A. System Description: Provide high performance coating system of urethane over epoxy primer as indicated, including surface preparation, priming and high-performance coating application.

- B. Regulatory Requirements, Volatile Organic Compound (VOC) Emissions: Provide materials complying with applicable air quality management requirements for volatile organic compound (VOC) emissions limitations.
- C. Special Coating: High build acrylic polyurethane or aliphatic polyurethane over compatible epoxy primer as recommended by coating manufacturer and suitable for applications indicated and based on quality of following products.
  - 1. Systems:
    - a. DuPont/Imron with 25P primer.
    - b. Tnemec/Endura-Shield II (Series 1075) with Series V69 epoxy primer.
    - c. PPG/AmerShield VOC with Amerlock 400 primer.
    - d. Substitutions: Refer to Section 01 25 00.
  - 2. Special Coating System: Provide specific primer and coating as recommended by manufacturer for applications indicated, conforming to specified requirements.
    - a. 1st Coat: Epoxy primer.
    - b. 2nd and 3rd Coat: High-build acrylic polyurethane or high-build polyurethane.
  - 3. System Requirements:
    - a. Abrasion: ASTM D4060, CS-17 Wheel, 1,000 grams load, no more than 95 mg. loss after 1000 cycles.
    - b. Adhesion: ASTM D3359 Method B (Crosshatch Adhesion), coating applied to sandblasted steel and cured 30 days at 77° F, minimum rating of 5 on average of three tests.
    - c. Humidity: ASTM D4585, no blistering, cracking or delamination of film after 1000 hours exposure.
    - d. Salt Spray (Fog): ASTM B117, no blistering, rusting, cracking, or delamination of film; maximum 1/8" rust creepage at scribe after 1000 hours exposure.
    - e. UV: ASTM G154, no blistering, cracking or chalking, less than 35% gloss loss and less than 3.5 MacAdam unit color change after 1500 hours exposure.
  - 4. Coordination: Provide special coating system compatible with prime paints, undercoats, and barrier coats used.
    - a. Review other Specification sections in which prime paints and zinc-rich touch-coatings up are provided; ensure compatibility of total coatings systems.
    - b. Upon request from other trades furnish information on characteristics of finish materials proposed for use.
    - c. Provide barrier coats over incompatible primers or remove and reprime as required. Reprime with zinc-rich primer where galvanized.

- d. Notify Architect in writing of any anticipated problems in use of specified coating systems with substrates primed by others.
- D. Colors and Finishes:
  - 1. Colors: Where color is not indicated on Drawings or Finish Schedule, provide custom color as directed by Architect.
  - 2. Final acceptance of colors will be from samples applied on site.
  - 3. Color pigments: Pure, non-fading, applicable types to suit substrates and service indicated; no lead content permitted.
  - 4. Sheen: Gloss; comply with ASTM D523, reflectance of coating, 75-100.
- E. Material Quality: Provide primers produced by same manufacturer as finish coats; use only thinners approved by coating manufacturer and use only within recommended limits.

### **PART 3 - EXECUTION**

#### **3.1 PREPARATION**

- A. Inspection: Examine areas and conditions under which high performance coating work is to be applied.
  - 1. Start of high-performance coating work indicates acceptance of surfaces and conditions of surfaces and conditions within any particular area.
  - 2. Do not apply coating over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions detrimental to a durable coating.
- B. Perform preparation and cleaning procedures in accordance with coating manufacturer's instructions and as specified for substrate condition.
- C. Remove items in place and not to be coated or provide protection prior to application of high-performance coating; after application of coating reinstall removed items.
- D. Clean surfaces before applying high-performance coating; remove oil and grease prior to mechanical cleaning; program cleaning so contaminants from cleaning process do not fall onto wet, newly coated surfaces.
- E. Metal Preparation: Comply with coating manufacturer recommendations, but not less than following requirements.
  - 1. Bare Surfaces: Clean surfaces which are not galvanized or shop-coated, of oil, dirt, loose mill scale and other foreign substances by solvent or mechanical cleaning.
  - 2. Galvanized Surfaces: Clean free of oil and surface contaminants, using non-petroleum-based solvent.

3. Painted Surfaces: Clean surfaces of loose paint, dirt, and foreign substances by mechanical cleaning; feather edges of existing paint to provide smooth, even substrate for high performance coating.
- F. Mix materials in accordance with manufacturer's directions.
- G. Store materials in tightly covered containers; maintain containers used in storage, mixing and application of coating in a clean condition, free of foreign materials and residue.
- H. Stir materials before application to produce mixture of uniform density and stir as required during application; do not stir surface film into material, if necessary, strain material before using.

### 3.2 APPLICATION

- A. Apply high performance coating in accordance with manufacturer's directions; use applicators and techniques best suited for substrate and coating material being applied.
  1. Apply additional coats when stains or blemishes show through final coat, until coating is a uniform finish, color and appearance.
  2. Provide extra attention to assure dry film thickness at corners and crevices is equivalent to that of flat surfaces.
- B. Scheduling: Apply first coat to surfaces that have been cleaned, pretreated or prepared for high performance coating as soon as practicable after preparation.
  1. Allow time between successive coatings to permit proper drying.
  2. Do not recoat until coating feels firm and does not deform or feel sticky under moderate thumb pressure.
- C. Minimum Coating Thickness: Apply materials at not less than manufacturer's recommended spreading rate, to establish a total dry film thickness as recommended by coating manufacturer.
- D. Prime Coats: Apply to items not previously primed; recoat primed and sealed surfaces where there is evidence of suction spots or unsealed areas in first coat.
- E. Finish Coats: Provide even texture; leave no laps, irregularity in texture, skid marks, or other surface imperfections; edges clean and sharp where work joins other materials and colors.
  1. Provide opaque, uniform finish, color and coverage; cloudiness, spotting, holidays, brush marks, runs, sags, ropiness and other surface imperfections are not acceptable.
- F. Completed Work: Match approved samples and mock-up for color, texture and coverage. Remove, refinish or recoat work not accepted.

**3.3 CLEAN-UP, PROTECTION AND REPAIR**

- A. Clean-Up: During progress of work, remove discarded coating materials, rubbish, cans and rags from site at end of each workday.
  - 1. Clean glass and coating-spattered surfaces immediately by proper methods of washing and scraping, using care not to scratch or damage finished surfaces.
- B. Protection: Protect work of other trades, whether to be coated or not; correct damage by cleaning, repairing or replacing, and refinishing, as acceptable to Architect.
  - 1. Provide "Wet Coating" or "Wet Paint" signs to protect newly coated surfaces.
  - 2. Remove temporary protective wrappings provided by others for protection of their work, after completion of coating operations.
- C. Repair: At completion of work of other trades, touch-up and restore damaged surfaces and defaced coated surfaces.

**END OF SECTION**



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**SECTION 10 14 00**

**SIGNAGE**

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**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Section Includes: Provide general signage as indicated complete with attachment devices and accessories as required for complete installation.

**1.2 SUBMITTALS**

- A. Product Data: Furnish manufacturer's literature and indicate each sign type, style, color, and method of attachment.
- B. Shop Drawings: Furnish listing of sign types, lettering and locations, along with dimensions of each sign.
  - 1. Computerized Output: Furnish computerized samples of signs and graphics at full scale duplicating final appearance.
  - 2. Dimensional Letter Signs: Furnish complete shop drawings regarding fabrication and method of attachment of dimension letter signs.
  - 3. Photoluminescent Egress Path Signage: Submit complete shop drawings indicating locations of luminous egress path markings and signage.
- C. Samples: Furnish full size samples where requested.
- D. Certification: Furnish manufacturer certification that photoluminescent egress path markings and signage conform to California Building Code requirements.

**1.3 QUALITY ASSURANCE**

- A. Sustainability Requirements: Comply with CALGreen requirements including those relative to finish material pollution control for adhesives.
- B. Signs regulated by the CBC are to be field inspected per CBC 11B-703.1.1.2.

**1.4 DELIVERY, STORAGE, AND HANDLING**

- A. Package separately or in like groups of names, labeled as to names enclosed; include installation template, attachment system and installation instructions.

**PART 2 - PRODUCTS**

**2.1 SYSTEMS MANUFACTURERS**

- A. ASI Modulex, ASI Sign Systems, Inc.
- B. Mohawk Sign Systems.

- C. Vomar Products, Inc.
- D. Substitutions: Refer to Section 01 25 00.

## 2.2 MATERIALS

- A. System Description: Provide signage as indicated with attachment devices and accessories.
- B. Regulatory Requirements: Provide signs for assuring access for persons with disabilities in accordance with state and federal regulations.
  - 1. California Regulations: Comply with California Building Code.
  - 2. Federal Regulations: Comply with Americans with Disabilities Act (ADA) Standards.
- C. Dimensional Letter Signage: Provide individual letter signs as indicated.
  - 1. Aluminum: Manufacturer's standard for individual letter signs.
    - a. Finish: Clear anodized finish, AA-M12C22A41, Class I, AAMA 607.1.
  - 2. Stainless Steel: ASTM A666, Type 304 nonmagnetic corrosion resistant stainless steel with No. 4 satin directional polish finish.
  - 3. Fabrication: Fabricate dimensional letters as indicated, of minimum 0.25" plate or casting with edges and corners smooth and finished to match adjacent metal finishes.
  - 4. Attachment: Secure letters using connections concealed after installation; method subject to Architect approval.
    - a. Take care back welding does not damage exposed sign surfaces.
- D. Toilet Room Door Signs: Provide door signs conforming to California requirements for signs for toilet rooms; concealed mounting system.
  - 1. Material, Plastic: Manufacturer's standard colored plastic/photopolymer signs.
    - a. Texture: Smooth.
    - b. Colors: Where color is not indicated on Drawings or Finish Schedule, provide custom color as directed by Architect.
  - 2. Material:
    - a. Aluminum: Manufacturer's standard for individual letter signs.
      - 1) Finish: Clear anodized finish, AA-M12C22A41, Class I, AAMA 607.1.
    - b. Stainless Steel: ASTM A666, Type 304 nonmagnetic corrosion resistant stainless steel with No. 4 satin directional polish finish.

3. Total Thickness: 0.25".
4. Provide signs required by California Code of Regulations Title 24.
  - a. Men's Room: 12" equilateral triangle, vertex pointing up.
  - b. Ladies' Room: 12" diameter circle.
  - c. Unisex Toilet: 12" diameter circle with equilateral triangle, vertex pointing up, superimposed on the circle; circle and triangle each 0.25" thick.
    - 1) Colors: Where color is not indicated on Drawings or Finish Schedule, provide custom color as directed by Architect.
5. Colors: Where color is not indicated on Drawings or Finish Schedule, provide custom color as directed by Architect.
6. Symbols: As selected from manufacturer's standard symbols.
7. Adhesive: Type as recommended by sign manufacturer for type of substrate involved.
- E. Toilet Room Wall Signs: Provide signs conforming to California Building Code and ADA Standards for signs for permanent rooms, with inset symbols and with raised and Braille characters; concealed mounting system.
  1. Material, Plastic: Manufacturer's standard colored plastic/photopolymer signs.
    - a. Texture: Smooth.
  2. Colors: Where color is not indicated on Drawings or Finish Schedule, provide custom color as directed by Architect.
  3. Material:
    - a. Aluminum: Manufacturer's standard for individual letter signs.
      - 1) Finish: Clear anodized finish, AA-M12C22A41, Class I, AAMA 607.1.
    - b. Stainless Steel: ASTM A666, Type 304 nonmagnetic corrosion resistant stainless steel with No. 4 satin directional polish finish.
  4. Comply with California Building Code and ADA Standards for raised and Braille characters, pictorial symbols, finish, and contrasts requirements.
- F. Entry Decals: Provide minimum 6" square decals with international handicapped symbol white on blue background with white border, applied to glass at accessible entry doors of existing buildings where all entry doors are not accessible.
- G. Stairway Signs: Not used.
- H. Porcelain Signs at Parking: Not used.

- I. Tactile Exit Door Signs: Provide colored plastic/photopolymer signs, conforming to California Building Code Section 1013 and ADA Standards for signs for permanent rooms, with tactile raised and Braille characters; concealed mounting system.
  1. Colors: Where color is not indicated on Drawings or Finish Schedule, provide custom color as directed by Architect.
  2. Size and Style: As indicated on Drawings.
- J. Room Identification and Direction Signs: Provide signs conforming to California and ADA Standards for permanent signs, total thickness 0.125"; provide raised and Braille characters conforming to California and ADA Standards; concealed mounting.
  1. Material, Plastic: Manufacturer's standard colored plastic/photopolymer signs.
    - a. Texture: Smooth.
  2. Colors: Where color is not indicated on Drawings or Finish Schedule, provide custom color as directed by Architect.
  3. Material:
    - a. Aluminum: Manufacturer's standard for individual letter signs.
      - 1) Finish: Clear anodized finish, AA-M12C22A41, Class I, AAMA 607.1.
    - b. Stainless Steel: ASTM A666, Type 304 nonmagnetic corrosion resistant stainless steel with No. 4 satin directional polish finish.
  4. Sizes and Styles: As indicated on Drawings, as directed by Architect where not otherwise indicated.
- K. Applied Copy Signs and Graphics: Letters and graphics as indicated on Drawings; Contractor option of silk-screen or vinyl applied.
  1. Silk-screen Signs and Graphics: Computer design screens for signs and graphics to designs and criteria established by Architect.
    - a. Silk-screen Lacquer: Match Advanced Screen Products/Industrial Gloss Lacquer Silk-screen Ink; colors as selected by Architect.
  2. Vinyl Signs and Graphics: Computer design vinyl signs and graphics to designs and criteria established by Architect.
    - a. Vinyl: Opaque non-reflective vinyl film, minimum 0.0035" thick, with pressure sensitive adhesive backing suitable for applications indicated; match 3M/Scotchcal Vinyl Film.
  3. Colors: Where color is not indicated on Drawings or Finish Schedule, provide custom color as directed by Architect.

- L. Tactile Emergency Evacuation Signs: Silk-screened polycarbonate with screening on back and with tactile and Braille information conforming to California requirements and ADA Standards.
  - 1. Information: Provide sign system with information as required by applicable authorities for emergency egress.
  - 2. Silk-Screen Colors:
    - a. Colors: Where color is not indicated on Drawings or Finish Schedule, provide custom color as directed by Architect.
    - b. Silk-screen Lacquer: Match Advanced Screen Products/Industrial Gloss Lacquer Silk-screen Ink; colors as selected by Architect.
  - 3. Size and Style: As indicated on Drawings and acceptable to applicable authorities.
  - 4. Attachment: Method subject to Architect approval.
- M. Photoluminescent Egress Path Markings and Signage: Provide exit path marking and signage required by applicable codes including but not limited to exit path markings, stair nosing, handrails, demarcation and obstruction markings, doors, and hardware.
  - 1. Acceptable Manufacturers:
    - a. Balco Inc./IllumiTread Exit Path Markings.
    - b. ZERO International/Exit Marking Systems.
    - c. American Permalight Inc./Egress Path Markings.
    - d. Active Safety/Egress Path Markings.
    - e. Substitutions: Refer to Section 01 25 00.
  - 2. Refer to CBC Title 24, Part 2, Section 1025.
  - 3. System: UL 1994 listed.
  - 4. Photoluminescent exit signs are in Division 26.

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION**

- A. General: Install signs in accordance with manufacturer recommendations and installation instructions, free from distortions and defects.
- B. Dimensional Letter Signage: Not used.
- C. Toilet Room Door Signs: Install signs on doors after doors are painted and finished.
  - 1. Location: Mount signs with centerline of sign between 58" and 60" height as required by applicable code.
  - 2. Install centered and level, in line, in accordance with the manufacturer's recommendations.

3. Clean and polish, remove excess adhesive.
- D. Toilet Room Wall Signs: Install signs on walls after surfaces on which they are to be mounted are painted and finished.
1. Location: Mount signs at 48" to 60" height as required by applicable codes on strike side of door.
  2. Location: Mount signs with tactile characters 48" minimum (baseline of lowest Braille cells) and 60" maximum (baseline of highest line of raised characters) above finished floor and with on strike side of door for room identification signs as required by applicable codes, at heights indicated on details.
  3. Install level, in line, in accordance with California Building Code and ADA Standards to allow a person to approach within 3" of signs without being within a door swing and without encountering protruding objects.
  4. Clean and polish, remove excess adhesive.
- E. Entry Signs: Install in locations as approved by Architect.
- F. Stair Signs: Not used.
- G. Parking Signs: Not used.
- H. Tactile Exit Door Signs: Install at doors with lighted "EXIT" signs; apply after walls are finished.
1. Location: Mount signs at 48" to 60" height as required by applicable codes on strike side of door.
  2. Install level, in line, in accordance with the manufacturer's recommendations and ADA Standards to allow a person to approach within 3" of signs without being within a door swing and without encountering protruding objects.
  3. Clean and polish, remove excess adhesive.
- I. Room Identification and Direction Signs: Install signs after walls are finished.
1. Location: Mount signs at 48" to 60" height as required by applicable codes on strike side of door for room identification signs, where indicated for direction signs.
  2. Room Identification Signs Location: Mount signs with tactile characters 48" minimum (baseline of lowest Braille cells) and 60" maximum (baseline of highest line of raised characters) above finished floor and with on strike side of door for room identification signs and where indicated for directional signs.
  3. Install signs level, in line, in accordance with the manufacturer's recommendations, California Building Code and ADA Standards.
  4. Install room identification signs at doors to allow a person to approach within 3" of signs without being within a door swing and without encountering protruding objects.

5. Clean and polish, remove excess adhesive.
- J. Applied Copy Signs and Graphics: Examine surfaces and construction for conditions adversely affecting installation, performance and quality of work.
1. Apply signage and graphics centered and level, in line, in accordance with manufacturer's recommendations.
- K. Emergency Evacuation Signs: Install signs after walls are finished.
1. Location: Mount signs at locations indicated, as directed by Architect and applicable authorities if not otherwise indicated.
  2. Install signs level and in accordance with the manufacturer's recommendations and requirements of applicable authorities.
  3. Clean and polish.
- L. Photoluminescent Egress Path Markings and Signage: Install exit path marking and signage as required by applicable codes.

**END OF SECTION**

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**SECTION 10 44 00**

**FIRE EXTINGUISHERS**

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**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Section Includes: Provide fire extinguishers with accessories as required for complete installation.

- 1. Fire Extinguishers: Furnished and installed by relocatable building manufacturer.

**1.2 SUBMITTALS**

- A. Product Data: Furnish manufacturer's literature.

**PART 2 - PRODUCTS**

**2.1 SYSTEMS MANUFACTURERS**

- A. Amerex Corporation or equal
- B. Systems Description: Provide 2A-10BC multi-purpose dry chemical type fire extinguisher.

**PART 3 - EXECUTION**

**3.1 EXAMINATION**

- A. Examine substrates and conditions under which fire extinguishers are to be installed.
- B. Do not proceed with work until unsatisfactory conditions have been corrected.

**3.2 INSTALLATION**

- A. Install fire extinguishers in locations and at mounting height to comply with requirements of governing authorities; prepare recesses in walls as required.
- B. Securely fasten to structure, square and plumb, in accordance with manufacturer's instructions.

- 1. Wherever exact location of units is not shown, locate as directed by Architect.

**3.3 IDENTIFICATION**

- A. After installation and finishing is completed, silkscreen or apply decal letters spelling "FIRE EXTINGUISHER" as applicable if not provided by manufacturer.
- B. Letter size, style and location as selected by Architect.



**END OF SECTION**

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**SECTION 10 51 00**

**METAL LOCKERS**

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**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Section Includes: Provide heavy duty metal lockers with metal base, sloped tops, hardware, hooks, latches and attachment hardware, and infill panels as required for complete finished installation.
  - 1. Fixed Locker Room Benches: Provide stock hardwood benches with metal supports matching lockers and accessories as required for complete finished installation. Provide benches as required for access for persons with disabilities.
- B. Related Sections:
  - 1. None.

**1.2 REFERENCES**

- A. Americans with Disabilities Act (ADA) Standards.
- B. California Building Code: California Code of Regulations, Title 24, Part 2, requirements for providing accessibility for persons with disabilities.

**1.3 SUBMITTALS**

- A. Product Data: Furnish manufacturer's literature.
- B. Shop Drawings: Indicate locker types, sizes, configurations, details, layout of groups of lockers, accessories, color and finish, and numbering.
- C. Samples: Furnish samples of metal finish.
  - 1. Furnish one full size locker, pay shipping costs for supply and return of sample locker; if approved, locker may be incorporated into work.

**1.4 SITE CONDITIONS**

- A. Protect locker finishes and adjacent surfaces and materials from damage or marring during installation.

**PART 2 - PRODUCTS**

**2.1 MANUFACTURERS**

- A. DeBourgh Mfg. Co.
- B. List Industries.

- C. Lyon Metal Products, Inc.
- D. Penco Products.
- E. Republic Storage Systems Company.
- F. Substitutions: Refer to Section 01 25 00.

## 2.2 MATERIALS

- A. System Description: Provide heavy duty metal lockers with metal base, sloped tops, hardware, hooks, latches, attachment hardware, and infill panels.
  - 1. Provide fixed wood locker room benches.
- B. Regulatory Requirements, Access: Comply with California Building Code and Americans with Disabilities Act (ADA) Standards.
- C. Lockers: Double tier type unless otherwise indicated.
  - 1. Base: Recessed, "Z" type closed metal base.
  - 2. Tops: Continuously sloping type.
  - 3. Fillers: Provide filler panels to close off openings between lockers and between lockers and adjacent construction.
  - 4. Accessible Lockers: See drawings for shelf heights.
- D. Sheet Steel: ASTM A526; commercial quality, zinc-coated, carbon steel sheet, hot-dip galvanized according to ASTM A924 and A653, with minimum A60 (ZF 180) or G 60 (Z 180) coating designation.
  - 1. Manufacturer's standard gages for heavy duty lockers materials but not less than following.
    - a. Body and Shelf: Minimum 24 gage.
    - b. Exposed Ends: Minimum 16 gage.
    - c. Doors: Minimum 14 gage.
    - d. Door frames: Minimum 16 gage.
    - e. Hinges: Minimum 14 gage.
    - f. Metal Base: Minimum 16 gage.
    - g. Metal Top: Minimum 20 gage.
    - h. Filler Panels: Minimum 18 gage.
- E. Fittings: Manufacturer's standard fittings for locker types indicated, including locking handle, coat hooks, shelves, door numbers, and rubber bumpers.
  - 1. Provide tamper proof handles with built-in padlock hasps.
  - 2. Fasteners: Zinc or nickel-plated steel; slotless type exposed bolt heads; self-locking nuts or lock washers for nuts on moving parts.

3. Finishes: Manufacturer's standard plated steel hooks.

F. Fixed Wood Benches: 1-1/4" thick hardwood, 9-1/2" wide typical, varnished; steel pipe pedestals at not over 6'-0" centers.

1. Accessible Benches: Size as required to comply with requirements for access for persons with disabilities.

## **2.3 FABRICATION**

A. Sizes: Refer to Drawings.

B. Bodies: Form backs, tops, bottoms, sides, and intermediate partitions of flanged sheet steel.

C. Door: One-piece steel sheet, flanged at all edges, constructed to prevent springing when opening or closing; fabricate to swing 180-degrees.

1. Provide recessed number plates; number doors consecutively in accordance with Architects instructions.

2. Locking Handle: Recessed cup type with lifting trigger.

D. Door Frame: Formed channel shapes.

E. Provide ventilation openings at top and bottom of each locker.

F. Finish edges smooth without burrs.

G. Fabricate lockers square, rigid, and without warp, with metal faces flat and free of dents and distortions.

H. Fabricate lockers for quiet operation with manufacturer's standard rattle-free latching mechanism and moving components isolated to prevent metal-to-metal contact.

1. Reinforce inner face of door with a steel sheet panel filled with sound deadening insulation.

## **2.4 FINISHING**

A. Clean, degrease, neutralize, and finish with manufacturer's standard process.

B. Colors: Where color is not indicated on Drawings or Finish Schedule, provide custom color as directed by Architect.

C. Finish bench pedestals same as lockers.

## **PART 3 - EXECUTION**

### **3.1 PREPARATION**

A. Take site dimensions affecting this work, ensure preparatory work is properly sized and located.

**3.2 INSTALLATION**

- A. Install lockers in accordance with manufacturer recommendations and installation instructions, secure, plumb, level, square, and in line.
- B. Bolt adjoining locker units together to provide rigid installation.
- C. Install metal bases, end panels, sloping tops, and filler panels to close off openings and as required for complete installation.
- D. Secure bench pedestals to floors and benches to pedestals in accordance with manufacturer recommendations and installation instructions.
  - 1. Space pedestals maximum 72" on center.

**3.3 ADJUSTING**

- A. Adjust doors and latches to operate easily without binding; verify integral devices are operating properly.

**3.4 CLEANING**

- A. Clean interior and exposed exterior surfaces; touch-up marred finishes and replace lockers which cannot be restored to factory-finished appearance.

**3.5 PROTECTION**

- A. Protect lockers from damage, abuse, dirt, and paint; do not allow lockers to be used during construction.

**END OF SECTION**

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**SECTION 11 52 00**

**PROJECTION SCREENS**

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**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Section Includes: Provide projection screens with hardware and accessories as required for complete installation.

- 1. Provide manually operated projection screens.

**1.2 SUBMITTALS**

- A. Product Data: Furnish manufacturer's literature.
- B. Shop Drawings: Show complete details of screen, including equipment, dimensions and field measurements.

**PART 2 - PRODUCTS**

**2.1 SYSTEMS MANUFACTURERS**

- A. Da-Lite Screen Company, Inc.
- B. Draper Screen Co.
- C. Bretford Manufacturing Inc.
- D. Substitutions: Refer to Section 01 25 00.

**2.2 MATERIALS**

- A. System Description: Provide projection screens with hardware and accessories.
- B. Manually Operated Projection Screens: Manufacturer's standard wall mounted white glass beaded projection screens.
  - 1. Sizes: 106" Diagonal.
  - 2. Roller: Provide rigid metal roller; mount roller on two cast aluminum brackets equipped with self-aligning bearings.
  - 3. Screen: Flame retardant and mildew resistant, matt white vinyl screen with tear-resistant woven fiberglass backing allowing maximum viewing area with matte black border.
  - 4. Case: Enclose viewing surface in case with double top for extra rigidity and sound deadening; line motor compartment with metal; finish case with prime coat.
    - a. Supply heavy metal brackets for mounting screen.

- b. Design for either wall or ceiling mounting.
- C. Electrically Operated Projection Screen: Not used.

**PART 3 - EXECUTION**

**3.1 INSTALLATION**

- A. Examine surfaces and openings and verify dimensions of in-place and subsequent construction; installation of screens constitutes acceptance of existing conditions.
- B. Install screens in accordance with manufacturer's recommendations and installation instructions, level, true to line, and in correct relation to adjacent materials and finishes.
- C. Upon completion of screen installation, instruct Owner's personnel in operation and maintenance of screens.

**END OF SECTION**

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**SECTION 26 00 00**

**GENERAL ELECTRICAL SPECIFICATIONS**

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**PART 1 - GENERAL**

**1.1 WORK INCLUDED**

- A. This specification shall apply to all phases of Work hereinafter specified, shown on Drawings, or as required to provide a complete installation of electrical systems for this Project. Work required under this specification is not limited to just the Electrical Drawings - refer to Architectural, Structural, Landscape, and Mechanical/Plumbing Drawings, as well as all other drawings applicable to this project, which designate the scope of work to be accomplished. The intent of the Drawings and Specifications is to provide a complete and operable electrical system that includes all documents that are a part of the Contract.
1. Work Included: Furnish labor, material, services and skilled supervision necessary for the construction, erection, installation, connections, testing, and adjustment of all circuits and electrical equipment specified herein, or shown or noted on Drawings, and its delivery to the Owner complete in all respects ready for use.
  2. The electrical Work includes installation or connection of certain materials and equipment furnished by others. Verify installation details, installation and rough-in locations from the actual equipment or from the equipment shop drawings.
- B. Electrical Drawings: Electrical Drawings are diagrammatic, and are intended to convey the scope of work, indicating intended general arrangement of equipment, conduit and outlets. Follow Drawings in laying out Work and verify spaces for installation of materials and equipment based on actual dimensions of equipment furnished.

**1.2 QUALITY ASSURANCE**

- A. Design, manufacture, testing and method of installation of all apparatus and materials furnished under requirements of these specifications shall conform to latest publications or standard rules of the following:
1. Institute of Electrical and Electronic Engineers - IEEE
  2. National Electrical Manufacturers' Association - NEMA
  3. Underwriters' Laboratories, Inc. - UL
  4. National Fire Protection Association - NFPA
  5. Federal Specifications - Fed. Spec.
  6. American Society for Testing and Materials - ASTM



7. American National Standards Institute - ANSI
8. National Electrical Code - NEC
9. National Electrical Safety Code - NESC
10. Insulated Cable Engineers Association - ICEA
11. American Institute of Steel Construction - AISC
12. State and Municipal Codes In Force In The Specific Project Area
13. Occupational Safety and Health Administration (OSHA)
14. Electronics Industries Association/Telecommunications Industry Association (EIA/TIA)
15. California Electrical Code - CEC
16. Local Authority Having Jurisdiction (AHJ) Published Electrical Standards and Codes

B. Perform Work in accordance with the National Electrical Code, applicable building ordinances, and other applicable codes, hereinafter referred to as the "Code." The Contractor shall comply with the Code including local amendments and interpretations without added cost to the Owner. Where Contract Documents exceed minimum requirements, the Contract Documents take precedence. Where code conflicts occur, the most stringent shall apply unless variance is approved.

1. Comply with all requirements for permits, licenses, fees and codes. The Contractor, at Contractor's expense, shall obtain all permits, licenses, fees, special service costs, inspections and arrangements required for Work under this contract, unless otherwise specified.
2. Comply with requirements of the applicable utility companies serving this Project. Make all arrangements with utility companies for proper coordination of Work.

### 1.3 GENERAL REQUIREMENTS

- A. Guarantee: Furnish a written guarantee for a period of (1) one-year from date of acceptance.
- B. Wherever a discrepancy in quantity or size of conduit, wire, equipment, devices, circuit breakers, etc., (all materials), arises on the Drawing and/or Specifications, the Contractor shall be responsible for providing and installing all material and services required by the strictest condition noted on Drawings and/or in Specifications to ensure complete and operable systems as required by the Owner and Engineer.
- C. All Core Cutting, Drilling, and Patching:

1. For the installation of work under this Section, the aforementioned shall be performed under this Section of the Specifications and the Concrete section of the Specifications.
2. No holes will be allowed in any structural members without the written approval of the Project's Structural Engineer and DSA.
3. For penetrations of concrete slabs or concrete footings, the work shall be as directed in the Concrete Section of Specifications.
4. The Contractor shall be responsible for patching and repairing surfaces where he is required to penetrate for work under this contract.
5. Penetrations shall be sealed to meet the rated integrity of the surface required to be patched and repaired. The patched surface shall be painted or finished to match the existing surface.

**D. Verifying Drawings and Job Conditions:**

1. The Contractor shall examine all Drawings and Specifications in a manner to be fully cognizant of all work required under this Section.
2. The Contractor shall visit the site and verify existing conditions. Where existing conditions differ from Drawings, adjustment(s) shall be made and allowances included for all necessary equipment to complete all parts of the Drawings and Specifications.

**1.4 WORK IN COOPERATION WITH OTHER TRADES**

- A. Examine the Drawings and Specifications and determine the work to be performed by the electrical, mechanical and other trades. Provide the type and amount of electrical materials and equipment necessary to place this work in proper operation, completely wired, tested and ready for use. This shall include all conduit, wire, disconnects, relays, and other devices for the required operation sequence of all electrical, mechanical and other systems or equipment.
- B. Provide a conduit-only system for low voltage wiring required for control of mechanical and plumbing equipment described in this or other parts of the Contract Documents. Install all control housings, conduits, and backboxes required for installing conductors to the controls.
- C. Install separate conduits between each heating, ventilating and air conditioning sensing device and its control panel and/or control motor. Before installing any conduit for heating, ventilating and air conditioning control wiring, verify the exact requirements from the control diagrams provided with the equipment manufacturer's shop drawings.

**1.5 TESTING AND ADJUSTMENT**

- A. Upon completion of all electrical work, the Contractor shall test all circuits, switches, light fixtures, lighting control and dimming systems including distributed systems, UPSs, generators, SPDs, lighting inverters, transfer switches, motors, circuit

breakers, motor starters and their auxiliary circuits and any other electrical items to ensure perfect operation of all electrical equipment.

- B. Equipment and parts in need of correction and discovered during such testing, shall be immediately repaired or replaced with all new equipment and that part of the system shall then be retested. All such replacement or repair shall be done at no additional cost to the Owner.
- C. All circuit(s) shall be tested for continuity and circuit integrity. Adjustments shall be made for circuits not complying with testing criteria.
- D. All test reports, including copies of any required Energy Code Acceptance Forms (e.g. CA Title 24 Acceptance for Code Compliance Forms) should be submitted to the Engineer at completion of project.

## 1.6 IDENTIFICATION

- A. Nameplates shall be provided for unit substations, switchgear, switchboards, distribution boards, distribution panels, panel boards, motor control centers, transformers, transfer switches, contactors, starters, disconnect switches, enclosed circuit breakers/switches, inverters, UPSs, PDUs, RDCs, SPDs, lighting control panels, dimming panels, door releasing system panels, fire alarm/central monitoring terminal cabinets/power supplies/control panels, and all low voltage system terminal and control cabinets.

- 1. Nameplate inscriptions shall be identical to the equipment designations indicated in plans and specifications. Nameplates shall be engraved with the device designation/identification on the top line, source identification for the device on the 2nd line per CEC Article 408.4 and load designation for the device on the bottom line. Where load designation consists of a branch circuit, omit bottom line. Where device designation is not indicated on plans/specifications, Contractor shall submit a written clarification request to the Engineer.

Example: Transformer 1TA

Source Disconnecting Location: Switchboard MSA located in Rm 110

Load: Panels 1LA and 1 LB

- 2. All circuit breakers/fuses in switchgear, switchboards, distribution boards, distribution panels, UPS output circuit breakers, PDU sub-feed circuit breakers and motor control centers shall have individual nameplates located immediately adjacent to the respective device. Nameplate inscription shall identify the downstream equipment or device served by the circuit breaker or fuse.
- B. Identification nameplates, UON, shall be laminated/extruded modified acrylic that is 3/32" thick, UV-stabilized, matte finish, suitable for use in 180 deg. F ambient, with beveled edges and engraved white letters 3/8" high, minimum, on 1-1/2" high black background (utility/normal and optional standby power systems) for single line of text. Where two lines of text are required, provide minimum 2" high nameplate. Where three lines of text are required, provide minimum 2.5" high nameplate. Provide white letters on red background for all CEC Article 517 essential power systems, Article 700 Emergency Systems, Article 701 Legally required standby systems and Article 708 COPS.

- C. Identification nameplates for new switchgear, switchboards, distribution boards, distribution panels, panel boards and motor control centers shall be attached with switchgear manufacturer-provided screws via switchgear manufacturer factory pre-drilled holes. A factory option to rivet identification nameplates to the equipment is only acceptable if screw-fastened nameplates are not an available option from the switchgear manufacturer. Field drilling or other mechanical attachment methods that change/void the NEMA or NTRL rating of the enclosure are strictly forbidden.
- D. Identification nameplates for transformers, transfer switches, disconnect switches, enclosed circuit breakers/switches, inverters, UPSs, PDUs, RDCs, SPDs, lighting control panels, dimming panels, door releasing system panels, terminal cabinets and all circuit breakers/fuses in switchgear, switchboards, distribution boards, distribution panels, UPS output circuit breakers, PDUs, PDU sub-feed circuit breakers, and motor control centers shall be attached to the equipment by self-adhesive backing integral to the nameplates. When equipment is located outdoors, provide nameplates without self-adhesive backing and attach to equipment using weather-rated, UV-resistant epoxy. In all cases, clean surfaces before applying identification nameplates parallel to equipment lines.
- E. Warning Placards, as required by General Single Line Diagram Notes for multiple power sources, or instruction placards, as required for all kirk-key interlock schemes, all UPS bypass procedures or as required elsewhere in the plans/specifications shall be engraved 1/2" high white lettering on a red background using the same material specified for identification nameplates with a self-adhesive backing. Warning/instruction placards shall be attached to the face of the equipment directly related to the placards. Provide a formal placard submittal for review by the Engineer prior to ordering any warning/instruction placards. In all cases, clean surfaces before applying warning/instruction placards parallel to equipment lines.
- F. Receptacles that are part of a UL-listed under floor computer room whip assembly, ceiling and/or cable/ladder tray-mounted receptacles used in lab, manufacturing, commercial kitchen environments or that are serving telecom/data/AV racks and cabinets shall have identification nameplates located on the wiring device plate cover. Nameplates shall be self-adhesive, 3/32" thick Micarta with beveled edges, engraved 1/4" high white lettering on black background with serving power source, circuit identification and NEMA/IEC receptacle type. Use of two (2) separate nameplates per device plate cover is acceptable. Affix nameplates to be visible when plugs are occupying receptacles.
- G. See wiring device section of this specification for wiring device plate cover labeling requirements.
- H. See drawings for panel board schedule directory installation requirements.
- I. See conduit installation section of this specification for conduit labeling requirements.

## 1.7 FINAL INSPECTION AND ACCEPTANCE

- A. After all requirements of the Specifications and/or the Drawings have been fully completed; representatives of the Owner will inspect the work. Contractor shall provide competent personnel to demonstrate the operation of any item or system to the full satisfaction of each representative.

- B. Final acceptance of the work will be made by the Owner after receipt of approval and recommendation of acceptance from each representative.

#### 1.8 RECORD DRAWINGS

- A. Drawings of Record: The Contractor shall provide and keep up-to-date, a complete record set of drawings. These shall be corrected daily and show every change from the original Drawings. This set of prints shall be kept on the job site and shall be used only as a record set. This shall not be construed as authorization for the Contractor to make changes in the layout without definite instruction in each case. Upon completion of the work, a set of reproducible Contract Drawings shall be obtained from the General Contractor and all changes as noted on the record set of prints shall be incorporated thereon with black ink in a neat, legible, understandable and professional manner.

#### 1.9 APPROVALS, EQUALS, SUBSTITUTIONS, ALTERNATIVES, NO KNOW EQUAL

- A. Approvals: Where the words (or similar terms) "approved", "approval", "acceptable", and "acceptance" are used, it shall be understood that acceptance by the Owner, Architect and Engineer are required.
- B. Equal: Where the words (or similar terms) "equal", "approved equal", "equal to", "or equal by", "or equal" and "equivalent" are used, it shall be understood that these words are followed by the expression "in the opinion of the Owner, Architect, and Engineer." For the purposes of specifying products, the above words shall indicate the same size, made of the same construction materials, manufactured with equivalent life expectancy, having the same aesthetic appearance/style (includes craftsmanship, physical attributes, color and finish), and the same performance.
- C. Substitution: For the purposes of specifying products, "substitution" shall refer to the submittal of a product not explicitly approved by the construction documents/specifications.
  - 1. Substitutions of specified equipment shall be submitted and received by the Engineer ten (10) days prior to the bid date for review and written approval. Regulatory Agency approval for all substitutions will be the sole responsibility of the Contractor. To receive consideration, requests for substitutions must be accompanied by documentary proof of its equality with the specified material. Documentary proof shall be in letterform and identify the specified values/materials alongside proposed equal values/materials. In addition, catalog brochures and samples, if requested, must be included in the submittal. ONLY PRE-BID APPROVED PRODUCTS, ISSUED VIA A FORMAL BID ADDENDUM TO ALL BIDDERS, WILL BE ALLOWED ON THE PROJECT. REGARDLESS OF THE APPROVAL ON ANY SUBSTITUTION, ALL BIDS SHALL BE BASED ON THE PRODUCTS EXACTLY AS SPECIFIED. PRICING FOR EACH APPROVED SUBSTITUTION SHALL BE INCLUDED IN THE BID SUBMITTAL AS A SEPARATE LINE ITEM.
  - 2. In the event that written authorization is given for a substitution, after award of contract, the Contractor shall submit to the Engineer quotations from suppliers/distributors of both the specified and proposed equal material for price comparison, as well as a verification of delivery dates that conform to the project schedule.

3. In the event of cost reduction, the Owner will be credited with 100 percent of the reduction, arranged by Change Order.
  4. The Contractor warrants that substitutions proposed for specified items will fully perform the functions required.
- D. Alternates/Alternatives: For the purposes of specifying products, “alternatives/alternates” may be established to enable the Owner/Architect/Engineer to compare costs where alternative materials or methods might be used. An alternate price shall be submitted in addition to the base bid for consideration. If the alternate is deemed acceptable, written authorization will be issued.
- E. No Known Equal: For the purposes of specifying products, “No Known Equal” shall mean that the Owner/Architect/Engineer is not aware of an equivalent product. The Contractor will need to submit a “Substitution” item, per the requirements listed above, if a different product is proposed to be utilized.

#### 1.10 SHOP DRAWINGS/SUBMITTALS

- A. Shop Drawings/Submittals shall be submitted in electronic format (PDF) to include a Letter of Transmittal (PDF), which shall give a list of the drawings submitted with dates and/or system(s) components contained within the submittal. Drawings and material cut sheets shall be complete in every respect and edited/marked to indicate specific items being provided. Printed/Hard copies are not acceptable.
- B. The Shop Drawings/Submittals shall be marked with the name of the project, numbered consecutively, and bear the approval of the Contractor as evidence that the Contractor has checked the Drawings. Any Drawings submitted without this approval will be returned to the Contractor for resubmission.
- C. If the shop drawings show variations from the requirements of the Contract because of standard shop practice or other reasons, the Contractor shall make specific mention of such variations in the Contractor’s letter of transmittal. If the substitution is accepted, the Contractor shall be responsible for proper adjustment that may be caused by the substitution. Samples shall be submitted when requested.
- D. Only products listed as “Equal” within the contract documents, along with formally approved “Substitutions” will be reviewed. Products not conforming to these items will not be reviewed and will be returned to the Contractor for re-submittal.
- E. Review comments used in response to shop drawings/submittals are:
  1. “No Exception Taken” - Product approved as submitted.
  2. “Furnish as Corrected” - Re-submittal not required, although the Contractor shall provide the submitted product with corrections as noted.
  3. “Revise and Resubmit” - Re-submittal required with corrections as noted.
  4. “Rejected” - Re-submittal required based upon the originally specified product.
- F. Shop drawings shall be submitted on the following but not limited to:

1. Lighting Fixtures, Lamps, and Ballasts.
2. Switchgear, Switchboards, Distribution Boards, Motor Control Centers, Panel boards, and Bus Ducts; complete with overcurrent device information.
3. Transformers.
4. Fire Alarm System/Central Monitoring System.
5. Wiring Devices.
6. Lighting Control System/Dimming System Products.
7. Pullboxes and Underground Vaults.
8. Terminal Cabinets
9. Lighting Inverters, UPSs, RDCs, PDUs, Generators, Transfer Switches, SPD Systems.
10. Cable Tray, Flexible Cable Tray and Cable Runway.
11. Power Poles and Floor Boxes.
12. Arc Flash, Short-Circuit and Coordination studies.
13. All other products called out on drawings that call for shop drawing submittal.

#### 1.11 MAINTENANCE, SERVICING, INSTRUCTION MANUALS AND WIRING DIAGRAMS

- A. Prior to final acceptance of the job, the Electrical Contractor shall furnish to the Owner at least four (4) copies of operating, maintenance, and servicing instructions, as well as four (4) complete wiring diagrams for the following, but not limited to, items or equipment:
  1. Lighting Control System/Dimming Systems.
  2. Fire Alarm System.
  3. Transformers.
  4. Switchgear, Switchboards, Distribution Boards, Motor Control Centers, Panel boards, and Bus Ducts; complete with overcurrent device information
  5. Lighting Inverters, UPS's, PDUs, Generators, Transfer Switches, SPD Systems
- B. All wiring diagrams shall specifically cover the system supplied. Typical drawings will not be accepted. Four (4) copies shall be presented to the Owner.

#### 1.12 INTERRUPTION OF SERVICE/SERVICE SHUTDOWN

- A. Any interruption of electrical services, electrical circuits, electrical feeders, signal systems, communication systems, fire alarm systems, etc. required to perform work,

shall meet the specific prior-approval requirements of the Owner. Such work shall be scheduled with the Owner to be performed at the Owner's convenience.

- B. Interruptions/outages of any of the Owner's systems and services mentioned above shall be scheduled to occur during other than the Owner's normal business hours. Any overtime costs shall be borne by the Contractor.
- C. See drawings for any additional requirements regarding outages, interruption and any temporary services required.

## **PART 2 - PRODUCTS**

### **2.1 MATERIALS**

- A. Materials and Equipment: All electrical materials and equipment, including custom-made equipment, shall be new and shall be listed by Underwriter's Laboratories (UL) and bear their label or be listed and certified by a Nationally Recognized Testing Lab (NRTL) that is also recognized by the local Authority-Having-Jurisdiction (AHJ)
- B. Switchgear/Switchboards/Distribution Boards/Motor Control Centers:
  - 1. See general single line notes on single line drawing for more information.
- C. Panel boards – Branch Circuit:
  - 1. See drawings for panel board schedules and specifications.
- D. Transformers:
  - 1. See drawings for transformer schedules and specifications.
- E. Lighting Fixtures:
  - 1. See drawings for lighting fixture and lamp schedules and additional specifications. Furnish, install and connect a lighting fixture at each outlet where a lighting fixture type symbol (designated on plans) is shown as being installed. Each fixture shall be complete with all required accessories including sockets, glassware, boxes, spacers, mounting devices, fire rating enclosure and lamps.
  - 2. Ballasts: See lighting fixture schedule notes. All noisy ballasts shall be replaced at no cost to the Owner.
  - 3. Lamps: See lamp/fixture schedule and lamp/lighting fixture schedule notes.
- F. Wiring Devices:
  - 1. Provide wiring devices indicated per plan. Devices shall be specification grade. Acceptable manufacturers are Leviton, Pass and Seymour and Hubbell. Provide all similar devices of same manufacturer, unless indicated otherwise. All device colors shall be from the full range of manufacturer standard color options as selected by the Architect. This selection will be made during the shop drawing review process



a. Wiring Devices (Decora)

1) Convenience Receptacle	#16252
2) Dedicated Receptacle	#16352
3) Convenience I.G. Receptacle	#16262-IG
4) Dedicated I.G. Receptacle	#16362-IG
5) Convenience G.F.C.I. Receptacle	#GFT1
6) Dedicated G.F.C.I. Receptacle	#GFNT2
7) Tamper Resistant Convenience Receptacle	#TDR15
8) Tamper Resistant Dedicated Receptacle	#TDR20
9) Tamper Resistant GFCI Receptacle	#GFTR2
10) Grade Receptacle	#GFTR1-HG
11) Grade Receptacle	#GFTR2-HG
12) Weather/Tamper Resistant GFCI Receptacle	#GFWT2
13) Convenience Simplex Receptacle	#16251
14) Dedicated Simplex Receptacle	#16351
15) Single Pole Switch	#5621-2
16) Double Pole Switch	#5622-2
17) Three Way Switch	#5623-2
18) Four Way Switch	#5624-2
19) Pilot Light Switch "On"	#5628-2
20) Pilot Light Switch "Off"	#5631-2
21) Projection Screen Switch	#5657-2
22) Low Voltage Momentary Switch	#5657-2
23) Keyed Switch	#1221-2L (Non-Decora)
24) Door Jam Switch	#1865

- b. Use of dedicated receptacles is required where plans depict a branch circuit supplying only a single simplex or duplex receptacle. Use of controlled

receptacles is required where depicted on plans - see controlled receptacle specifications for additional information.

2. I.G. (isolated ground) receptacle bodies shall be of a basic color specified above with an orange triangle to symbolize isolated ground.
3. When shown circuited with an I.G. conductor, receptacles shall be of an I.G. type. As an example, a NEMA L6-30R denoted on the plans and shown circuited with an I.G. conductor shall be an I.G. version of that receptacle.
4. Wiring devices located in wood finished areas shall generally be black unless otherwise indicated by the Architect.
5. Wiring devices located in mirrors shall generally be white with stainless steel cover plates unless otherwise indicated by the Architect.
6. In addition to other device requirements listed elsewhere in this specification, 125V (Volt), 15A (Amp) and 20A Tamper-Resistant wiring devices shall be provided as follows:
  - a. In dwelling units per CEC Article 210.52.
  - b. In pediatric care areas per CEC Article 517.18(C).
  - c. In child care or day care facilities.
  - d. In wet and/or exterior locations.
7. Wiring device cover plates located on recessed boxes shall be commercial grade nylon. Plate color shall match wiring device color UON on plans. Cover plates utilized on surface mounted boxes shall be metal. Plastic cover plates are unacceptable.
8. Except as otherwise noted, all wiring device plates on the project shall be labeled with panel and circuit number(s) utilizing a Brother P-Touch labeling system with 1/2" tape (yellow on black) or equal by Herman-Tellerman or Panduit. Locate label on the concealed side of the wiring device plate. Handwritten labels are unacceptable.
9. The Contractor shall provide duplex receptacle outlets in the appropriate configurations necessary to comply with applicable energy code requirements for controlled receptacles and as shown on plans. All wiring devices indicated to be controlled receptacles shall be NEMA-approved, electrical code-compliant with factory markings on the face of the receptacle(s) with the word "Controlled" or utilize further markings and symbols to indicate which receptacles on each outlet is/are controlled. Stickers, field-applied markings or other non-permanent markings are not acceptable. Where a GFCI receptacle outlet is required to be controlled, provide an adjacent controlled duplex receptacle outlet connected on the load side of the GFCI outlet. Generally, one receptacle in a duplex receptacle outlet is required to be controlled. It may be the lower receptacle or upper receptacle based on manufacturer offering. However, the controlled receptacle location within a controlled receptacle outlet shall remain consistent

throughout the project. Where an existing duplex receptacle outlet is required to be controlled, provide a new wiring device with the appropriate control configuration necessary to comply with plans. All controlled receptacles shall be connected to a branch circuit controlled by an occupancy sensor-based or relay panel lighting control system. Acceptable manufacturers are Leviton, Pass and Seymour and Hubbell.

10. The following wiring device plates shall have custom engraving:

- a. Key operated switches, switches with pilot lights, and switches for the control of motors, heaters and ventilators. Engraving shall be black and occur on the exposed side of the plate indicating the motor, heater, or ventilator controlled.
- b. Receptacles on optional standby generator and/or UPS power shall have custom engraved plates with the words "Generator" or "UPS" in black letters. In addition, where located in telecommunications closets, IDFs, server rooms, data centers, labs (wet, dry or electronic) indicate panel board and circuit number.
- c. All stainless steel and nylon device plates shall be engraved using a rotary engraving process except for black lettering on stainless steel device plates which may be accomplished via laser etching process. All lettering shall be 3/16" high. Provide a dimensioned submittal drawing detailing a typical device faceplate with engraving.

G. Weatherproof Outlet Covers/Assemblies: All Receptacles identified as weatherproof on the drawings shall be weather-resistant, tamper-resistant, GFCI type and equipped as follows:

1. Type WP-A: Recessed wall box with a hinged, lockable, cast aluminum, self-closing, gasket-equipped door that is wet location-listed rain tight while "in use". Unit shall comply with CEC Article 406.9(A) and (B). UON on drawings, provide a minimum of 2 separate compartments suitable for installation of power receptacles, AV or communications outlets. Additionally, unless otherwise noted on drawings, provide the following:
  - a. A 20A weather-resistant, tamper-resistant, GFCI duplex receptacle in the first compartment. Provide branch circuiting per plans.
  - b. A blank metal plate suitable for field installation of power, AV or communications devices in the second compartment.
  - c. Where indicated on plans as requiring data, AV, or other low voltage service outlet, provide minimum 3/4"C.O. with pull string routed from the second compartment to nearest low voltage pull box. Where shown mounted in a building wall, any blank/unused compartment shall be equipped min. 3/4" C.O. with pull string routed to the nearest accessible ceiling space.
  - d. See wiring device section of this specification for additional wiring device plate cover labeling requirements.

- e. 1 key minimum per device (minimum of 2 per project) to the Owner's project manager upon completion of project.
  - f. Custom color powder coat finish as selected by Architect - Include all costs in base bid for same.
  - g. In locations with sufficient wall depth, provide 6" wide x 6" tall x 5-1/2" deep recessed wall box (C.W. Cole #TL310-WCS-K1-CUSTOM COLOR).
  - h. In locations utilizing shallow stud walls construction or other walls of insufficient depth, provide 10-3/4" wide x 7-3/8" tall x 3-7/8" deep recessed wall box (C.W. Cole #TL310-WCS-SH-K1 -CUSTOM COLOR).
  - i. See drawings for additional details.
2. Type/Subscript WP-B: Wet location-listed raintight while "in use" cast copper-free aluminum lockable cover with baked aluminum lacquer finish and one gang, weather-resistant, tamper-resistant GFCI receptacle. Hubbell WP26E series. Polycarbonate covers are unacceptable. Unit shall comply with CEC Article 406.9(A) and (B). Contractor shall powder coat cover assembly to a custom color where receptacle locations are deemed by the Architect to be in aesthetically sensitive or public spaces. Custom color as selected by Architect.
3. Type WP-C: (C.W. Cole #TL310-WCS-PED-ADA-K1-CUSTOM COLOR or #TL310-WCS-PED-K1-CUSTOM COLOR) pedestal device box with a hinged, lockable, cast aluminum, self-closing, gasket-equipped door that is wet location-listed raintight while "in use". Unit shall comply with CEC Article 406.9(A) and (B). UON on drawings, provide a minimum of 2 separate compartments suitable for installation power receptacles, AV or communications outlets. Additionally, unless otherwise noted on drawings, provide the following:
- a. A 20A weather-resistant, tamper-resistant, GFCI duplex receptacle in the first compartment. Provide branch circuiting per plans.
  - b. A blank metal plate suitable for field installation of power, AV or communications devices in the second compartment.
  - c. Where indicated on plans as requiring data, AV, or other low voltage service outlet, provide minimum 3/4" C.O. with pull string routed from the second compartment to nearest low voltage pull box.
  - d. See wiring device section of this specification for additional wiring device plate cover labeling requirements.
  - e. 1 key minimum per device (minimum of 2 per project) to the Owner's project manager upon completion of project.
  - f. Include all costs in base bid for ADA version (22.5" tall) of pedestal box. Prior to ordering material, contractor shall coordinate with Architect and/or AHJ to determine which pedestal box locations do not require ADA compliance and may be changed to the standard (11.5" tall) version of the pedestal box.

- g. Custom color powder coat finish as selected by Architect. Include all costs in base bid for same.
  - h. See drawings for additional details.
- 4. Type/Subscript WP-D: Damp location-listed (not-Raintite-in-use) cast copper-free, pad lockable, die-cast aluminum cover with baked aluminum lacquer finish and one gang GFCI receptacle. Hubbell/Rayco 502?/503? Series. Polycarbonate covers are unacceptable. Unit shall comply with CEC Article 406.9(A) and (B). Custom color powder coat finish as selected by Architect. Include all costs in base bid for same.
- H. Motor Controllers/Starters: See drawings for motorized equipment schedules and specifications.
- I. Circuit Breakers:
  - 1. Service entrance circuit breakers smaller than 400A (Amp) frame shall be thermal-magnetic trip with inverse time current characteristics unless otherwise indicated below. Service entrance main circuit breakers and main circuit breakers. 400A frame and larger shall be 100% rated, solid-state type as outlined in this specification. All other service entrance circuit breakers, 400A frame and larger, shall be 100% rated, solid-state type as outlined in this specification.
  - 2. All non-service entrance circuit breakers 225A and larger shall be thermal magnetic type and have continuously adjustable instantaneous pick-ups of approximately 5 to 10 times trip rating. Breakers shall have either tamper-resistant rating dials or easily changed trip rating plugs with trip ratings as indicated on the Drawings. Rating plugs shall be interlocked so they are not interchangeable between frames. Additionally, all non-service entrance circuit breakers, 600A frame and larger, located in 480V, 3-phase, 3-wire or 277/480V, 3-phase, 4-wire switchgear, distribution boards, panel boards or busway plugs shall be solid state, 100% rated. Breaker shall have built-in test points for testing long delay, short delay and instantaneous, and ground fault (where shown) functions of the breaker by means of a 120V operated test kit. Contractor shall utilize a test kit capable of testing all breakers 400A and above - at the Engineer's request.
  - 3. All non-service entrance circuit breakers less than 225A shall be molded plastic case, air circuit breakers conforming to UL 489. Provide breakers with thermal magnetic trip units, and a common trip bar for two- or three-pole breakers, connected internally to each pole so tripping of one pole will automatically trip all poles of each breaker. Provide breakers of trip-free and trip-indicating bolt-on type, with quick-make, quick-break contacts. Provide single two- or three-pole breaker interchangeability. Provide padlocking device for circuit breakers as shown on the Drawings.
  - 4. Where a Current Limiting Circuit Breaker (CLCB) is indicated on drawings or as required elsewhere in this specification, provide a UL listed current limiting thermal magnetic circuit breaker(s) UON. An independently operating limiter section within a molded case is not allowed. Coordinate CLCB ratings as

required to protect electrical system components on the load side of the CLCB to include, but not limited to, protecting automatic transfer switches, panel boards and lighting control panels.

5. Where a solid-state circuit breaker is indicated on drawings or as required elsewhere in this specification, provide a solid-state circuit breaker with minimum five function complete with built-in current transformers. The five functions shall be independently adjustable and consist of Overload/Long Time Amp Rating, Long Time Delay, Short Time Delay, Short Circuit/Instantaneous Pickup, but may also include Shunt Trip and/or Ground Fault if so indicated on the Drawings. Rating plugs shall be interlocked so they are not interchangeable between frames. Breaker shall have built-in test points for testing long delay and instantaneous, and ground fault (where shown) functions of the breaker by means of a 120V operated test kit. Contractor shall utilize a test kit capable of testing all breakers 400A and above, at the Engineer's request.
6. Circuit breakers, 1200A Frame or larger, or circuit breakers with sensors or adjustable trip settings, 1200A or larger, shall be equipped with an Energy Reducing Maintenance Switch that complies with CEC Article 240.87(B)(3) unless specified elsewhere with an alternate arc energy reduction method allowed by this same code section.
7. Ground Fault Interrupting Breakers: Provide with molded plastic case, air circuit breakers, similar to above with ground fault circuit interrupt capability, conforming to UL Class A, Group 1.
8. Arc Fault Interrupting Breakers: Provide with molded plastic case, air circuit breakers, similar to above with arc fault circuit interrupt capability, conforming to UL 1699. Provide on all dwelling-unit circuits supplying bedrooms, sleeping quarters etc. as required to comply with CEC Article 210.12.
9. Tandem or half-sized circuit breakers are not permitted.
10. Series-Rated Breakers: UL listed series-rated combinations of breakers can be used to obtain panelboard-interrupting ratings shown on Drawings. If series-rated breakers are used, switchboards, distribution boards, and panel boards shall be appropriately labeled to indicate the use of series-rated breakers. Shop drawing submittal shall include chart of UL listed devices, which coordinate to provide series rating.
11. Circuit breakers shall be standard interrupting construction. Panelboard shall accept standard circuit breakers up to 100A.
12. Circuit breaker handle accessories shall provide provisions for locking handle in the on or off position.
13. Shunt-trip equipped circuit breakers shall be provided on all elevator feeders.
14. Temperature compensating circuit breaker(s) shall be provided when located in outdoor enclosure(s) or when located in an enclosure subject to high ambient heat due to due nearby industrial processes, etc.

15. Provide 75 degree Celsius-rated conductor lugs/lug kits as required on all circuit breakers to accept conductor quantities and sizes shown on drawings.
16. All circuit breaker terminations shall be suitable for use with 75-degree Celsius ampacity conductors. Listed, dual-rated pin terminals, straight or offset, are acceptable for use to in accommodating oversized or parallel conductor installations.
17. Circuit breakers serving Fire Alarm or Central Monitoring panels and power supplies shall be red in color and lockable in the "ON" position.

**J. Disconnect Switches:**

1. Non-fusible or fusible, heavy-duty, externally-operated horsepower-rated, 600V A.C: Provide NEMA 3R, lockable enclosures for all switches located on rooftops, in wet or damp areas and in any area exposed to the elements.
2. Fusible switches shall be Class "R" when 600A or less or Class "L" when greater than 600A.
3. Amperage, Horsepower, Voltage and number of poles per drawings: All shall be clearly marked on the switch nameplate.
4. Provide the Owner's project manager with one (1) spare set of fuses and two (2) sets of fuse clips/fuses for every set of fuses on the project.

**K. Fuses:**

1. Provide fuses at all locations shown on the Drawings and as required for supplemental protection:
  - a. Fuses shall be manufactured by Bussman, Shawmut, or equal.
  - b. All fuses shall be the product of a single manufacturer.
2. Main and Feeder Protection:
  - a. Protective devices rated greater than 600A: Provide Bussman Hi-Cap fuses, Class L, current limiting, having an interrupting rating of 200,000A RMS.
  - b. Protective devices rated 600A or less: Provide Bussman Class R fuses, Class RK series current limiting fuses, having an interrupting rating of 200,000A RMS.
3. Motor Protection:
  - a. Where rating of protective device is greater than 600A, provide Bussman Hi-Cap fuses, Class L, current limiting, having an interrupting rating of 200,000A RMS.

- b. Where rating of protective device is 600A or less, provide Bussman Class RK series current limiting fuses, having an interrupting rating of 200,000A RMS.
  - c. Where fuses feeding motors are indicated, but not sized, it shall be the responsibility of the Contractor to coordinate the fuse size with the motor to provide proper motor running protection.
  - d. When rejection type fuses are specified (Class RK series) the fuse holder of all switches (specified in other Sections) shall be suitable for the fuses provided.
- L. Cable Tray, Flexible Cable Tray and/or Cable Runway:
  - 1. See drawings for Cable Tray, Flexible Cable Tray and/or Cable Runway specifications.
- M. Uninterruptible Power Systems (UPS):
  - 1. See drawings for UPS schedules and specifications.
- N. Power Distribution Units (PDU):
  - 1. See drawings for PDU schedules and specifications.
- O. Generator Systems:
  - 1. See drawings for Generator schedules and specifications.
- P. Transfer Switches:
  - 1. See drawings for Transfer Switch schedules and specifications.
- Q. Lighting Control/Dimming Systems:
  - 1. See drawings for Lighting Control and/or Dimming Systems schedules and specifications.
  - 2. Wall box dimmers shall be rocker-type as manufactured by Lutron (no known equal except as noted below). Dimmers and dimmer faceplates shall match the color of adjacent switches and faceplates. Dimmers and dimmer faceplates in wood finished areas shall generally be black unless otherwise indicated by the Architect. The Contractor shall obtain written approval of the Architect regarding final dimmer and dimmer faceplate color selection prior to ordering material. Multiple dimmers/switches shall be ganged together with a common cover plate. Provide dimmers as follows:
    - a. Incandescent: Lutron DIVA DV-10P or DV-103P (3-way) (1000-Watt max.).
    - b. Electronic Low Voltage: Lutron DIVA DVELV-300P or DVELV-303P- (3-way) (300 Watt).



- c. Magnetic Low Voltage: Lutron DIVA DVLV-10P or DVLV103p (3-way) (800-Watt max.).
  - d. Fluorescent (3-Wire): Lutron DIVA DVF-103P (single/3way, 8A @ 120V) or DVF-103P-277 (single/3way, 6A @ 277V).
  - e. Fluorescent (0-10V): Lutron DIVA DVTV with PP-???H Power Pack.
  - f. Fluorescent (Lutron Tu-Wire): Lutron DIVA DVFTU-5A3P with Lutron H.P. module where required.
  - g. LED (0 - 10V): Lutron DIVA DVTV with PP-???H Power Pack.
  - h. Screw Base CFL/LED: Lutron DIVA DVCL-153P.
  - i. Fan Control: Lutron DIVA DVFSQ-F (1.5A @ 120V max, 3 speed, single pole, 3-way).
3. Contractor shall verify if dimmer(s) requires derating when ganged. Contractor shall provide, and provide connections to, additional Lutron Power Modules, Lutron Power Packs, and / or Lutron Interface Modules where required to accommodate loads higher than dimmers standard or derated load-carrying capacity. Note - contractor may to provide a Lutron recommended dimmer type (typically a #DVF-103P unit) to control the necessary power modules or interface devices.
- R. Fire Alarm System/Central Monitoring System:
- 1. See drawings for Fire Alarm System or Central Monitoring System specifications.
- S. Surge Protective Device (SPD):
- 1. See drawings for SPD specifications.
- T. Conduit:
- 1. Galvanized Rigid Conduit (GRC) shall be full weight threaded type steel. Steel conduit shall be protected by overall zinc coating to inside and outside surfaces, applied by the hot dip, metalizing, or sherardizing process.
  - 2. Intermediate Metal Conduit (IMC), shall be hot-dipped galvanized in accordance with UL 1242, and meet Federal Specification WWC-581 (latest revision).
  - 3. Electrical Metallic Tubing (EMT) shall be zinc-coated steel with baked enamel or plastic finish on inside surfaces. EMT shall be dipped in a chromic acid bath to chemically form a corrosion-resistant protective coating of zinc chromate over galvanized surface.
  - 4. Flexible metal conduit shall be constructed of aluminum or hot-dipped galvanized steel strips wound spirally with interlocking edges to provide greatest flexibility with maximum strength. Interior surfaces shall be smooth and offer minimum drag to pulling in conductors. Use only as directed in writing by the Engineer

with the exception of 400 Hz feeders and 400 Hz branch circuits which shall be run in flexible aluminum conduit.

5. Liquid-tight conduit (Seal-Tite) shall be galvanized steel flexible conduit as above except with moisture and oil-proof jacket, pre-cut lengths and factory-installed fittings. For outdoor installations and motor connections only unless otherwise noted on drawings.
6. Factory assembled, or off-site assembled wiring systems (such as Metal Clad (MC) Cable, Type AC Cable, Type NM Cable, Type BX Cable, etc.) shall not be used unless otherwise indicated in the Allowed Specification Deviations Section or Deductive/Additive Alternate Pricing Section generally located on the symbols list drawing.
7. When approved for use in the Allowed Specification Deviations Section, generally located on the symbols list drawing, MC cables shall be allowed for lighting branch circuits (homeruns shall be EMT), receptacle branch circuits (homeruns shall be EMT) and poke-thru fed systems furniture homeruns. MC shall not be used where exposed, except for a maximum 6' length for final connections to light fixtures, or terminate in electrical panelboards or distribution boards. Equipment ground conductor shall be green. Isolated ground conductor shall be green with yellow stripe. Provide 600V rated aluminum or lightweight steel interlocking armor Metal Clad (MC) cable with copper conductors, THHN (90-degree C) insulation, and integral equipment grounding conductor and isolated grounding conductor as required. Type AC cable listed for use in patient care areas for non-essential electrical system branch circuits per CEC Article 517.13 shall be required in such areas in lieu of MC cable. Type AC and MC cable shall not be used for essential electrical system branch circuits. MC cable shall be manufactured to Underwriter Laboratory Standard 1569. See PART 3 - EXECUTION section of this specification for additional installation requirements.
8. Nonmetallic Flexible Tubing (ENT) shall not be used unless otherwise indicated in the Allowed Specification Deviations Section or Deductive/Additive Alternate Pricing Section generally located on the symbols list drawing. Use of ENT, if allowed, is strictly limited to use in CMU walls and parking structures decks or as directed in writing by the Engineer. See PART 3 - EXECUTION section in this specification for additional installation requirements.
9. Non-Metallic Conduit:
  - a. Polyvinyl chloride (PVC) rigid conduit, Schedule 40, Type II for underground installation only with solvent welded joints, conforming to Underwriters Laboratories, Inc. (UL) requirements, listed for exposed and direct burial application.
  - b. Conduit and fittings shall be produced by the same manufacturer.
10. Fire-rated MC Cable:
  - a. 2-hour fire-rated, polymer insulated 600V MC cable listed and conforming to Underwriters Laboratories, Inc. (UL) 2196 and UL 1569 requirements for installation as an Electrical Circuit Protective System for use in complying

with CEC Articles 695 and 700. Cable sheath shall be suitable for use as a CEC equipment grounding conductor, and shall be listed for use in wet locations to 90 degrees C (Raychem or equal).

- b. Cable connectors shall be brass MC connectors.

U. Fittings:

1. Condulet type fittings shall be smooth inside and out, taper threaded with integral insulating bushing and of the shapes, sizes and types required to facilitate installation or removal of wires and cables from the conduit and tubing system. These fittings shall be of metal, smooth inside and out, thoroughly galvanized, and sherardized cadmium plated.
2. Metallic condulet covers shall have the same finish as the fitting and shall be provided for the opening of each fitting where conductors do not pass through the cover.
3. Connector, coupling, locknut, bushings and caps used with rigid conduit shall be steel, threaded and thoroughly galvanized. Bushings shall be insulated.
4. UON all EMT fittings, connectors and couplings installed in concealed locations, areas not considered to be wet or damp locations by the AHJ, or areas not subject to physical damage, shall be steel, zinc or cadmium plated, threadless, compression, steel locking ring type with insulated throat. Where suitable for use, steel set screw fittings are allowed for trades sizes of 2" and smaller. Insulated throat is not required for fittings, connectors and couplings 1" and smaller.
5. All interior and exterior EMT fittings, connectors and couplings, 2" and smaller, installed in exposed or concealed locations that are considered by the AHJ to be wet or damp locations, shall be Raintite-listed, steel, zinc or cadmium plated, threadless, compression, steel locking ring type with insulated throat. If Raintite-listed, EMT fittings, connectors and couplings are unavailable for a given trade size or if conduit is installed in an area subject to damage – provide rigid metallic or intermediate metallic conduits, fittings, connectors and couplings as required.
6. Flexible steel conduit connectors shall be a malleable iron clamp or squeeze type or steel twist-in type with insulated throat. The finish shall be zinc or cadmium plating.
7. Conduit unions shall be "Erickson" couplings, or approved equal. The use of running threads will not be permitted.

V. 600 Volt Conductors - Wire and Cable:

1. All conductors shall be copper. Provide stranded conductor for #10 AWG and larger or when making flexible connections to vibrating machinery. Use compression "fork" type connectors or transition to solid conductors when connecting to switches, receptacles, etc.

2. Type THHN/THWN-2 thermoplastic, 600 volt, UL approved, dry and wet locations rated at 90 degrees Celsius, for conductors of all sizes from #12 AWG up to and including 1000 kcmil. RHH/RHW insulation is allowed only to provide an Electrical Circuit Protective System to comply with CEC Articles 695 and 700.
3. Wire and cable shall be new, manufactured not more than six (6) months prior to installation, shall have size, type of insulation, voltage rating and manufacturer's name permanently marked on outer covering at regular intervals.
4. Wire and cable shall be factory color-coded by integral pigmentation with a separate color for each phase and neutral. Each system shall be color-coded and it shall be maintained throughout.
5. Systems Conductor Color Coding:
  - a. Power 208/120V, 3PH, 4W:
    - 1) Phase A = Black
    - 2) Phase B = Red
    - 3) Phase C = Blue
    - 4) Neutral = White or White with Phase Color Tracer
    - 5) Switch legs = Purple (Switch legs shall also be identified separately by numerical tags).
    - 6) Travelers = Purple with Black stripe or Pink.
  - b. Power 480/277V, 3PH, 4W:
    - 1) Phase A = Brown
    - 2) Phase B = Orange
    - 3) Phase C = Yellow
    - 4) Neutral = Grey or Grey with Phase Color Tracer
    - 5) Switch legs = Purple (Switch legs shall also be identified separately by numerical tags).
    - 6) Travelers = Purple with black stripe or Pink..
  - c. Ground Conductors: Green
  - d. Isolated Ground Conductors: Green with continuous yellow stripe.
  - e. Fire Alarm System: As recommended by the manufacturer.

6. All color-coding for #12 through #6 AWG conductor shall be as identified above. Conductors #4 AWG and larger shall be identified with utilizing phase tape at each termination.
7. No conductors carrying 120V or more shall be smaller than #12 AWG.
8. Aluminum conductors shall not be used.
9. Wire-pulling compounds used as lubricants in installing conductors in raceways shall only be "Polywater J". No oil, grease, graphite, or similar substances may be used. Pulling of #1/0 or larger conductors shall be done with an approved cable pull machine. Other methods; e.g. using vehicles and block and tackle to install conductors are not acceptable.

W. Medium Voltage Conductors (greater than 600V):

1. See drawings for Medium Voltage Cable Schedule and Specifications.

X. Junction and Pullboxes:

1. For interior dry locations, boxes shall be NEMA 1 galvanized one-piece drawn steel, knockout type, with removable, machine screw secured covers.
2. For outside, damp or surface locations, boxes shall be NEMA 3R heavy cast aluminum or cast iron with removable, gasketed, non-ferrous machine screw secured covers.
3. For in-grade applications, junction and pull boxes shall be pre-cast concrete or molded fiberglass manufactured by Christy, Brooks-Jensen, or Utility Vault Co. Fiberglass boxes shall:
  - a. Be used only in landscape planter areas that are not subject to damage from lawnmowers, tractors and other machinery.
  - b. Not be used in lawn or turf areas.
  - c. Not exceed 11" W x 17" L in size unless required to be larger to meet code requirements.
4. All boxes shall be sized for the number and sizes of conductors and conduits entering the box and equipped with plaster rings where required.
5. All boxes located in traffic areas shall be traffic rated.

Y. Outlet Boxes:

1. For fixtures, boxes shall be galvanized, one-piece drawn steel, knockout type equipped with 3/8" fixture studs and plaster rings where required.
2. For convenience outlets, wall switches, or other devices, outlet boxes shall be galvanized one-piece drawn steel, knockout type 4" x 4" x 2-1/8" minimum size with plaster rings as required.

3. For locations where standard boxes are not suitable due to number and size of conduit to be terminated, special boxes shall be designed to fit space or meet other requirements, and submitted for approval.
  4. For exposure to weather, damp locations, or surface mounting, outlet boxes shall be heavy cast aluminum or cast iron with threaded hubs; covers shall be watertight with gaskets and non-ferrous screws.
  5. Outlet boxes used for support of ceiling fans shall be galvanized, one-piece drawn steel, knockout type equipped with bracing bars and plaster rings where required and listed for ceiling fan support use. Such boxes shall be labeled and capable of supporting ceiling fan weights up to 70 pounds.
  6. See drawings for floor box installation notes and specifications.
- Z. Plywood Backboards: Where indicated for telephone or communications system terminals or other equipment assemblies, provide backboards of size indicated. Use 3/4" thick x 8' all (length per plans), Douglas Fir, void-free, kiln-dried, fire-rated plywood finished on one side and prime coat painted on all surfaces with finish coat of enamel paint, color by Architect. Leave one (1) fire-rating stamp/sheet exposed for inspection.
- AA. Terminal Cabinets:
1. Terminal cabinets shall be fabricated of hot dipped galvanized code gauge sheet metal for flush or surface mounting, complete with barriered sections, a door for each vertically barriered section and sizes as indicated on plan. Doors shall be hinged and lockable. Locks shall be keyed to match the branch circuit panelboards. Terminal cabinet trims shall match the branch circuit panels.
  2. Provide each terminal cabinet with a full size mounting backplate.
  3. Terminal cabinets shall be installed complete with full-length skirts of the same construction and finish as the terminal cabinet.
  4. Where mounted outdoors, terminal cabinets shall be NEMA 3R, weatherproof complete with gaskets and required sealant to prevent moisture from entering the terminal cabinet.
  5. All terminal cabinets and terminal cabinet barriered sections shall be labeled by the cabinet or cabinet section use (i.e. CATV, Security, etc.). Labels shall be Micarta type as specified elsewhere in these specifications. Unless otherwise noted, all termination blocks and cables shall be labeled per ANSI/EIA 606 standard.
- BB. Painting: Terminal cabinets, panels, junction boxes, pull boxes, etc., and conduit installed in public view shall be painted with colors selected by the Architect to match the subject surfaces. Refer to painting section of the specifications for additional requirements.

- CC. Trenching and Backfilling: Contractor shall be responsible for trenching and backfilling. Refer to Trenching and Backfilling section of the specifications for complete requirements.

## **PART 3 - EXECUTION**

### **3.1 PREPARATION AND INSTALLATION**

#### **A. Installation of Conduit and Outlet Boxes:**

1. All conduit installed in the dry walls or ceilings of a building shall be steel tube (EMT), aluminum tube (EMT), or Intermediate Metal Conduit (IMC). Flexible conduit shall not be used in lieu of EMT, IMC or rigid conduit except as noted herein.
2. Galvanized rigid conduit (GRC) or intermediate metal conduit (IMC) shall be used as follows:
  - a. When noted on the drawings.
  - b. When considered exposed to damage by the local AHJ.
  - c. When installed in wet or damp locations and of a trade size where listed-Raintite fittings, connectors, couplings etc. are unavailable.
  - d. When required by CEC Article 517.13.
  - e. When installed in concrete and masonry. The use of ENT in CMU walls and parking structures may be allowed only as directed in writing by the Engineer. Request for ENT substitution must be made prior to bid and in accordance with pre-bid substitution requests requirements of these specifications.
3. Intermediate metal conduit (IMC), is approved for use in all locations as approved for GRC or steel-tube EMT and in accordance with CEC Article 342.
4. Flexible steel conduit shall only be permitted to be used at light fixture outlets and connections to vibrating electrical equipment. Except when concealed in walls or other structural elements, all flexible steel conduit runs shall be less than 6'-0". All outdoor installation shall be made using liquid-tight flex with approved fittings. Include a separate insulated green ground conductor sized per CEC in each conduit. Other uses of flexible conduit shall be allowed only as approved in writing by the Engineer.
5. Flexible liquidtight conduit shall be installed in lieu of the flexible steel; where required by the CEC in damp and wet location, where exposed to weather, in refrigerated area (65°F or less), and/or between seismic joints. All rotating electrical equipment shall be supplied with flexible, liquid-tight conduit with appropriate slack and shall not exceed thirty-six (36) inches. Include a separate insulated green ground conductor sized per CEC in each conduit. Other uses of

liquidtight flexible conduit shall be allowed as approved in writing by the Engineer on a case by case basis.

6. Rigid metallic conduit installed underground or embedded in concrete shall be 1" trade size minimum and shall be wrapped with 20 mil. Polyvinylchloride plastic tape, PVC conduit installed underground or embedded in concrete shall be 3/4" minimum trade size.
7. Where required for providing an electrical circuit protective system to comply with CEC Articles 695 and 700 utilize UL Listed 2-hour fire-rated, MC cable or UL Listed 2-hour fire-rated RHH/RHW conductors in conduit.
8. Conduit shall be run so as not to interfere with other piping fixtures or equipment.
9. The ends of all conduit shall be cut square, carefully reamed out to full size and shall be shouldered in fitting.
10. No running threads will be permitted in locations exposed to the weather, in concrete or underground. Special union fittings shall be used in these locations.
11. Where conduit is underground, under slabs or grade, exposed to the weather, or in wet locations, make joints liquid tight and gas tight.
12. All metal conduit in masonry and concrete and where concealed under floor slabs shall have joints painted with thread compound prior to makeup.
13. PVC conduit shall not be run in walls except where approved by the Engineer prior to bid in limited instances that may include concrete or CMU walls used in site retaining, parking structures, or exterior equipment yard or enclosure walls, etc.
14. Where conductors enter a raceway or a raceway in a cabinet, pull box, junction box, or auxiliary gutter, the conductors shall be protected by a plastic bushing type fitting providing a smoothly rounded insulating surface.
15. Where conduit extends through roof to equipment on roof area, the Contractor shall provide flashing material compatible with the roofing system as required by the roofing specifications or as required by the Owner's roof warranty. This flashing shall be delivered to the roofing Contractor for installation. The actual location of all such roof penetrations and outlets shall be verified by the Architect/Owner. Contractor to verify type of flashing prior to bid and include all costs.
16. All conduit shall be supported at intervals not less than 6'-0" and within 12" from any outlet and at each side of bends and elbows. Conduit supports shall be galvanized, heavy stamped, two-hole conduit clamp properly secured.
17. Where conduit racks are used the rack shall consist of two-piece conduit clamps attached to galvanized steel slotted channels, properly secured via threaded rods attached directly to the building structure.



18. Nail-in conduit supports, one-piece set screw type conduit clamps or perforated iron for supporting conduit shall not be used.
19. Seismic Conduit Support:
- a. All conduit shall be supported in such a manner that it is securely attached to the structure of the building. Attachment is to be capable of supporting the tributary weight of conduit and contents in any direction. Maximum spacing of support and braces are to be as follows:

<u>CONDUIT SIZE</u>	<u>MAXIMUM BRACE SPACING</u>
1/2" to 3"	6'-0"
3-1/2" to 4"	8'-0"

20. All conduit runs shall be installed parallel or perpendicular to walls, structural members, or intersection of vertical planes and ceilings. Field made bends and offset shall be avoided where possible. Crushed or deformed raceway shall not be installed.
21. Open knockouts in outlet boxes only where required for inserting conduit.
22. Locate wall outlet of the same type at same level in all rooms, except where otherwise noted.
23. Outlet boxes on metal studs shall be attached to metal hangers, tack welded or screwed to studs; on wood studs attachment shall be with wood screws, nails are not acceptable.
24. Recessed boxes shall not be mounted back-to-back in any wall; minimum offset shall be 24 inches.
25. Junction Boxes that do not contain any device(s) shall be located in storage rooms, electrical closets, or above accessible ceilings, not in hard lid ceilings or other forms of inaccessible ceilings. Place boxes which must be exposed to public view in a location approved by the Owner's Project Manager. Provide covers or plates to match adjacent surfaces as approved by the Owner's Project manager.
26. Surface mounted pull boxes, terminal cabinets, junction boxes, panel boards etc., shall be attached to walls using appropriate screws, fasteners, backing plates, stud blocking etc., as detailed on architectural and/or structural drawings. If architectural and/or structural drawings are not provided on the project, Contractor shall provide all necessary mounting hardware and backing support to comply with local building code requirements and any additional requirements imposed by the local Authority-Having-Jurisdiction.
27. Sleeves shall be installed where conduit passes through masonry or concrete walls and shall be 24-gauge galvanized steel no more than 1/2" greater in diameter than the outside diameter of the conduit. When located in non-rated structures, caulk conduit sleeve with stone wool and waterproof below grade. When located in fire rated structures, provide UL listed fire stopping system. See fire stopping section of this specification for additional requirements.

28. All boxes shall be covered with outlet box protector, Appleton SB-CK, or similar device/method to keep dirt/debris from entering box, conduit or panels. If dirt/debris does get in, it shall be removed prior to pulling wires.
29. All boxes installed outdoors shall be suitable for outdoor installations, gasketed, screw cover, and painted as directed by the Architect with weatherproof paint to match building.
30. All conduit entries to outdoor mounted panels, cabinets, boxes, etc., shall be made using Myers "SCRU-TITE" hubs Series ST.
31. Provide nylon or a 1/8-inch O.D. polyethylene rope, rated at 250 pounds tensile strength, in all conduits more than 5 feet in length left empty for future use. Not less than 5 feet of rope shall be left at each end of the conduit. Tag all lines with a plastic tag at each end indicating the termination/stub location of the opposite end of the conduit.
32. All multiple conduit runs within suspended ceilings shall be suspended from building structure by means of unistrut hangers/racks, Conduit shall not be allowed to lay on ceiling or be supported from ceiling suspension wires or other suspension system. Support conduit to structure above suspended ceilings 8" minimum above ceiling to allow removal of ceiling tile. Maintain two-inch clearance above recessed light fixtures
33. All exposed conduits and support hardware shall be painted to match the finish of the wall or ceiling to which it is supported.
34. Where conduits or wireways cross seismic joints, provide approved flexible conduit connection or approved expansion/deflection fitting to allow for displacement of conduit in all three axes. Connection shall allow for movement in accordance with design of seismic joint. Non-flexible raceways crossing expansion joints or other areas of possible structural movement shall make provision for 3-way movement at such points by means of expansion/deflection fittings. Fittings shall be installed in the center of their axes of movement and shall not be deflected to make part of a conduit bend, or compressed or extended to compensate for incorrect conduit expansion/deflection fittings(s) complete with ground jumpers. Where necessary, provide approved expansion joints to allow for thermal expansion and contraction of conduit(s). Install expansion joints complete with ground jumpers.
35. Seal all conduits where termination is subject to moisture or where conduit penetrates exterior wall, floor or roof, in refrigerated areas, classified (hazardous areas) and as indicated on the drawings.
36. Except as otherwise indicated on the Drawings or elsewhere in these specifications, bends in feeder and branch circuit conduit 2 inches or larger shall have a radius or curvature of the inner edge, equal to not less than ten (10) times the internal diameter of the conduit. Except where sweeping vertically into a building, and where sweep radius equals ten (10) times conduit diameter, underground communications and building interconnect conduits 3 inches or larger shall have a minimum 12'-6" radius or curvature of the inner edge. For the serving utilities, radius bends shall be made per their respective specifications.

37. Tag all empty conduits at each accessible end with a permanent tag identifying the purpose of the conduit, footage end-to-end, and the location of the other end. In wet, corrosive outdoor or underground locations, use brass, bronze, or copper 16-gauge tags secured to conduit ends with #16 or larger galvanized wire. Inscribe on the tags, with steel punch dies, clear and complete identifying information.
38. The following additional requirements shall apply to underground conduits:
- a. Underground conduit shall be Schedule 40 PVC (polyvinyl chloride) unless otherwise indicated elsewhere in these specifications or as required per CEC Article 517.13.
  - b. For all communications conduits 2" and larger and feeders 100A or greater, provide with a minimum 3" inch concrete envelope with 2-inch minimum separation between conduits, installed at depth of not less than 24" below grade. Concrete to be used for encasement shall be normal weight concrete with minimum 28-day compressive strength of 2,000 psi. (Provide concrete encasement and/or greater minimum conduit depth as required by the Utility Companies.) Conduit separation within a duct bank shall be maintained using plastic spacers located at 5'-0" intervals. Where power and communication conduits are run in a common trench, a 12-inch minimum separation shall be maintained between power and communication conduits or as required by Utility Companies. Where concrete encasement is not required by serving utilities for a utility-only duct bank, provide free draining sand bedding suitable to achieve 95% relative compaction based on ASTM D1557 using 6" lifts or directed by Utility Company Standards.
  - c. In all cases, where any conduit(s) pass under a building slab or footing, the electrical Contractor will provide a Bentonite clay or concrete barrier that conforms to the height and width of the trench excavation extending a minimum of 24" on either side of the foundation. In all cases, where conduit(s) pass through a sleeve in a footing or other foundation element, the electrical Contractor will provide a Bentonite clay or concrete barrier between the sleeve and the conduit(s) surrounding the conduit(s) for the entire depth of the sleeve. The barrier is required to prevent passage of moisture under or through the slab or footing via the trench or sleeve.
  - d. Where underground conduit passes under a building slab, concrete encasement may not be required, except as required above, contact the Engineer for written direction prior to omitting any encasement.
  - e. Underground conduits, which terminate inside building(s) below grade, such as in a basement level, or which slope so that water might flow into interior building spaces, shall be sealed at the point of penetration with a modular conduit seal (Link-Seal or equal by Rox Systems). Conduit/conduit sealing system penetrations of waterproofing membranes/systems on existing structures shall be completely restored as required to maintain membrane/system manufacturer and installer warranty for the installation. All conduits shall be provided with a 4% slope away from buildings. All conduits shall be installed such that the water cannot accumulate in the conduit and such that water drains into the nearest manhole, pull box or vault – not into

the facility. In instances where grade changes or elevation differences prevent sloping of conduit away from a building into the nearest manhole, pull box or vault or where accumulation of water in a manhole, pull box or vault may result in water traveling into the facility, conduits shall be sealed internally at each end of each conduit using conduit sealing bushing, sized as required for the conductors contained within the conduit (O-Z Gedney #CSBG 100psig withstand or equal). In all cases, install plugs or caps in spare (empty) conduits at both ends of each conduit (Jackmoon or equal) preventing both water and gas from entering the facility via the conduits.

- f. Include a separate insulated green ground conductor sized per CEC in each underground electrical feeder/branch circuit.
  - g. All underground conduits with circuits rated at 40As or greater and all underground communications conduits shall be provided with a metallic marker tape located 12 inches below the finished grade.
  - h. Where underground conduits sweep into/through slabs, utilize PVC 90 degree sweeps that transition, via female PVC adapter to GRC coupling mounted flush in slab. GRC couplings shall be 1/2 lap taped with 20-mil tape. If the distance of the conduit run between a sweep and the next connecting sweep, pullbox, vault or manhole exceeds 150 ft then the sweep shall be concrete encased. Exceptions:
    - 1) Communications conduits shown terminating at a finished floor shall have an additional 4" high GRC nipple equipped with a bushing, removable conduit plug, labeling tag and pull rope. Tie off pull rope to conduit plug.
    - 2) Utility conduit sweeps shall be installed per the requirements of the respective utility company.
  - i. All PVC conduit shall be glued for a water and gas tight installation. The Contractor shall use appropriate solvent on all joints prior to gluing conduit and fittings together.
  - j. All underground conduit work shall conform to the Federal, State and Local Safety Orders or Rules regarding excavations, trenches and related earthwork. For projects in California, refer to the California Code of Regulations, Title 8, Construction Code Sections 1540 and 1541 for additional requirements.
39. Installation of Metal Clad (MC) Cable (when use is permitted in the Allowed Specification Deviations Section or Deductive/Additive Alternate Pricing Section, generally located on the symbols list drawing).
- a. Provide J-box above accessible ceiling prior to running MC cable within partitions or walls. J-box shall be permanently labeled with panel identification and circuit numbers contained within.
  - b. Overhead MC cable runs shall generally follow building lines to provide a neat and workmanlike installation.

- c. Provide code-sized J-boxes to accommodate MC cable splicing in general. For systems furniture poke-through feeds utilizing MC cable, transition from MC cables to conduit and wire near the panelboard in the TI accessible ceiling space on the floor below the panel board via code-sized gutter(s). Utilize UL listed, insulated barrier strips with recessed screw heads (Ideal #89-6?? Series or equal) fastened within the gutter(s), terminate MC conductors on one side of the strips(s) and individual conductors in conduit from the panelboard(s) on the other side of the strip(s). Label each terminal strip(s) with panel designation. Label each phase conductor with circuit number using wire markers (Ideal or equal). Wire nuts are not an acceptable alternative to the terminal strips in these underfloor transition locations. Provide (1) spare 3/4" conduit from each gutter to its respective panelboard.
- d. MC cable shall not run directly into panelboards, distribution boards or electrical rooms.
- e. MC cabling shall be provided with its own code-approved ceiling support wires, cable hangers, individual spring steel support clips, steel trapeze hangers, threaded rods or dedicated #10 AWG drop wire. Cable supports shall be fastened to concrete slabs, beams, joists or other structural members of the building. In no case shall MC cable rest on ceilings, suspended ceilings or structures. Do not support MC cable using ceiling support wires. The use of nylon cable ties to support MC cable is not allowed.
- f. Use lock or spring nut MC cable fittings.
- g. Cable runs shall be continuous from wiring device to wiring device – no intermediate splicing J-boxes allowed.
- h. When terminating or splicing at a junction, outlet, or switch box, cut the cable with an armored cable rotary cutter such that 6-inches of free conductors remain for connections or splices. Use screw-in or spring lock connector and ensure a proper bonding by firmly tightening the connector to both the box and cable. Insert an anti-short bushing at cable ends to protect conductors from abrasion and use insulated connectors.
- i. MC cable bend radius shall not be less than seven (7) times the external diameter of the cable.
- j. MC cables passing through fire-rated walls or floors shall be firestopped as required with a UL listed system. See firestopping requirements outlined elsewhere in this specification for additional requirements.
- k. Installation shall not exceed code requirements for total current carrying conductors in multiple MC Cable runs bundled together into a single MC cable hanger or strap, unless support device is specifically listed for such purpose. Neutrals shall be counted as current carrying conductors.
- l. Maintain MC Cable clearance of at least 6 inches from hot water and any other high temperature pipes. Maintain at least 12-inches clearance

between MC cable(s) and telecommunication conduits and cables. MC cable shall cross telecommunication cables and conduits at right angles.

- m. MC cabling shall not be run through exposed ceilings, where open grid conditions exist, exposed on walls, or exposed to view. See Power Plan and Lighting Plan General Notes for additional requirements.
40. Installation of Electrical Nonmetallic Tubing (ENT) Cable (when use is permitted in the Allowed Specification Deviations Section or Deductive/Additive Alternate Pricing Section generally located on the symbols list drawing).
- a. When approved for use in the Allowed Specification Deviations Section or Deductive/Additive Alternate Pricing Section, generally located on the symbols list drawing, 1/2" and 3/4" trade size ENT shall be allowed for concealed lighting branch circuits, receptacle branch circuits and miscellaneous signal system circuits within concrete floors, walls and columns within parking structures.
  - b. ENT conduit shall meet the requirements of Underwriters Laboratories Standards 1479 and 1655, NEMA TC-13, and be UL-listed.
  - c. All ENT conduit, ENT fittings, ENT boxes and ENT accessories shall be UL listed and manufactured by the same manufacturer so as to form a complete ENT system. ENT systems shall only be used if they are listed for use in fire resistance rated concrete floors and ceilings with resistance ratings as indicated elsewhere in the project plans. ENT system shall comply with CEC Article 362.
  - d. All ENT fittings and ENT boxes shall be concrete-tight listed without the use of tape. Additionally, ENT fittings shall be constructed of high impact PVC and able to resist ENT conduit pull out forces of a minimum of 175 lbs. ENT fittings with fewer than 6 locking tabs for ENT connection shall utilize manufacturer approved glue as additional protection from fitting/conduit separation. ENT conduit to rigid conduit transition fittings shall be equipped with set screw fittings on the rigid conduit side of the fitting. ENT to metal box fittings shall be equipped with a threaded end and lock washer.
  - e. Where tubing enters a box, fitting, or other enclosure provide a bushing or adapter to protect conductors from abrasion unless the box, fitting, or enclosure design provides equivalent protection.
  - f. ENT junction boxes shall have brass screw inserts and shall be rated to support lighting fixtures weighing less than 50 lbs.
  - g. Concrete tight metal boxes shall be used to support pendant hung fixtures or fixtures over 50 lbs.
  - h. ENT shall be provided in continuous lengths between junction boxes without use of in-line splices or connectors and shall be clearly marked/labeled at least every 10 feet.

- i. All ENT conduit containing electrical branch circuits shall contain a code-sized equipment ground conductor.
  - j. ENT shall transition to EMT, IMC, RMC, or rigid PVC, as appropriate or as called out elsewhere in this specification, for all exposed conduits within/on/under a parking structure.
  - k. ENT shall transition to appropriately sized PVC expansion joint(s) at all structure expansion or seismic joints.
  - l. ENT shall be securely fastened and supported every 2 – 3 ft. and within 1 ft. of every junction box and fitting to prevent movement and sag.
  - m. ENT shall be routed straight without sags, or excessive bending. Where bends are required, comply with Table 362.24 of the CEC for minimum radius of bends. Number of bends shall not exceed quantity allowed by code where used for power and lighting branch circuit and/or feeder conductors. Where utilized for communications system conductors (phones, data cabling, etc.) number of bends shall not exceed the equivalent of (2) 90-degree bends with conduit length no more than 100 feet without installation of a TIA 569-compliant pull box.
  - n. Separation of ENT from fittings, excessive sags, or deflections in ENT runs that prevent pulling of wire and other ENT system product or system installation failures/errors shall be corrected by saw cutting and patching as necessary at no additional cost to the Owner. Use of surface mounted conduits and junction boxes as a repair method is unacceptable.
  - o. Empty ENT runs shall be provided with a nylon pull string.
  - p. Coordinate installation of raceway with structural steel and other structural members. Do not cut, notch or otherwise alter structural members without obtaining approval in writing from the Structural Engineer of record and DSA.
  - q. No more than (2) 3/4" ENT conduits may cross each other within a horizontal concrete slab without obtaining approval in writing from the Structural Engineer of record.
- B. Installation of 600-Volt Conductors:
- 1. All electrical wire, including signal circuits, shall be installed in conduit.
  - 2. All circuits and feeder wires for all systems shall be continuous from over current protective device or switch to terminal or farthest outlet. No joints shall be made except in pull, junction or outlet boxes, or in panel or switchboard gutters.
    - a. Utilize preinsulated "winged" spring type connectors, 3M Company "Performance Plus" #O/B or #R/Y or equal as required for splices and taps in conductors #6 AWG and smaller. When a spring connector is used in an underground environment or when subject to moisture, utilize a 3M Company Scotchcast 3507G epoxy resin connector sealing pack to seal the

spring connector. THE USE OF PUSH-WIRE CONNECTORS (e.g. "WAGO" OR EQUIVALENT) IS STRICTLY PROHIBITED.

- b. Wires #4 AWG and larger AWG shall be joined together as follows:
    - 1) When located in an underground environment or when subject to moisture, the splice shall be made with compression connector and sealed by a 3M, or equal, PST cold shrink connector insulator.
    - 2) When located in an interior environment, the splice shall be made with an IlSCO or equal dual rated, insulated splice-reducer connector or multi-tap connector-listed for use with 75/90-degree Celsius rated conductors.
  - c. Connections to busbar shall be made with dual-rated copper/aluminum one-piece compression lugs. Paralleled conductor connections shall be by mechanical lugs.
  - 3. Thoroughly clean all conduit and wire-ways and see that all parts are perfectly dry before pulling any wires.
  - 4. Install UL approved fixture wire from all lighting fixture lamp sockets into fixture outlet or junction box.
  - 5. For 20A branch circuit wiring, increase #12 conductors to #10 for 120-volt circuits longer than 100 feet and for 277V circuits longer than 150 feet.
  - 6. Conductor Support: Provide conductor supports as required by codes and recommended by cable manufacturer. Where required, provide cable supports in vertical conduits and provide lower end of conduit with a ventilator.
- C. Grounding/Bonding:
- 1. Provide grounding and bonding for entire electric installation as shown on plans, as listed herein, and as required by applicable codes. Included, but not limited to, are items that require grounding/bonding:
    - a. Conduit, Raceways and Cable Trays.
    - b. Neutral or identified conductors of interior wiring system.
    - c. Panel boards, Distribution Boards, Switchgear and Switchboards.
    - d. Non-current carrying metal parts of fixed equipment.
    - e. Telephone distribution equipment.
    - f. Transformers, Inverters, UPS, PDU, RDC, Transfer Switch and Generator Systems.
    - g. Raised Flooring.
    - h. Exposed metal in maintenance holes, hand holes.



- i. Lightning Protection Systems and Antennas.
  - j. Metal piping installed in or attached to a building/structure.
  - k. Metallically isolated structural steel.
  - l. Metallically isolated underground metal water piping.
  - m. Elevator hydraulic piston/lift case.
2. In multi-occupancy buildings, Contractor shall bond metal water piping systems instated in, under or attached to a building and/or structure serving individual occupancies where the piping system(s) are metallically isolated from each other. Per CEC Article 250.104(A)(2) and (4), the bonding conductor shall be sized per Table 250.122 and connected to the switchboard/panel board serving that suite/occupancy.
3. Use of Ground Rods: Furnish and install required number of 3/4" x 10' copper clad ground rods to meet specified resistance, all required grounding wires, conduit and clamps. The size of the grounding conductors shall be not less than that set forth in the latest edition of the California Code of Regulations, Title 24, State of California and CEC, unless otherwise indicated. Rods shall be installed such that at least 10 feet of length is in contact with the soil. Where rock bottom is encountered, the electrode shall be driven at an oblique angle not to exceed 45 degrees from vertical or shall be buried in a trench that is at least 30 inches deep. The upper end of the electrode shall be flush with or below ground level unless the above ground end and the grounding electrode conductor attachments are protected against physical damage. Unless otherwise noted, connection to the grounding electrode conductor may be by compression type or exothermic process connector. Mechanical connectors shall not be used.
4. Grounding System Connection:
- a. Compression connectors shall be unplated copper, manufactured by Burndy, or approved equal, designed specifically for the intended connection.
  - b. Exothermic weld-type connectors shall be 'Cadweld' manufactured by Erico Products, or approved equal, designed specifically for the intended connection.
  - c. Mechanical connectors shall not be used.
5. Isolated Ground Receptacles shall have an insulated ground wire connected between the receptacle and the panelboard isolated ground bus. Unless otherwise noted, this ground wire shall not be grounded at any other point, and shall be distinguished from other ground wires by a continuous yellow stripe.
6. Provide separate green equipment ground conductor in all electrical raceways to effectively ground all fixtures, panels, controls, motors, disconnect switches, exterior lighting standards, and noncurrent carrying metallic enclosures. Use bonding jumpers, grounding bushings, lugs, busses, etc., for this purpose. Connect the equipment ground to the building system ground. Use the same

size equipment ground conductors as phase conductors, up through #10 AWG. Use CEC Table 250.122 for conductor size with phase conductors #8 and larger, if not shown on the Drawings.

7. Clean the contact surfaces of all ground connections prior to making connections.
  8. Ductwork: Provide a flexible ground strap, No. 6 AWG equivalent, at each flexible duct connection at each air handler, exhaust fan, and supply fan, and install to preclude vibration.
  9. Motors: Connect the ground conductor to the conduit with an approved ground, and to the metal frame with a bolted solderless lug. Bolts, screws and washers shall be bronze or cadmium plated steel.
  10. Building grounding system resistance to ground shall not exceed 25 ohms unless otherwise noted and should be confirmed by testing.
- D. Line Voltage and Low Voltage Power Supplies to all Mechanical Equipment Including Plumbing, Heating and Air Conditioning Units:
1. An electric power supply, including conduit, any necessary junction and/or outlet boxes and conductors and connection shall be furnished and installed by the Contractor for each item or mechanical equipment.
  2. Power supplies to individual items of equipment shall be terminated in a suitable outlet or junction box adjacent to the respective item of equipment, or a junction box provided by the manufacturer or the equipment and directed by the Mechanical Contractor. Allow sufficient lengths of conductor at each location to permit connection to the individual equipment without breaking the wire run.
  3. The location of all conduit terminations to the equipment is approximate. The exact location of these conduit terminations shall be located and installed as directed by the Mechanical and Plumbing Contractor.
  4. Provide power supplies to all plumbing and mechanical equipment, including but not limited to, equipment furnished and installed by Owner or Contractor such as heating and air conditioning equipment, pumps, boilers, auto valves, water coolers, trap primers etc. The installation shall produce a complete and operable system.
  5. Unless otherwise noted, the Contractor shall furnish and install all conduit, boxes, wires, etc., for line voltage wiring and low voltage wiring.
  6. It is the Contractor's responsibility to verify with the drawings of other trades regarding the extent of his responsibility for mechanical equipment. The bid must include a sum sufficient to cover the cost of the installation.
  7. The location of all power supply connection and/or terminations to the mechanical equipment is approximate. The exact locations of these terminations shall be verified with other trades during construction.

- E. Prefabricated Equipment: Installation of all prefabricated items and equipment shall conform to the requirements of the manufacturer's specifications and installation instruction pamphlets. Where code requirements affect installation of materials and equipment, the more stringent requirements, code or manufacturer's instructions and/or specifications, shall govern the work.
- F. Firestopping:
  - 1. The Contractor shall be responsible for furnishing all material, labor, equipment, and services in conjunction with the selection and installation of a complete, fully functioning, code compliant, UL-listed, fire stop assembly/system(s) as required by project conditions.
  - 2. Each fire stop assembly/system shall have an "F" and/or "T" rating as required by each condition requiring fire stopping. Each fire stop assembly/system shall have a current UL listing, as indicated in the latest edition of the UL Fire Resistance Directory. Contractor shall verify acceptability of all fire stopping methods and system selections with the authority having jurisdiction prior to installation. The Contractor shall install each fire stop assembly/system in accordance with the manufacturer's printed instructions.
  - 3. Each fire stop assembly/system shall be labeled with fire stop manufacturer-furnished label on each side of the fire stopping systems depicting UL # etc.
- G. Housekeeping Pads
  - 1. Provide a minimum 3" high housekeeping pad above finished floor/finished grade for all floor-mounted switchgear, switchboards, distribution boards, transformers, motor control centers, etc., flush with the face of the equipment. Located in mechanical central plant(s), other mechanical spaces, and located outdoors, pads shall be flush with the face of the equipment. Confirm pad dimensions with local inspector prior to forming pad to ensure any local code interpretations/conditions are met regarding housekeeping pads.
  - 2. Unless otherwise noted above, provide a minimum 1-1/2" high housekeeping pad above finished floor/finished grade for all interior floor-mounted switchgear, switchboards, distribution boards, transformers, motor control centers, transfer switches etc., flush with the face of the equipment. All housekeeping pad heights are as measured from finished floor or grade. Confirm pad dimensions with local inspector prior to forming pad to ensure any local code interpretations/conditions are met regarding housekeeping pads.
  - 3. Provide a 1-1/2" high housekeeping pad above finished floor/finished for service equipment. Prior to pad rough-in, Contractor shall verify serving utility company's maximum meter height requirements and, if necessary, adjust height of housekeeping pad to comply with those requirements. In indoor applications, the pad shall be flush with the face of the switchgear. In outdoor applications, the housekeeping pad shall extend a minimum of 4 feet from the front of switchgear/switchboard's weatherproof enclosure. Confirm pad dimensions with local inspector prior to forming pad to ensure any local code interpretations/conditions are met regarding housekeeping pads.

4. All housekeeping pads located in, on or attached to a building shall be seismically braced/connected to the building structure.

**END OF SECTION**

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**SECTION 27 10 00**

**STRUCTURED CABLING SYSTEM**

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**PART 1 - GENERAL**

**1.1 SCOPE OF WORK**

- A. The work under this section includes all final design, material, equipment, supplies, labor, testing, and accessories required to furnish and install a complete Structured Cabling System (SCS) as indicated on the drawings and as specified herein. These systems shall be defined as all cables, equipment, products, etc, as indicated on the drawings, and mentioned in these specifications.
- B. It is the intent of the Drawings and Specifications to provide comprehensive design criteria for the Contractor to provide and install a complete, fully operational, and tested system.
- C. All miscellaneous system components including, but not limited to, cables, cable supports, termination equipment, punch blocks, patch panels, patch cords, device outlets, ladder runway, backboards, equipment racks, equipment cabinets, enclosures, terminal cabinets, equipment grounding, and any other related items shall be furnished and installed complete under this section, such that the system shall perform all functions listed herein in compliance with all of the specified requirements.
- D. Schedule is paramount to the project's success. With this, the SCS Contractor will have to be a team player, continually working with the team to facilitate expeditious design, procurement, and construction processes.
- E. This project will be performed in a phased construction format. Each phase of construction will be completely installed, labeled and tested, to the greatest extent physically possible, before moving to the next phase.
- F. It is a mandatory requirement that a single Contractor perform the work described in the following specification sections:
  - 1. Section – General Electrical.

**1.2 RELATED WORK, STANDARDS, DOCUMENTS AND PUBLICATIONS**

- A. Each agency's relative codes, standards, and recommended practices apply to the voice/data cabling systems and their components as specified herein:
  - 1. American National Standards Institute (ANSI)
    - a. ANSI T1.336 Engineering requirements for a universal telecommunications frame.
    - b. ANSI T1.404 Network and customer installation interfaces – DS3 and metallic interface specification

2. Building Industry Consulting Service International (BICSI)
  - a. Telecommunications Distribution Methods Manual (TDMM) – latest edition.
  - b. Customer-Owned Outside Plant Design Manual (CO-OSP) – latest edition.
3. Comite Consultatif Internationale de Telegraphique et Telephonique (CCITT)
4. Federal Communications Commission (FCC)
  - a. FCC Part 68 Rule
5. American Society for Testing and Materials (ASTM)
  - a. E814-02 Standard Test Method for Fire Tests of Through-Penetration Fire Stops
6. Insulated Cable Engineers Association (ICEA)
  - a. Communications Wire and Cable for Premises Wiring
7. International Electrotechnical Commission (IEC)
  - a. IEC 61935-01 Generic Cabling Systems - Specification for the testing of balanced communication cabling in accordance with ISO/IEC 11801 Part 1: Installed Cabling
  - b. IEC 61935-02 Generic Cabling Systems - Specification for the testing of balanced communication cabling in accordance with ISO/IEC 11801 Part 2: Patch Cords and Work Area Cords
8. Institute of Electrical and Electronics Engineers (IEEE)
  - a. IEEE 802 Specification for Local Area Networks, latest edition.
  - b. IEEE 802.3an Specification for 10GBASE-T Ethernet, latest edition.
9. ANSI/IEEE C62.41 – Guide on the Surge Environment in Low-Voltage (1000V or less) AC Power Circuits, latest edition
10. International Organization for Standardization (ISO)
  - a. ISO/IEC 11801 Information Technology – Generic Cabling for Customer Premises, latest edition.
  - b. ISO TR 24750 Technical Report
11. National Fire Protection Association (NFPA)
  - a. ANSI/NFPA-70 National Electric Code – Current version as adopted by AHJ(NEC)

- b. ANSI/NFPA-75 Standard for the protection of information technology equipment
- 12. National Electrical Manufacturers Association (NEMA)
  - 13. Occupational Safety and Health Administration (OSHA)
  - 14. Telecommunications Industry Association (TIA)
    - a. Optical Fibers Suitable for Manufacturing OS2 Cabled Optical Fiber.
    - b. TIA-526-7 Optical Power Loss of Installed Single-Mode Fiber Cable Plant.
    - c. TIA-526-7-A Measurement of Optical Power Loss of Installed Single-Mode Fiber Cable Plant, Adoption of IEC 61280-4-2 edition 2: Fibre-Optic Communications Subsystem Test Procedures – Part 4-2: Installed Cable Plant – Single-Mode Attenuation and Optical Return Loss Measurement
    - d. TIA-568-C.0 Telecommunications Cabling for Customer Premises, latest edition.
    - e. TIA-568-C.1 Commercial Building Telecommunications Cabling Standard
    - f. TIA-568-C.2 Twisted-Pair Telecommunications Cabling and Components Standard, latest edition.
    - g. TIA-568-C.3 Optical Fiber Cabling Components Standard, latest edition.
    - h. TIA-568-C.4 Broadband Coaxial Cabling and Components Standard
    - i. TIA-569-C Telecommunications Pathways and Spaces, latest edition.
    - j. TIA-598-C Optical Fiber Cable Color Coding.
    - k. TIA-606-B Administration Standard for Commercial Telecommunications Infrastructure, latest edition.
    - l. TIA-607-B Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications, latest edition.
    - m. TIA-758-B Customer-Owned Outside Plant Telecommunications Infrastructure Standard, latest edition.
    - n. TIA-862-A Building Automation Systems Cabling Standard, latest edition.
    - o. TIA-1152 Requirements for Field Test Instruments and Measurements for Balanced Twisted-Pair Cabling, latest edition.
  - 15. ANSI/TIA-862-A Building Automation Systems Cabling Standard, latest edition.
  - 16. ANSI/TIA-1152 Requirements for Field Test Instruments and Measurements for Balanced Twisted-Pair Cabling, latest edition. Underwriters Laboratories

Standards (UL) Underwriters Laboratories Standards (UL)

- a. UL 5 Surface Metal Raceways and Fittings, latest edition.
- b. UL 5A Nonmetallic Surface Raceways and Fittings, latest edition.
- c. UL 5B Strut-Type Channel Raceways and Fittings, latest edition.
- d. UL 5C Surface Raceways and Fittings for Use with Data, Signal, and Control Circuits, latest edition.
- e. UL 514A Metallic Outlet Boxes, latest edition.
- f. UL 514B Conduit, Tubing, and Cable Fittings, latest edition.
- g. UL 514C Nonmetallic Outlet Boxes, Flush-Device Boxes, Covers, latest edition.
- h. UL 514D Cover Plates for Flush-Mounted Wiring Devices, latest edition.
- i. UL 1449 Transient Voltage Surge Suppressors, latest edition
- j. UL 1685 Vertical-Tray Fire-Propagation and Smoke-Release Test for Electrical and Optical-Fiber Cables, latest edition.
- k. UL 1863 Communications-Circuit Accessories, latest edition.

17. Intetech Testing Services ETL SEMKO (ETL)

- B. The Contractor shall be responsible for obtaining and utilizing the latest Structured Cabling, Architectural, Security and Electrical plans.

### 1.3 GENERAL REQUIREMENTS

- A. Manufacturer: The term "manufacturer" shall be defined as the company, or group of companies, that actually produces the products meeting the requirements of Section 2 of this document. The manufacturer shall have a minimum of seven (7) year's experience in manufacturing products of this type and shall be ISO 9001 Certified. The products, summarized in this specification, shall be supplied by a single manufacturer, with the exception of:
  - 1. Data racks and other hardware that is not defined as part of the copper cable channel test configuration by TIA-568-C.
  - 2. Fiber Optic Cable and Outside plant (OSP) fiber optic cable.
  - 3. Channel solutions consisting of cabling and connectivity hardware independently tested as by UL or ETL and that are listed Section 2 of this document.
  - 4. Cables manufactured by another manufacturer specifically called out on the drawings.



- B. Contractor: The term "Contractor" shall be defined as the company, or group of companies, that actually provides the products per Section 2 and installs the products per Section 3 of this document. The Contractor selected to provide the installation of this system shall be certified by the manufacturer in all aspects of design, installation and testing of the products described herein.
1. The Contractor shall hold a valid State of California C-7 Low-Voltage license, shall have completed at least ten (10) projects of equal scope, shall have been in business of furnishing and installing systems of this scope and magnitude for at least the past five (5) consecutive years, and capable of being bonded to assure the Owner's Project Manager of performance and satisfactory service during the guarantee period.
  2. The Contractor shall have a minimum of one (1) Registered Communications Distribution Designer (BICSI RCDD) and a minimum of one (1) BICSI Technician level installer on staff as full time employees.
  3. All work shall be performed under the supervision of a company accredited and trained by the manufacturer and such accreditation must be presented with the bid submittal. Contractor must be accredited a minimum of 180 days prior to bid submittal date.
  4. The Contractor shall be a manufacturer's Authorized Installer and Warranty Station for the equipment offered and shall maintain a fully equipped service organization capable of furnishing adequate repair service to the equipment.
  5. All personnel performing work on this project must have successfully completed the manufacturer's training course prior to performance of any work on this project. Accreditation will consist of individual employee certifications issued by the manufacturer. All personnel engaged in the testing of fiber optic and category-6A metallic premise horizontal and distribution systems must have successfully completed the test equipment manufacturer's training. Certification of such training must be presented with the bid submittal.
  6. The Contractor selected for this Project shall adhere to the engineering, installation and testing procedures and utilize the authorized manufacturer components and distribution channels in provisioning this Project.
  7. The Contractor shall own and maintain tools and equipment necessary for successful installation and testing of fiber optic cable, and Categories 6A metallic premise horizontal and distribution systems, and have personnel who are manufacturer- trained in the use of such testing tools and equipment.
  8. The Contractor shall hold all other licenses required by the legally constituted authorities having jurisdiction (AHJ) over the work.
  9. The Contractor shall maintain and provide appropriate liability and worker's compensation insurance coverage.
  10. For additional Contractor requirements, see Section 1.6.A.1 (b) of this document in its entirety.

#### 1.4 QUALITY ASSURANCE

- A. It is the intent of these specifications to establish an installation standard of quality for labor and materials. For any proposed product substitution, or when the Contractor intends to include a "Substitution/or-equal" product in the bid pricing, the Contractor shall provide a "Substitution/Or-Equal Request" submittal to the Owner's Project Manager for review no later than ten (10) calendar days prior to Bid submittal. This report shall include *all* of the following items:
1. Description of how the proposed product(s) will impact meeting the project completion date, indicate all item(s) with lead times and expected delivery date(s).
  2. Itemized cost comparisons between the proposed product(s) and the listed product(s).
  3. Detailed technical analysis of the electrical and mechanical specification differences between the proposed product(s) and the listed product(s).
  4. Provide either ETL "Verified" or UL "Verified" test lab documentation for the proposed product(s) and assemblies proposed.
  5. Proposed product identification, manufacturer literature (specifications and cut sheets).
  6. Name, address and contact information of several (minimum of two) similar projects where the substituted product(s) have been used.
  7. Name, address and contact information of the proposed product(s) manufacturer's local representative.
  8. Sample proposed product(s) manufacturer's component and application extended warranty. Detailed warranty requirements are described in Section 1.10 General System Product Warranty of this document.
- B. The Owner's Design Team/Project Manager must approve any proposed product(s) "substitution/or equal" item in writing. The Owner's Design Team/Project Manager reserves the right to require a complete sample of any proposed product(s) and may request a sample tested by an independent testing consultant to prove equality. The decision of the Owner's Design Team/Project Manager regarding equality of proposed product(s) items will be final.
- C. If a proposed product(s) is given final acceptance by the Owner's Project Manager, the Contractor shall reimburse the Owner's Design Team/Project Manager for the costs to review the proposed product(s), and for any additional engineering charges, and shall pay all charges of other trades resulting from this product's use, at no cost to the Owner or the Owner's Design Team/Project Manager.

#### 1.5 GENERAL SUBMITTAL REQUIREMENT

- A. Submittals shall be presented and formatted per the guidelines in the Division 1 section of this bid package.

- B. All cut sheets shall represent the latest version, part number, and revision of the product. Where multiple products or part numbers appear on a page, a bold arrow or circle shall indicate which product or part numbers are to be used as part of the installation. The submittal shall include all descriptive pages associated with the product, not just the page showing the part number. Contractor submittal shall include a materials list. Cut sheets shall be numbered by and match page numbers of each item included on the material list.

## 1.6 PRE-INSTALLATION SUBMITTAL REQUIREMENTS

- A. Within fifteen (15) calendar days after the date of award of the Contract, the Contractor shall submit the following:
  - 1. Submittal Binder: Submit one (1) hard copy and one (1) electronic copy of the complete Submittal Binder to the Project Engineer for review. The binder shall consist of five (5) major sections with each section separated by Index Tabs. Each page in the binder shall be numbered sequentially and shall be summarized in the Index.
    - a. The FIRST section shall include the following items:
      - 1) The TITLE SHEET which shall include the Submittal Date, Project Title and Address, Contractor's Name and contact information, and name of the Owner.
      - 2) The INDEX sheet which shall list each item included in the binder along with the page number where it may be found.
    - b. The SECOND section shall include the following items:
      - 1) CONTRACTOR'S LICENSE: A copy of the low voltage Contractor's valid State of California C-7 Low-Voltage license.
      - 2) PROOF OF EXPERIENCE: Proof (written documentation) that the low voltage Contractor has been regularly engaged in the business of low voltage contracting consisting of, but not limited to, engineering, fabrication, installation, and servicing of communication systems of the type specified herein for at least the past five (5) consecutive years.
      - 3) PENDING LITIGATION: Provide a statement summarizing any pending litigation involving any officer or principal of/or the company, the nature of the litigation and what effect the litigation may carry as it relates to this work in the worst-case scenario. Non-disclosure of this item, if later discovered, may result, at the Owner's discretion, in the Contractor bearing all costs and any cost related to the associated delays in the progress of the work.
      - 4) INSURANCE CERTIFICATES: Copy of low voltage Contractor's current liability insurance, workers compensation, and state industrial insurance certificates in conformance with the contract documents.

- 5) **PROJECT LIST:** A List containing at least ten (10) California installations completed within the last five (5) years by the low voltage Contractor that are comparable in scope and nature to that specified in the contract document. Provide up to date contact information for each project listed including contact name, title, email address and phone number.
- 6) **SERVICE CAPABILITY:** Documentation indicating in detail that the low voltage Contractor has competent engineering, installation, service personnel and facilities with reasonable stock of service parts within 75 air miles of the job site. Do not submit a sales brochure as documentation.
- 7) **AUTHORIZATION LETTERS:** Letters from the low voltage equipment manufacturer stating that the low voltage bidding Contractor is a Factory Authorized Distributor/Installer, and is trained and certified for the equipment he proposes to use on this project, and is licensed to purchase and install software required to provide the specified functions.
- 8) **CERTIFICATION:** Copy of the following current BICSI certifications. Provide proof that the certificate holders are full time employees of the low voltage Contractor's local facility servicing this project and will be actively involved on site for the duration of this project.
  - a) BICSI RCDD, minimum of (1). Mandatory requirement: Shall be on site a minimum of one (1) day per workweek.
  - b) BICSI TECHNICIAN, minimum of (1). Mandatory requirement: Shall be on site a minimum of five (5) full 8-hour days per workweek.
- 9) **PROOF OF TRAINED PERSONNEL:** Documentation that the Contractor has full time on-staff personnel, manufacturer trained and BICSI certified, for the equipment proposed for this project, and on-staff manufacturer trained and certified by the Test Equipment manufacturer in the proper use of the test equipment required on this project. Provide copies of all manufacturers' training/certification documentation, and Test Equipment manufacturer's training/certification documentation. Provide a statement that personnel meeting these qualifications are in the local facility, and will be maintained at that facility throughout the project and the warranty period.
- c. The THIRD section shall contain a detailed bill of materials including the quantity, product Manufacturer, product part number, product description, and corresponding specification section number or drawing sheet number where that product is referenced. Also listed in the Contractor's bill of materials shall be each item of test equipment to be used to test the optical fiber, copper and coax components. Include all patch cords and other specialized components. See example format below:

Description	Part #	Quantity	UoM	Spec	Test Equip.
CAT6A Station cable	Panduit #12345	100 boxes	1000ft/box	2.03	Fluke DTX-1800

This information may be used by the Owner to evaluate the Contractor's general understanding of the project scope during the bid evaluation. Errors or omissions from this bill of material do not relieve the Contractor from providing all material, components, labor, etc., as outlined in this specification and on the drawings to provide a complete and useable structured cabling system.

- d. The FOURTH section shall contain original manufacturer cut sheets for all of the materials that meet the requirements listed in Part 2 of this specification and all materials described on the construction documents. Include manufacturer's cut sheets for all testing equipment to be used for completion of the project. All pages shall be numbered sequentially corresponding to the sequence listed in the Contractor's bill of materials. On each cut-sheet, provide an indicating arrow next to each part number of proposed material. Cut sheets with no specific part numbers identified with an arrow shall be rejected.
- e. The FIFTH section shall contain a designation schedule for each system component location and complete full size 30" x 42" (unless otherwise specified) bond drawings (shop drawings), showing system wiring plans. The professionally drafted drawings shall be generated on AutoDesk AutoCAD 2017 (or later) computer design software. These drawings shall also include:
  - 1) MDF and IDF Diagrams - Including:
    - a) Cable routing
    - b) Position of all devices, components and apparatus (racks, tray, terminal cabinets, ground bus bar, power supplies, etc)
    - c) Detailed elevation layout of the wallfield(s)
    - d) Labeling plan (see District labeling requirements)
  - 2) Site Plan – Including:
    - a) Conduit routing of all site conduits including size and quantity
    - b) Building designations
    - c) MDF and IDF locations
    - d) Campus cabling and conduit between MDF and IDF racks including cable type and quantity
  - 3) Work Area Floor Plans - Including:

- a) Detailed cable routes including cable type and quantity
  - b) Device locations and quantities with labeling
  - c) Approved Work area labeling plan (see District labeling requirements)
  - 4) Cross Connect Documentation - Including:
    - a) Cross-connect records for all voice and data devices
    - b) Cross-connect records may be in either Excel or Word format
  - 5) Riser Distribution Plan
  - 6) Rack elevations of all MDF and IDF equipment
  - 7) Cable Tray, Conduit, and Raceway Plans (if applicable)
  - 8) Campus Distribution Plan (if applicable)
- B. Failure to comply with any of the requirements listed above may result in the rejection of the entire submittal package.

#### 1.7 PROJECT DIRECTION

- A. Single Point of Contact: Contractor shall provide an English-proficient, single point of contact, i.e., Project Manager, to speak for the Contractor and shall provide the following functions:
- 1. Initiate and coordinate tasks with Owner's Project Manager, and others as specified by Owner's Project Manager.
  - 2. Provide day-to-day direction and on-site supervision of Contractor personnel.
  - 3. Shall be readily available to the Owner/Owner's Project Manager 24 hours a day / 7 days a week throughout the duration of the Project.
  - 4. Shall have full time cellular phone capability, and the ability to send/receive email correspondence, accessible by the Owner's Project Manager.
  - 5. Ensure conformance with all Contract provisions.
  - 6. Participate in weekly site project meetings and construction meetings.
  - 7. Provide detailed and written weekly status reports to Owner's Project Manager. The content shall be substantive enough to bring about a full understanding of all situations current and situations future. Weekly reports shall include but are not limited to:
    - a. Detailed progress report and 2-Week look-ahead report

- b. RFI status log (Request for Information)
  - c. Change Order Log (pending and approved items)
  - d. Project Addendum log
  - e. Each of the above must show assigned responsibilities and event history. Weekly reports shall include milestone information, resource updates (staff and materials), and any conditions or incidents that may impact the Project Schedule.
- B. This individual shall remain as Project Manager for the duration of the project. The Contractor may change Project Managers only with the Owner's Project Manager's written approval.

#### 1.8 PLANNING

- A. Planning meetings and schedule: Within fifteen (15) calendar days after the date of award of the Contract, an initial planning meeting will be held with the successful bidder to clarify all requirements (systems, services, distribution methods, etc.), identify responsibilities, and schedule the events that will transpire during the implementation of the project. Within seven (7) calendar days of this initial meeting, the Contractor shall provide a written report and project schedule to clearly document the events and responsibilities associated with the project. Contractor's project schedule shall conform to the overall Project Construction Schedule issued by the Construction Management Company or the Owner. Contractor is required to attend all planning and other construction meetings as requested by the Owner, Architect, or Engineer.

#### 1.9 POST INSTALLATION SUBMITTAL REQUIREMENTS

- A. Within fifteen (15) calendar days after the completion of work, the Contractor shall submit the following:
- 1. Record Documentation:
    - a. Final Test Results – Test results for each cable indicating tests performed, results obtained and values measured. Test results shall be provided in electronic format with the associated application (if required) for viewing. Contractor shall provide individual test results for each cable tested, and a summary sheet listing all cables, test summary, lengths, and the total cable count. Provide test reports for all copper cables and fiber optic cables. Testing shall be conducted in accordance with Section 3.06 of this document.
    - b. As-Built Drawings – Contractor shall provide a complete set of professionally drafted full size 30" x 42", unless otherwise noted, reproducible bond as-built drawings, generated on AutoDesk AutoCAD 2010 or later. Contractor shall provide/create backgrounds and floor plans. Borders to be provided or approved by the Architect. MDF and IDF Diagrams – Including:

- 1) Cable routing for each system. This will include all underground cable routes, and building interior cable routes.
  - 2) Position of all components and apparatus.
  - 3) Detailed elevation layout of the wall field(s).
  - 4) Labeling plan. (utilize labeling plan as specified in this document)
  - 5) Cross-connect records for all analog and voice devices in Word or Excel.
  - 6) Riser Distribution Plan.
  - 7) Cable Tray, Conduit, and Raceway Plans.
  - 8) Campus Distribution Plan (include utility company pathways and cabling).
  - 9) Voice, data, WAP, CCTV device locations.
  - 10) Terminal cabinet(s), equipment racks, UPS power supply(s), control panel(s), switch(s), server(s), patch panel(s), wireless access point locations.
2. After as-built submittal is approved by Owner, the Contractor shall provide two (2) sets of CDs containing all post-installation submittals and close out documentation in AutoCAD (or Revit) format; and in PDF, Word, or Excel formats as required elsewhere in this document.
  3. As-Built Documentation Display in Each MDF and IDF: Within fifteen (15) days after the completion of work, the Contractor shall install a complete Contractor-provided, professionally drafted as-built floor plan in color in each MDF and IDF mounting frame. Each floor plan, generated on AutoDesk AutoCAD computer design software and printed in color, shall depict all jack locations in each modular furniture cubicle and all other areas. Also depicted shall be wireless access point, terminal cabinets, MDF, IDF, pull boxes, vaults, CCTV cameras, or any other communications outlet cables by the SCS Contractor. All jack locations shall be color coordinated with the Owner's labeling scheme as described elsewhere in this specification. Contractor's device symbols shall match the device symbols utilized on the bid documents. The Contractor will provide to Owner two (2) sets of CDs containing all as-built records in AutoCAD (.dwg) and full size PDF format.

**B. Warranty Documentation:**

1. Contractor shall apply for all Manufacturers' Extended Warranties on behalf of the Owner. Contractor shall present to Owner all product Warranty documents per General System Product Warranty Section of this document. Warranty shall commence after final acceptance of System and Project Close Out by the Owner.



## **1.10 GENERAL SYSTEM WARRANTY**

- A. A twenty-five (25) year Extended Product Warranty and Application Assurance for the data / WAP wiring systems shall be provided as follows.

1. 25 Year Extended Product Warranty

- a. The 25 Year Extended Product Warranty shall ensure against product defects, that all approved cabling components exceed the specifications of ANSI/TIA/EIA 568-C and ISO/IEC 11801, exceed the attenuation and NEXT requirements of ANSI/TIA/EIA 568-C and ISO/IEC 11801 for cabling channels, that the installation will exceed the loss and bandwidth requirements of ANSI/TIA/EIA 568-C and ISO/IEC 11801 for fiber channels, for a twenty-five (25) year period. The warranty shall apply to all passive SCS components.
- b. The 25 Year Extended Product Warranty shall cover the replacement or repair of defective product(s) and labor for the replacement or repair of such defective product(s) for a twenty-five (25) year period

2. 25 Year Application Assurance

- a. The 25 Year Application Assurance shall cover the failure of the wiring system to support the application which it was designed to support, as well as additional application(s) introduced in the future, up to 350 Mbps parallel transmission schemes, by recognized standards or user forums that use the ANSI/TIA/EIA 568-C or ISO/IEC 11801 component and channel specifications for cabling, for a twenty-five (25) year period.

3. System Certification

- a. Upon successful completion of the installation and subsequent inspection, the Owner's Project Manager shall be provided with a numbered certificate, from the manufacturing company, registering the installation.

- B. Cable Manufacturer's "site certifications" are not allowed.

## **1.11 GENERAL ENGINEERING AND DESIGN GUIDELINES**

A. Cabling System Installation Practices

- 1. Plastic cable tie (tie wrap) devices shall not be utilized at any time. Only Velcro-type strap devices are permitted. Velcro-type straps are to be utilized in the MDFs and IDF's at a maximum interval of three (3) feet.
- 2. All pull rope devices are to be replaced or provided in all pathways accessed by the Contractor, for future use.
- 3. All intra-building cabling shall be routed either parallel or at right angles to the building structure and/or walls.
- 4. All innerduct shall be supported at a maximum of twelve (12) inch intervals if

running vertical and maximum of forty-eight (48) inch intervals if running horizontal.

5. No cabling is to be pulled through electrical conduit body "condulet" devices unless specifically noted on the plan drawings by the project Engineer. If conduit body devices are pre-existing and it is determined, at the review of the Owner's representative, that sufficient space in the conduit is available and the Owner provides written approval to utilize the condulet, the Contractor shall remove the condulet cap, pull the cable to and beyond the cap then carefully reinstall cap.
6. Communications cabling shall never be tied or attached to electrical conduits, power cables or devices, lighting systems, or co-exist inside any pathway with power cabling.
7. Any visible damage to a cable such as kinks or bends in violation of the minimum bend radius shall render the cable segment defective and shall be removed and replaced by the Contractor at no additional cost to the Owner.
8. Cabling installed above accessible ceiling spaces shall either be installed in conduit, or supported above the accessible ceiling tiles by Contractor-provided Contractor-installed j-hooks. All j-hooks shall be installed on their own independent support wires or rods, and spaced at intervals not to exceed 5 feet.
9. All materials shall be new, unused, and delivered to job site in original manufacturer or distributor cartons or packages. No previously installed material shall be used at any time.
10. Reference Part 3 of this document for additional installation guidelines and requirements.

## 1.12 SPECIFIC SYSTEM REQUIREMENTS

### A. Backbone Infrastructure Cabling

#### 1. Backbone Fiber Optic Cabling

- a. Contractor shall provide (1) 12-strand 9/125 micron single mode OS2 fiber optic cable for backbone connectivity between the Intermediate Main Distribution Frame (IDF) location in the Art Building and the new IDF location at the interim housing portables, where indicated on the plan drawings.
- b. At the Art Building IDF, provide a 20-foot slack loop neatly coiled and secured. At each new IDF, provide a 10-foot slack loop neatly coiled and secured.
- c. Splicing of fiber optic cable shall not be permitted unless specifically called out on the bid documents and authorized in writing by the District's engineer.
- d. All exposed fiber optic cable shall be enclosed in innerduct. Innerduct is not required within inter-building conduits.

- e. Provide 2-meter LC to LC duplex 9/125 micron fiber optic patch cords at the MDF and each IDF. A minimum of two (2) per 6-strands of fiber optic cable installed.
  - f. Contractor shall cross connect fiber at Art building to provide continuous signal path from the MDF in the Laney Tower to the interim housing IDF. Provide all required patch cords.
  - g. Refer to Part 2 of this document for fiber optic cable specifications.
2. MDF/IDF UTP Termination Equipment
- a. The horizontal cross-connect for data circuits shall consist of Category-6A patch cords from the horizontal Category-6A termination panels to the network equipment within the same or adjacent racks.
  - b. The IDF horizontal data cross-connects shall be contained in 2-post floor mounted racks as described in Part 2 of this document, and as detailed on the bid documents/plan drawings.
  - c. Patch panels shall be 24 or 48 modular jack ports, wired to T568B wiring scheme, and include 1RU (1.75" high) horizontal wire management immediately below each 24 port patch panel, and include 2RU (3.5" high) horizontal wire management immediately below each 48 port patch panel.
  - d. Category 6A patch cords shall be provided by the Contractor. See Part 2 of this document for additional patch cord requirements.
  - e. See Part 2 of this document for category 6A copper cable specifications.
3. Wireless Access Point procurement and installation.
- a. Wireless Access Points (WAP) shall be installed at locations identified on construction drawings.
  - b. Contractor shall provide WAPs. Device manufacturer shall be approved by Peralta Community College District prior to purchase.

## **PART 2 - PRODUCTS**

### **2.1 STRUCTURED CABLING SYSTEM**

- A. Acceptable Manufacturers - all equipment listed herein will be by:
- 1. SCS components: Panduit or approved equal.
  - 2. Cabinets, Racks, Ladder tray: Chatsworth, or UL Listed and approved equal.
  - 3. Outside Plant (OSP) Fiber Optic Cable: Corning or approved equal.
  - 4. OSP Copper Cable: Superior Essex or approved equal.

5. Protectors: Circa Telecom, Emerson, Marconi or approved equal.
- B. It is the responsibility of the bidder to insure that the proposed product meets or exceeds every standard set forth in these specifications and the equipment's technical data sheets.
- C. The functions and features specified are vital to the operation of this facility; therefore, inclusion of a component's manufacturer in the list of acceptable manufacturers does not release the Contractor from strict compliance with the requirements of this specification.

## 2.2 OUTLETS

- A. Telecommunications outlets (TO) shall consist of one- or two-gang utility outlet boxes equipped with 8-pin modular (RJ-45) jacks utilizing the T568B wiring scheme and a faceplate. All outlet cabling shall terminate on patch panels at their associated Intermediate Distribution Frame (IDF) Rooms, or as otherwise indicated on the drawings.
- B. Faceplates
  1. All Faceplates shall be available in duplex, quad, or six-plex configuration in a single-gang form.
  2. Surface mount boxes shall be available in dual, quad, and six-plex configuration.
  3. Wall mounted phone jack faceplates shall be single gang configuration, constructed of stainless steel and have two standard phone mounting posts located above and below the jack opening. Wall mounted phone faceplates will consist of 8p8c modular (RJ-45) jacks.
  4. Faceplates shall have two (2) designation windows, one located at top and one located at bottom. Designation windows shall be equipped with clear plastic covers.
  5. Color of faceplates shall be electrical ivory color, unless otherwise noted.
  6. Provide blank faceplate inserts for all unused outlet locations within the faceplate.
  7. Product Specifications: District Standard, Panduit #CFPE2EIY, #CFPE4EIY, #CFPE6EIY
- C. Category 6A 10-Gigabit jacks
  1. All category 6A jacks shall be 8-position/8-conductor (8p8c) modular RJ-45 jacks incorporating 110-style rear termination lugs for termination of Category 6A cable, T568B wiring type, with a connector body made of high-impact fire-retardant plastic.
  2. Category-6A jacks shall be channel-rated.
  3. All Category 6A jacks shall meet or exceed TIA-568-C.2 component Cat 6A

requirements for connecting hardware from 1MHz to 500MHz, 10Gb/s.

4. Cable entry can be 90-degree or 180-degree orientation.
5. Category 6A jacks shall include a pair separation tower to facilitate required conductor separation.
6. The jacks shall incorporate a Cone of Silence, a metalized body, and a printed circuit board to suppress alien crosstalk.
7. Category 6A jack color shall be White. Please verify color with district prior of purchasing and installing.
8. Category 6A jacks shall be utilized for all horizontal copper outlet locations.
9. Category 6A jacks shall only be terminated on Category 6A cables.
10. Product Specification: District Standard: Panduit #CJ6X88TGWH Modular Jack

#### 11. STATION CABLE

- D. Station cables shall extend between the station location (TO) and its associated MDF/IDF.

E. Category 6A station cable:

1. The Category 6 augmented (6A) cable shall consist of 4-pair, 23-AWG bare copper twisted pairs with a UTP design.
2. The cable jacket shall be rated for the environment in which it is installed. Install CMP cable in plenum-rated spaces, CMR cable in riser-rated spaces, and OSP/Indoor-Outdoor cable in outdoor and underground conduit spaces.
3. Category 6A cable shall be ETL verified to TIA-568-C.2-10 Category 6A, and support 10GBASE-T IEEE 802.3an standard of 10Gb/s.
4. Color of cable shall be green. Please verify color with district prior of purchasing and installing.
5. Category 6A cable shall be utilized for all horizontal copper outlet locations.
6. Category 6A cable shall only be terminated on Category 6A-rated jacks and patch panels.
7. Product Specification: Panduit #PUP6AV04GR-G or approved equal. At outdoor environments: General Indoor/Outdoor Plenum Cat-6A #7141007 or approved equal.

## 2.3 MODULAR PATCH PANEL SYSTEM

- A. All Modular jack panels shall be wired to ANSI/TIA/EIA 568-C using T568B wiring scheme.

- B. The wiring block shall be able to accommodate 23 AWG cable conductors.
- C. The Category 6A modular jack panels shall meet or exceed the Category 6A standards requirements in ISO/IEC 11801 and ANSI/TIA/EIA. They shall also be UL Listed.
- D. Contractor shall provide Category 6A modular jack panels in sufficient quantities to terminate all category 6A cables.
- E. All patch panels shall have two (2) cable strain relief/management bars (Panduit #SRB19D5BL or approved equal) installed at the rear of the panel to support the terminated horizontal cabling.
- F. Contractor shall provide and install a 2RU horizontal wire manager (Panduit #NCMH2) immediately below each 2RU patch panel. Contractor shall provide and install a 1RU horizontal wire manager immediately below each 1RU patch panel.
- G. Product Specification: District Standard, Panduit 1RU Modular Patch Panel: #CPPL24WBLY, 2RU Patch Panel: #CPPL48WBLY

#### 2.4 COPPER PATCH/STATION CORDS

- A. Provide Category 6A Modular Patch/Station cords for each assigned port on the patch panel and for each outlet in the station locations. Cords shall be equipped with an 8-pin 8-conductor modular connector on each end and shall conform to the length(s) specified. All cords shall be wired to T568B wiring scheme. All cords shall be factory-built by the cable manufacturer. Fabrication of cords in the field is prohibited.
- B. All category 6A patch cords shall exceed ANSI/TIA/EIA and ISO/IEC Category 6A specifications.
- C. At the IDF, provide one (1) 3-foot cat-6A patch cord for each cat-6A cable terminated in the patch panels. At the workstations, provide one (1) 10-foot cat-6A patch cord for each cat-6A cable terminated at a cat-6A outlet. At wireless access point locations, provide two (2) 3-foot cat-6A patch cord. In instances where longer cords are required, the Contractor shall clarify the requirement with the Owner before installing any longer cords. Where the specifications and the plan drawings conflict, the more stringent requirement will apply.
- D. Category 6A patch cords shall be blue in color. Please verify color with district prior of purchasing and installing.
- E. All patch cords shall be channel-rated and include a snagless boot.
- F. Category 6A patch cords shall be UL Verified for ANSI/TIA/EIA 568-C Electrical Performance.
- G. Category 6A patch cords shall be provided at all Category 6A patch panels and outlets.
- H. Product Specification:

1. Panduit Cat-6A Patch Cord, #UTP28X, or approved equal.

## 2.5 FIBER OPTIC CABLING

- A. 12-strand, OS2, single mode, graded-index, fibers with 9/125 micron core/cladding diameter.
- B. Fiber optic cable shall meet or exceed ANSI/EIA/TIA-492 specifications and ISO/IEC 11801 standards.
- C. All fibers shall be color coded to facilitate individual fiber identification.
- D. Fibers will have dual wavelength capability; transmitting at 1310 and 1550nm ranges.
- E. Single mode fiber maximum attenuation 0.50 dB/km @ 1310 nm: 0.50 dB/km @ 1550 nm.
- F. All fiber in a cable run shall be from the same manufacturer and shall be the same type. A mix of fibers from different manufacturers is prohibited.
- G. All fiber optic cable installed inside buildings shall be installed within contractor-provided innerduct. Innerduct shall be rated for the environment in which it is installed. Innerduct shall be orange in color, unless otherwise noted in the bid documents/plan drawings.
- H. Outdoor-rated and installed cables shall be loose tube construction. Indoor-rated and installed cables shall be tight buffered construction.
- I. Loose tube cables shall be gel free and indoor/outdoor rated.
- J. The use of "indoor-outdoor-plenum-rated" cable is acceptable for backbone cable runs between buildings, as long as it meets the cable specifications listed in section 2.6.A through J of this document.
- K. Tight buffered cables shall be gel free, riser rated, and plenum rated when installed in a plenum rated environment.
- L. Provide buffer tube fan out kits as required.
- M. Product Specification:
  1. Corning OSP 12-strand singlemode OS2 fiber. #012EU4-T4100D20, or approved equal.

## 2.6 FIBER OPTIC PATCH CORDS

- A. Fiber patch Cords shall be available in Single mode.
- B. Construction shall be either 3.0 mm cordage or 1.6 mm cordage.
- C. Connectors shall be available in Duplex LC to LC or duplex LC to SC

- D. The single mode fiber optic solution shall utilize factory- made patch cords.
- E. At the MDF and at each IDF room, provide a minimum of two (2) 2-meter LC to LC duplex OS2 9/125 micron single mode fiber optic patch cords for every 6-strands of single mode fiber optic cable installed. Verify patch cord length and connector type with District prior to ordering product.

## **2.7 FIBER DISTRIBUTION CENTER (FDC)/FIBER PATCH PANEL**

- A. Fiber Patch Panels/Enclosures: A rack mount that terminates, provides cross connection, interconnection, and splicing and fiber identification from 18 to 360 fiber strands. The shelf will provide protection from mechanical stress on the cable and fibers and from macro-bending losses.
  - 1. The shelf shall be rack mountable depending on the location requirement. The units must fit into a 19" wide frame arrangement and have an integrated jumper routing trough.
  - 2. The rack mounted enclosure shall provide front and rear access doors and can be fully administered from the front and rear. The unit shall have integrated sliding tray to allow bulkhead to glide forward or backward after installation.
  - 3. The rack mounted enclosure shall have a transparent hinged front cover to allow visibility of interior after install.
  - 4. Rack mount enclosures shall be available in 2U size for 19" wide racks, and made of 16-gauge steel power coated.
  - 5. The adapter/connector plates shall snap into the front of the enclosure and accommodate LC connectors as required. Adapter plates shall utilize ceramic sleeves.
  - 6. Provide one (1) 6-port LC duplex single mode adapter panel for every 12-strands of single mode fiber optic cable installed. Fiber patch panel/shelf shall be labeled according to the District's specific requirements.
  - 7. Provide quantity of enclosures and adapter panels as required to terminate all strands.
  - 8. Include all buffer tube fan out kits as required.
  - 9. Product Specification:
    - a. Rack Mount Enclosure: Panduit #FRME2, 2RU or approved equal.
    - b. Adapter panel: Panduit or approved equal.

## **2.8 FIBER OPTIC CONNECTORS**

- A. Fiber Optic Connectors: Provide a field installable single mode type connectors to terminate fiber optic cables from cable-to-cable, cable-to-equipment or equipment-to-equipment, and to make jumpers.



1. The connector must:
  - a. Be pre-polished and field installable.
  - b. Have a ceramic zirconia ferrule.
  - c. Be capable of mounting on either 250 um or 900 um buffered fiber.
  - d. Single mode shall be rated OS2.
  - e. Average connector insertion loss: single mode 0.1dB. Maximum insertion loss: single mode 0.5dB.
  - f. Be available in LC style for single mode.
  - g. Have a locking feature to the coupler and assure non-optical disconnect.
2. Product Specification:
  - a. Panduit or approved equal.

## 2.9 COPPER CABLING

### A. Outside Plant Multipair Copper Cables

1. All outside plant multipair copper cables shall support analog voice circuits (fire alarm, intrusion alarm, elevator phone, etc.) and building energy management systems.
2. All copper cable placed in the outside environment shall be 24 AWG, solid annealed copper, twisted pair, and multi-conductor. Refer to section 1.12.A.2 of this document for additional requirements.
3. The outside plant cable shall be resistant to mechanical damage, lightning or damage from wildlife.
4. The outside plant cable shall have an aluminum shield, conductors surrounded by FLEXGEL III filling compound (or other water-blocking compound), and have a black polyethylene jacket.
5. Outside plant cable shall be aerial rated.
6. All outside plant cable shall be installed in conduit and innerduct. Direct-bury cable is prohibited. Install in aerial environment where shown on plans.
7. Multi-pair voice grade copper cables installed in underground conduit shall be minimum category-3 rated.
8. Product Specification: 25-pair Superior Essex (PE-89), or equal.

## 2.10 INDOOR MULTIPAIR RISER CABLE TERMINATIONS

- A. The multipair riser cable wiring block shall be rack mounted 110-type (unless otherwise noted) and support analog voice circuits (fire alarm, intrusion alarm, elevator phone, etc. ) and building energy management circuits, be Category 5E or 6 rated, and facilitate cross connection and interconnection using either cross connect wire or the appropriate category patch cords.
1. The wiring blocks shall be fire retardant, molded plastic consisting of horizontal index strips for terminating 25 pairs of conductors each. These index strips shall be marked with five colors on the high teeth, separating the tip and ring of each pair, to establish pair location.
  2. The wiring blocks shall accommodate 22- through 26-AWG conductors and shall be able to mount directly on wall surfaces either with backboards.
  3. Clear label holders with the appropriate colored inserts shall be provided with the wiring blocks. Labels shall be color-coded and machine labeled/numbered according to Owner's requirements.
  4. The wiring blocks shall be available in 100 pair sizes with mounting legs. The space created by the feet, on each side of the block, allows it to be used as a vertical jumper trough.
  5. For each wiring block shown on the drawings, provide and install 110-type 5-pair connecting blocks for each horizontal index strip on each wiring block. For example, a 100-pair wiring block serving station cables requires twenty (20) 5-pair connecting blocks.
  6. Product Specification:
    - a. Panduit 110-block, rack mount: #P110B1005R4WJ or approved equal
- B. MPOE/MDF/IDF Rooms, or as otherwise indicated on drawings, shall be equipped with 110-type termination blocks for termination of analog station cables. Termination blocks shall consist of a minimum 100-pair. All blocks shall be securely fastened to the room backboards or equipment racks – refer to bid documents/plan drawings. Provide all required D-rings or other approved cable guides as required to provide a neat installation. All cables shall terminate in numerical sequence.

## 2.11 PROTECTORS

- A. All outside plant underground backbone multipair copper cables shall be provided with protection between each building with an entrance cable protector panel(s). All building-to-building multipair copper cables shall be routed through this protector(s). The protector(s) shall be connected with a #6 AWG copper bonding conductor between the protector's ground lug and the MDF/IDF telecommunications ground busbar (TMGB/TBG).
- B. Plug in Surge Protection Modules shall be provided for each pair terminated on the protector chassis. Protector module shall be solid-state type unless otherwise noted.

1. 240VDC/300VDC solid-state protector modules shall provide transient and power fault protection for standard telephone line applications. The modules shall be fast acting, self-resetting current limiters to protect against sneak current type faults. These modules shall be UL Listed with integrated test points and Black in color.
  2. 30VDC/75VDC solid-state protector modules shall provide transient and power fault protection for digital and data line applications. The modules shall be fast acting, self-resetting current limiters to protect against sneak current type faults. These modules shall be UL Listed with integrated test points and Red in color.
  3. In the event that protector modules are not called out in the drawings, SCS Contractor shall include all costs in base bid to provide the 75v solid-state modules w/sneak current protection. Confirm module color with Owner's Engineer prior to ordering. In all cases, SCS Contractor is responsible to coordinate appropriate module with District prior to ordering material.
- C. Product Specification: Circa Telecom #1800ECA-100, #3B1FS-240, #4B3S-75, Emerson, Marconi or approved equal.

## 2.12 GROUNDING SYSTEM AND CONDUCTORS

- A. The SCS Contractor shall utilize a solid copper Bonding Conductor for Telecommunications (BCT) as provided by the Electrical Contractor. The SCS Contractor shall terminate BCT cable(s) on SCS Contractor-provided telecommunications ground bus bars located at the interim housing IDF Room, or as otherwise indicated on the drawings.
- B. Telecommunications ground bus bars shall be ANSI/TIA-607-B compliant and UL Listed. Telecommunications Ground Bus bars (TGB) in the IDF room shall be Panduit #GB2B0304TPI-1 or as noted on the drawings. Wall and floor mounted cabinets each require horizontal rack ground bus bar and shall be mounted in the top rail position at the rear of the cabinet. All communication system bonding and grounding shall be in accordance with the ANSI/TIA-607-B, the CEC and NFPA.
- C. Shielded horizontal cables shall be grounded in compliance with ANSI/NFPA 70 and local requirements and practices.
- D. Horizontal equipment including cable trays, ladder trays, cabinets, racks, frame work, terminal cabinets, and conduits over 10 feet in length that enter the MDF/IDF room, shall be bonded to the TMGB/TGB ground bus bars utilizing a #6-AWG green insulated conductor with 2-hole compression-type grounding lugs. Cabinets, racks, frames, trays, and other enclosures in the IDF room shall not be bonded serially (daisy-chained); each shall have their own dedicated #6AWG bonding conductor to the TGB.
- E. Conduit sleeves less than 10 feet in length do not require to be bonded to ground.
- F. All connections shall be bare metal to bare metal using appropriate antioxidant compound. Mechanical-type (screw type) grounding lugs and terminals (e.g. CPI #40167-001, Hubbell #HGBKA6U) are prohibited. Minimize the length and number of bends of the grounding conductors to the busbar.

- G. Attachment to every IDF cabinet and rack shall be made as follows:
1. Floor Mounted Cabinet/Racks - Install a dedicated copper horizontal ground busbar strip in the top rail position at the rear of each rack and cabinet. Attach the ground conductor using a 2-hole compression lug and (2) standard bolts with (2) "type B" internal-external tooth lock washers per bolt. Minimize the length and number of bends of the grounding conductor from the cabinet to the TGB busbar.
  2. Electronic equipment and equipment mounted within cabinets/racks shall be bonded to the cabinet/rack-mounted horizontal bus bar in accordance with the manufacturer's instructions. Where instructions are not given, provide all bonding jumpers from the equipment to the bus bar with a #12AWG green ground conductor (minimum).
- H. All ladder tray, ladder runway, and basket tray shall be bonded to the TGB bus bar. Each section of runway and tray shall be bonded together. Attach bonding straps to each ladder tray section by utilizing either two (2) tri-lobular thread-forming screws (not self-tapping or sheet metal screws) or by using two (2) standard bolts with two (2) "Type B" internal-external tooth lock washers per bolt. If thread-forming screws are not used, remove paint at each connection point and use an approved anti-oxidant prior to attaching the bonding strap. Provide a #6AWG green ground conductor from the TGB to the nearest section of ladder runway and connect with a 2-hole compression connector.
- I. The SCS Contractor shall be responsible for providing an approved ground at all newly installed distribution frames, and/or insuring proper bonding to any existing facilities. The SCS Contractor shall also be responsible for ensuring ground continuity by properly bonding to the TGB all appropriate cabling, cable sheaths, circuit protectors, enclosures, cabinets, racks, service boxes, framework, etc.
- J. SCS Contractor shall label both ends of each grounding conductor as close as practical to the point of termination in a readable position. Ground tag must indicate the location of both ends of the ground conductor (e.g. Rack#1 to TGB) and tag must include the warning "If this connector or cable is loose or must be removed, please call the Owner's Telecommunications Manager".

## 2.13 EQUIPMENT RACKS

- A. Equipment racks shall be provided in the sizes and quantity as indicated on the plan drawings.
- B. Racks shall be 7-foot high, 45 available rack units of space, 2-post, 3" deep equipment channels, heavy duty construction, black in color, and UL Listed unless otherwise noted on the plan drawings.
- C. Floor mounted racks shall be anchored to the structural floor below per the anchorage detail on the plan drawings.
- D. Equipment racks shall come equipped with two (2) 7-foot high vertical cable managers with covers. Install one manager on each side of the rack. Managers shall be double-sided, and be available in 6" and 10" widths.

- E. Floor mounted open racks shall be secured from the base to the structural floor to prevent movement, and secured to ladder tray sections installed above. Contractor shall provide and install a minimum of four (4) fasteners/anchors per floor mounted rack. Fasteners installed to the structural floor shall be torqued to the "fastener manufacturer's" recommendation.
- F. Product Specification: Rack: Chatsworth 2-post rack #55053-503, vertical cable manager: Chatsworth double-sided manager 6" and 10" wide : #13912-703 , #13914-703

## 2.14 BACKBOARDS

- A. Where indicated on drawings, provide new plywood terminal backboards. Use Douglas Fir Plywood, A/C grade, finished side face out, and prime coat painted on all surfaces with a finish coat of white enamel paint. On each plywood sheet leave one (1) Fire Marshal Stamp unpainted for inspection. Unless otherwise indicated, use 8'-0" high x length as shown on drawings x 3/4" thick plywood.
- B. Provide painted plywood backboard to cover entire IDF room, regardless if plywood backboard is called for in the plan drawings or not. Plywood shall be lag-screwed to wood stud walls with a minimum of four (4) lag screws per wall stud for a total of twelve (12) lag screws (minimum).

## 2.15 LADDER RUNWAY TRAY

- A. Contractor shall provide and install a complete ladder runway system as shown on the plan drawings.
- B. Ladder runway specifications are shown in the Ladder Runway details located on the plan drawings.
- C. Provide all ladder runway sections, wall and ceiling supports, connections, fittings, cable guides/dropouts, etcetera as required for a complete system.
- D. Ladder runway, tray, and basket shall be bonded to the Telecommunications bus bar (TGB) per this document, and in accordance with the Ladder Runway Detail shown on the plan drawings.
- E. Product Specification:
  - 1. 12" Cable Runway : CPI #10250-112, or approved equal.

## 2.16 WIRELESS ACCESS POINTS (WAP)

- A. Contractor shall provide and install wireless access point devices and mounting accessories at locations shown on plan drawings.
- B. Ceiling mounted WAPs shall be installed to t-grid dropped ceiling using the appropriate mounting bracket provided by device manufacturer.
- C. Configuration and programming of access points with the existing Wi-Fi network to be completed by District IT personnel.

D. Product Specifications:

1. Access Point: Aerohive #AP230

**2.17 UNSPECIFIED EQUIPMENT AND MATERIAL**

- A. Any item of equipment or material not specifically addressed on the drawings or in this document and required to provide a complete and functional SCS installation shall be provided in a level of quality consistent with other specified items.

**2.18 FIRE RATED PATHWAY**

- A. The firewall through-penetration shall be a manufactured, UL Classified, firestop device/ system designed to allow cables to penetrate fire-rated walls with a built-in fire sealing system that automatically adjusts to the amount of cables installed.
- B. The firestopping device shall be capable of installation in new construction or retrofit in existing structures.
- C. The device shall be UL Tested and Classified in accordance with ASTM E814 (UL 1479) and with ratings up to and including 2 hours.
- D. Manufacturer: Specified Technologies Inc., EZ-Path (#EZDP33FW) or equal by Wiremold.

**PART 3 - EXECUTION**

**3.1 GENERAL INSTALLATION REQUIREMENTS**

- A. The wiring of the system shall be executed in accordance with the drawings and the equipment manufacturer's wiring diagrams. Should any variations in these requirements occur, the Contractor shall notify the District's Project Manager before making any changes. It shall be the responsibility of the manufacturer-authorized distributor of the approved equipment to install the equipment and guarantee the system to operate as per plans and specifications.
- B. Furnish all conductors, equipment plugs, terminal strips, etc., and labor to install a complete and operable system.
- C. The cables within the rack or cabinets shall be numbered for identification using machine generated labels wrapped around the cable jacket within 6 inches of termination point. Refer to Labeling Requirements section of this document for additional requirements. Hand written labels are prohibited.
- D. Splicing of any cable is not acceptable.
- E. The labor employed by the Contractor shall be regularly employed in the installation and repair of communication systems and shall be acceptable to the District's Project Manager to engage in the installation and service of this system.
- F. The Contractor shall thoroughly clean all equipment and materials. All exposed parts

of the equipment, cabinets, and other equipment shall be left in a clean condition, unblemished and free of all dirt, dust, smudges, spots, fingerprints, etc. The Contractor shall remove all debris and rubbish created in the course of this project. The Contractor shall thoroughly clean all buildings of any dirt, debris, rubbish, marks, etc., caused by the performance of this work.

- G. The system must meet all local and other prevailing codes.
- H. All cabling installations shall be performed by qualified and manufacturer-trained technicians.
- I. Cable lubricants (i.e. Polywater) shall be used to reduce the cable pull tension stated by the cable manufacturer during cable installation in conduits and innerduct. Contractor shall verify the acceptability of the lubricant to be used with the cable manufacturer, prior to using such a lubricant. Lubricants that harden after installation are not allowed. Submit all proposed lubricants for approval PRIOR to use on low voltage, A/V, coax, fiber, and data cable installation. Cable lubricants shall be allowed to dry a minimum of 15 days before performing cable certification tests.
- J. Cables may be run exposed above ceilings, provided the cabling is supported independent of other utilities such as conduits, pipes, and the ceiling support systems. Contractor shall provide/install all hanger wire, threaded rod, j-hooks, etc. as required. The Contractor shall include all costs in base bid for any additional supports/seismic bracing required by the Local Authority having Jurisdiction. The cables shall not be laid directly on the ceiling panels. The cable jacket composition must meet local and all other prevailing fire and safety codes.
- K. The cable jacket composition must meet local and all other prevailing fire and safety codes.
- L. All firewalls penetrated by structured cabling trays, wireways, or conduit shall be sealed by use of a non-permanent fire blanket or other method in compliance with the current edition of NFPA and the CEC or other prevailing code and must be a system listed by UL. The Contractor must not use concrete or other non-removable substance for fire stopping on cable trays, wireways or conduits. Contractors who use this method will be required to replace all cables affected and provide the original specified access to each effected area. This requirement also applies to maintaining fire ratings of all floors penetrated by conduits or devices designated for use by voice and data cabling.
- M. All floor mounted equipment racks/cabinets shall be bolted to the structural floor by the SCS Contractor in the location shown on drawings. Wall mounted racks and wall mounted cabinets shall be secured to studs, not drywall.
- N. Any cable damaged or exceeding recommended installation parameters during installation shall be replaced by the Contractor before final acceptance at no cost to the Owner.
- O. The cable manufacturer's minimum bend radius and maximum pulling tension shall not be exceeded.
- P. Cable raceways, when required, shall not be filled greater than the CEC maximum fill

for the particular raceway type.

- Q. Roof penetrations are prohibited. No conduit shall be installed on roofs or route horizontally on exterior walls.

### 3.2 SPECIFIC SYSTEM INSTALLATION REQUIREMENTS

- A. All communications cabling used throughout this project shall comply with the requirements as outlined in the CEC Articles 725, 760, 770, and 800 and the appropriate local codes. All copper cabling shall bear UL listed type CMP (Plenum Rated) and/or CM/G (General Purpose) and/or CMR (Riser Rated). All fiber optic cabling shall bear OFNP (Plenum Rated) and/or OFNR (Riser Rated) and/or OFN/G (General Purpose). SCS Contractor is responsible for installing appropriately rated cable for the environment in which it is installed.
- B. Cable Pathways:
1. In suspended ceiling, accessible ceiling, and raised floor areas where duct, cable trays or conduit are not available, the Contractor shall bundle, in bundles of 48 or less, station or other cabling. Cable bundles shall be supported via "J" hooks attached to the existing building structure and framework at a maximum of five (5) foot intervals. Cable ties and Velcro fasteners shall not be installed around bundles located in suspended or accessible ceiling spaces. In areas where two or more bundles are traveling in close proximity, utilize a Chatsworth Rapid-Trak Cable support system. The Contractor shall adhere to the manufacturers' requirements for bending radius and pulling tension of all cables.
  2. cables or J-hooks shall not be attached to lift out ceiling grid supports or laid directly on the ceiling grid.
  3. Cables or J-hooks shall not be attached to or supported by fire sprinkler heads, HVAC ducts, or delivery systems or any environmental sensor located in the ceiling air space.
  4. Where additional conduit(s)/sleeve(s) are required, but not provided by the electrical Contractor, the SCS cabling Contractor shall be responsible to provide such conduit(s)/sleeve(s). Conduit(s) and sleeve(s) shall be of suitable material, sized, installed, fire-stopped, and grounded as required by the NEC, ANSI/TIA/EIA standards and all other applicable codes and standards. Any conduit(s) and sleeve(s) added by the SCS Contractor shall be approved by the District's Project Manager prior to rough-in.
  5. Any exposed conduit and associated hardware installed by the contractor shall be painted to match surrounding surfaces.
  6. All J-hooks shall be rated and designed for Category 6A cabling.
- C. Sealing of openings between floors, into or through rated fire and smoke walls, existing or created by the Contractor for placement of new or removal of old cable into or through shall be the responsibility of the Contractor. Sealing material (Approved UL listed system) and application of this material shall be accomplished in such a manner that is acceptable to the local fire and building authorities having



jurisdiction over this work. Creation of such openings as are necessary for cable passage between locations as shown on the drawings shall be the responsibility of the Contractor's work. Any openings created by or for the Contractor and left unused shall also be sealed as part of this work.

1. Fire stopping work shall be performed by a single Contractor to maintain consistency and accountability on the project.
  2. The Contractor shall install penetration firestop seal materials in accordance with design requirements, and manufacturer's instructions.
  3. The Contractor's installer shall be certified, licensed or otherwise qualified by the firestopping manufacturer as having been provided the necessary training to install manufacturer's products per specified requirements.
  4. All installed through penetration firestops shall be identified via label, or stencil. Label shall state that the fill material around the penetrating item is a firestop, and that it shall not be disturbed unless by an authorized Contractor. The label shall include the firestop brand name, and the classified system number for which it was installed.
    - a. Sample Firestop Assembly Label:  
MANUFACTURER'S NAME:  
ATTENTION  
Fire Rated Assembly  
For Any Changes To This System, Please Refer To UL System Listed Below  
PRODUCT:  
HOUR RATING:  
UL SYSTEM:  
INSTALLATION DATE:  
INSTALLED BY: (Contractor's Company name)  
CONTRACTOR LICENSE NUMBER:  
BUSINESS PHONE:  
EMAIL ADDRESS:
- D. The Contractor shall be responsible for damage to any surfaces or work disrupted as a result of his work. Repair of surfaces, including painting, shall be included as necessary.
- E. Cable bundles within the IDF shall be dressed into bundles of no more than twenty-four (24) cables. Maintain each bundle with half inch-wide hook and loop strips spaced every twelve (12) inches maximum.
- F. The Contractor shall install all patch cords per direction of the District's project manager in a neat and systematic fashion. Prior to installing all patch cords, the Contractor shall install patch cords in a single rack to demonstrate work practices to the District's project manager. Only after any corrections/modification to the installation as directed by the District's project manager, may the Contractor continue installing the patch cords in the remaining racks.
- G. Each equipment rack requires its own dedicated grounding connection to the

grounding infrastructure. Grounding infrastructure shall consist of a dedicated #6 AWG (min.) green conductor from every rack/cabinet back to the TGB. All ground conductor attachments to the TGB shall utilize 2-hole compression lugs. See Section 2.13 Grounding System and Conductors of this document for more information.

- H. Rack/cabinet mounted equipment shall be grounded via the chassis, in accordance with manufacturer's instructions. The equipment chassis shall be bonded to the rack/cabinet using one of the following methods:
  - 1. If the equipment has a separate grounding hole or stud, use a #10-AWG ground wire from the chassis ground hole/stud to the rack grounding bus.
  - 2. If the manufacturer suggests grounding via the chassis mounting flanges, use tri-lobular thread-forming screws (not self-tapping or sheet metal screws) to attach the equipment to the rack/cabinet rails. If the equipment mounting flanges are painted, remove the paint and apply an anti-oxidant, or use tri-lobular thread-forming screws and two (2) "Type B" internal-external tooth lock washers to safely ground equipment to the rack.
- I. Bonding of ladder tray sections- Attach bonding straps to each ladder tray section by utilizing either two (2) tri-lobular thread-forming screws (not self-tapping or sheet metal screws) or by using two (2) standard bolts with two (2) "Type B" internal-external tooth lock washers per bolt. If thread-forming screws are not used, remove paint at each connection point and use an approved anti-oxidant prior to attaching the bonding strap.
- J. All installation shall be done in conformance with TIA/EIA 568-C standards, BICSI TDMM guidelines and manufacturer's installation guidelines. The Contractor shall ensure that the maximum pulling tensions of the specified distribution cables are not exceeded and cable bends maintain the proper radius during the placement of the facilities. Failure to follow the appropriate guidelines will require the Contractor to provide, in a timely fashion, any additional material and labor necessary to properly rectify the situation to the satisfaction and written approval of the District's Project Manager. This shall also apply to any and all damages sustained to the cables by the Contractor during the implementation.
  - 1. Bonding and Grounding: All cable sheaths and splice cases shall be grounded to a Telecommunications Ground Bus. All grounding must be in accordance with the NEC, NFPA, ANSI-J-STD-607-B and all local codes and practices. The Electrical Contractor shall be responsible for providing a properly sized grounding conductor from the main electrical ground to the telecommunications ground bus in the IDF room. The SCS Contractor shall be responsible to provide the telecommunications busbar, attach the Electrical Contractor-provided ground conductor, and bond all required equipment and components within each IDF to the busbar.
  - 2. Power Separation: The Contractor shall not place any distribution cabling alongside power lines, or share the same conduit, channel or sleeve with electrical apparatus. Maintain a minimum of 12 inch separation from light fixtures.
  - 3. Miscellaneous Equipment: The Contractor shall provide any necessary screws,

anchors, clamps, hook & loop ties, distribution rings, wire molding (IDF locations), miscellaneous grounding and support hardware, etc., necessary to facilitate the installation of the System.

4. **Special Equipment and Tools:** It shall be the responsibility of the Contractor to furnish any special installation equipment or tools necessary to properly complete the System. This may include, but is not limited to, tools for terminating cables, testing and splicing equipment for copper/fiber cables, communication devices, jack stands for cable reels, or cable winches.
5. **Labeling:** The Contractor shall be responsible for printed labels for all pull boxes, conduits, cables, protectors, racks, cabinets, patch panels, connector panels, cords, distribution frames, and outlet locations, according to the specifications. No labels are to be written by hand. Contractor shall submit sample of all labeling schemes for Owner's consideration and approval prior to final label installation. Final label scheme shall be by direction and approval of the Owner.
6. **Cable Storage:** The Contractor shall not roll or store cable reels without an appropriate underlay and the prior written approval of Owner's Project Manager.
7. **Cable Records:** The Contractor shall maintain conductor polarity (tip and ring) identification at the main equipment room (MDF), IDF rooms, and station connecting blocks in accordance with industry practices, but only in locations authorized by the Owner's Project Manager. Contractor to provide an Excel spread sheet for all outdoor backbone and indoor riser backbone cables tested. Include in close-out deliverables package.

### 3.3 STRUCTURED CABLING GENERAL INSTALLATION DESCRIPTION

- A. The structured cabling system shall consist of any or all of the following subsystems:
  1. Work Area Subsystem
  2. Horizontal Subsystem
  3. Administration Subsystem
  4. Backbone Subsystem
  5. Equipment Subsystem
- B. **Work Area Subsystem:** The Work Area Subsystem provides the connection between the telecommunications outlet (TO) and the station equipment in the work area. It consists of cords, adapters, and other transmission electronics.
  1. Contractor shall supply the wiring or cords that connect terminal devices to telecommunications outlets. This includes mounting cords and connectors, as well as extension cords.
- C. **Horizontal Subsystem:** The Horizontal Subsystem provides connections from the horizontal cross connect to the telecommunications outlets in the work areas. It consists of the horizontal transmission media, the associated connecting hardware

terminating this media and outlets in the work area. Each floor of a building is served by its own Horizontal Subsystem(s).

1. Horizontal Cabling

- a. Contractor shall supply horizontal cables to connect each telecommunications outlet to the backbone subsystem as shown on the drawings.
- b. Unless otherwise noted on the floor plans or within this document, the type of horizontal cables used for each work location shall be 4-pair unshielded twisted pair (UTP).
- c. The 4-pair UTP cables shall be run using a star topology format from the administration subsystem to every individual telecommunications outlet. All cable routes, other than those dictated on the drawings, are to be approved by District's Project Manager prior to installation.
- d. The length of each individual run of horizontal cable from the administration subsystem to the telecommunications outlet shall not exceed 295-ft (90 m).
- e. Contractor shall observe the bending radius and pulling strength requirements of the 4-pair UTP cable during handling and installation.
- f. Each run of cable between the termination block and the telecommunications outlet shall be continuous without any joints or splices.
- g. All station cable shall be placed in the interior of walls unless otherwise noted in the bid documents/plan drawings.
- h. In the event Contractor is required to remove ceiling tiles, such Work shall not break or disturb the ceiling grid. Removal of the ceiling grid must be coordinated with the Owner's Project Manager. All insulation shall be replaced in its original location. Contractor shall be responsible to replace any ceiling tiles that they damage during the course of their work, at no additional cost to the District.
- i. Avoid electromagnetic interference (EMI) by maintaining adequate physical separation between telecommunications cabling and possible sources such as, but not limited to, electric motors, electric erasers, electric pencil sharpeners, transformers, fluorescent lighting that share distribution space with telecommunications cabling, copiers that share work area space with line cords and terminals, large fax machines and power cords that supports such equipment. Minimum separation shall be six (6) inches.
- j. Contractor shall provide District's Project Manager with detailed cable run diagrams for cable runs within raised floors (if shown on plans) detailing exact locations of cable for review and written approval by Owner's Project Manager.

- k. Conduit runs installed above grade by the Contractor should not exceed 100 feet or contain more than two 90 degree bends without utilizing appropriately sized pull box. Pull boxes are not to be used in lieu of a bend.
  - l. Station cables and riser cables installed within ceiling spaces shall be routed through these spaces at right angles to electrical power circuits.
  - m. Each station cable shall have 10 feet of service slack configured in an "S" shape via J-hooks at the IDF rack or wall field end, and 1 foot of service loop at station outlet end. Service slack shall be installed in a neat and "workmanship like" manner.
- D. Administration Subsystem: The Administration Subsystem links all of the subsystems together. It consists of labeling hardware for providing circuit identification and patch cords or jumper wire used for creating circuit connections at the cross connects. All wallfield layouts must be approved by Owner's Project Manager prior to rough-in and installation.
- 1. Separate termination fields shall be created for voice/data, wireless access points, paging, surveillance cameras, clocks, and building energy management system applications.
  - 2. Termination blocks that require rotation after connection of horizontal/vertical wiring will not be allowed.
  - 3. Contractor shall supply cross-connect wire, patch cords and fiber patch cords for cross-connection and inter-connection of termination blocks and lightguide interconnection units.
- E. Backbone Subsystem:
- 1. The main cable route between two or more buildings is called the Backbone Subsystem. It links the main distribution frame (MDF) in the equipment room to each intermediate distribution frame (IDF). It consists of the backbone transmission media between these locations and the associated connecting hardware terminating this media. It is normally installed in a star topology, with first-level backbone cables beginning at the main cross connect. If needed, second-level backbone cables begin at intermediate cross connects.
  - 2. All backbone fiber optic cable(s) will be run in innerduct and terminated in the MDF/IDF Rooms, or as otherwise indicated on the plan drawings, with connectors, type as specified elsewhere, in rack mounted or wall mounted fiber patch panels equipped with sufficient panels, couplers and jumper storage shelves to terminate and secure all fibers. All innerduct (Carlson or equal) shall be corrugated and a minimum of 1" in diameter unless otherwise indicated on plans. Innerduct shall be plenum, riser or general rated as required by the environment in which it is to be installed. Innerduct capacity shall not exceed 40 percent fill.
  - 3. All backbone multipair copper cable(s) will be terminated in the MDF/MPOE/IDF rooms, or as otherwise indicated on the plan drawings. Backbone multipair cable shall be terminated on building entrance fused protectors as specified elsewhere

in this document. The minimum pair count for multipair copper cable between buildings shall be 25-pairs. Refer to bid documents/plan drawings for any additional required pairs.

- F. Equipment Room Subsystem: The Equipment Subsystem consists of shared (common) electronic communications equipment in the equipment room or telecommunications closet and the transmission media required to terminate this equipment on distribution hardware.

### 3.4 DAMAGES

- A. The Contractor will be held responsible for any and all damages to portions of the building caused by it, its employees or sub-Contractors; including but not limited to:
  - 1. Damage to any portion of the building caused by the movement of tools, materials or equipment.
  - 2. Damage to any component of the construction of spaces.
  - 3. Damage to the electrical distribution system.
  - 4. Damage to the electrical, mechanical and/or life safety or other systems caused by inappropriate operation or connections made by the Contractor or other actions of Contractor.
  - 5. Damage to the materials, tools and/or equipment of the Owner, its consultants, agents and tenants.

### 3.5 PENETRATIONS OF WALLS FLOORS AND CEILINGS

- A. Unless specifically shown on the drawings, the Contractor shall make no penetration of floors, walls or ceiling without the prior written approval of the Owner's Project Manager.
- B. Any penetrations through acoustical walls or other walls for cable pathways/cables shall be sealed by the Contractor in compliance with applicable code requirements and as directed by Owner's Project Manager.
- C. Any penetrations through fire-rated walls for cable pathways/cables shall be sealed by the Contractor as required by code and as directed by Owner's Project Manager. The Contractor shall be required to work together with the General Contractor and the Electrical Contractor to coordinate and develop all fire stopping methods prior to any cable installation. The Contractor shall also, prior to the commencement of on-site activities, submit to Owner's Project Manager, details of any special systems to be used.
- D. Roof penetrations are prohibited. No conduit shall be installed on roofs or route horizontally on exterior walls.

### 3.6 TESTING/WARRANTY

- A. Structured Cabling System

1. The Contractor shall provide competent, test equipment manufacturer-trained engineers and/or technicians, authorized by the manufacturer of the cabling system, to technically supervise and participate during all tests for the systems.
2. The Contractor shall test and certify the cabling system to minimum standards as set forth in the TIA/EIA-568-C specifications for 100BaseTX Ethernet and for Category 6A cable, token ring, and 1000baseT signals.
3. All cables and termination hardware shall be 100% tested for defects in installation and to verify cable performance under installed conditions. All conductors of each installed cable shall be verified usable by the Contractor before system acceptance. Any defect in the cable system installation including but not limited to cable, connectors, feed-through couplers, patch panels, splices, and connector blocks shall be repaired or replaced in order to ensure 100% useable conductors in all cables installed.
4. Each cable shall be tested for continuity on all pairs and/or conductors. Twisted-pair voice cables shall be tested for length, continuity, pair reversals, opens, shorts, transpositions, presence of AC and DC voltages and opens. Twisted-pair horizontal cables shall be tested for the all of the above requirements, plus tests that indicate installed cable performance. Catgegory-6A cables shall be tested using a TIA-568-C.2-1 Category 6A Level III/IEC 61935 Level III or better, ETL certified cable tester/analyzer.
5. Shielded/screened cables shall be tested with a device that verifies shield continuity in addition to the above stated tests.
6. The test shall be recorded as pass/fail as indicated by the test set in accordance with the manufacturers recommended procedures, and referenced to the appropriate cable identification number and circuit or pair number. Any faults in the wiring shall be corrected and the cable re-tested before final acceptance.
7. Each installed cable shall be tested for installed length using a Time Domain Reflectometer (TDR) type device. The cables shall be tested from patch panel to patch panel, block to block, patch panel to outlet or block to outlet as appropriate. The cable length shall conform to the maximum distances set forth in the TIA-568-C Standard. Cable lengths shall be recorded, referencing the cable identification number and circuit or pair number.
8. Multi-pair cables, record the following tests on every cable pair in each multipair cable using a TDR type device: record the shortest pair length, continuity, pair reversals, shorts, opens, transpositions, presence of AC and DC voltage.
9. Cat 6A data cable shall be performance verified using an automated test set. This test set shall be capable of testing for the continuity and length parameters defined above, and provide results for the following tests:
  - a. Attenuation (Insertion Loss).
  - b. Return Loss (RL).
  - c. Near End Crosstalk (NEXT) – measured at both ends of each cable pair.

- d. Attenuation to Crosstalk Ratio (ACR).
  - e. Power Sum Near End Crosstalk (PSNEXT).
  - f. Power Sum Attenuation to Crosstalk Ratio (PSACR).
  - g. Far End Crosstalk (FEXT).
  - h. Equal Level Far End Crosstalk (ELFEXT).
  - i. Power Sum Equal Level Far End Crosstalk (PSELFEXT).
10. Test results shall be automatically evaluated by the equipment, using the most up-to-date criteria from the ANSI/TIA/EIA Standard, and the result shown as pass/fail. Test results shall be printed directly from the test unit or from a download file using an application from the test equipment manufacturer. The printed test results shall include all tests performed, the expected test result, and the actual test result achieved.
11. Optical Fiber Cable Testing: All fiber testing shall be performed on all fibers in the completed end to end system by test equipment manufacturer-trained engineers and/or technicians. There shall be no splices unless clearly defined in Section 3 of this specification or on the plan drawings. Testing shall consist of a bi-directional end to end OTDR trace performed per ANSI/TIA/EIA 455-61 & ANSI/TIA/EIA 526 and a bi-directional end to end power meter test performed per ANSI/TIA/EIA 455-53A. The system loss measurements shall be provided at 1310 and 1550 nanometers for single mode fibers.
- a. Pre-installation cable testing: The Contractor shall test all fiber optic cable prior to the installation of the cable. The Contractor shall assume all liability for the replacement of the cable should it be found defective during the warranty period.
  - b. Loss Budget: Fiber links shall have a maximum loss of: (allowable cable loss per km) x (km of fiber in link) + (.4dB) x (number of connectors) = maximum allowable loss.
  - c. Any link not meeting the requirements of the standard shall be brought into compliance by the Contractor, at no additional charge to District.
12. The Contractor shall provide test documentation to the District's Project manager in a three ring binder(s) and in CD format within three weeks after the completion of a specific project. The binder(s) shall be clearly marked on the outside front cover and spine with the words "Test Results", the project name, and the date of completion (month and year). The binder shall be divided by test type. A paper copy of the test results shall be provided that lists all the links that have been tested, and include link name, overall pass/fail evaluation, date and time of test, cable type and NVP value. Detailed test results shall be provided for each link tested and shall include length, propagation delay, delay skew, insertion loss, return loss, NEXT, ELFEXT, ACR, PSNEXT, PSELFEXT, and PSACR. Detailed test results for each link will also include customer site name, name of standard selected to execute the tests, date and time test results were saved in memory of



test unit, brand name model and serial number of tester and revision of the tester software and test standards database in the tester. Individual test data within each section shall be presented in the sequence listed in the test summary records. Unless a more frequent calibration cycle is specified by the manufacturer, an annual calibration cycle is anticipated on all test equipment used for this installation.

13. When repairs and re-tests are performed, the problem found and corrective action taken shall be noted, and both the failed and passed test data shall be collocated in the binder.
14. The entire SCS system shall be warranted free of mechanical or electrical defects by the Contractor for a period of one year after final acceptance of the installation.
15. Any equipment that is not installed per the manufacturer's recommendation shall be replaced promptly and at no cost to the District.
16. Any material showing mechanical or electrical defects shall be replaced promptly at no expense to the District.
17. Provide all labor and material warranties for each system, as described elsewhere in this document.
18. At the District's direction, the Contractor shall perform additional random testing which shall consist of a random sample of up to 10% of each installation distribution system. The Contractor shall assume responsibility for providing the proper test equipment and staff to conduct tests. The District's representative shall witness the tests.
19. Should the initial 10% test not be 100% successful (all drops testing over CAT6A up to 500MHz), the Contractor shall assume responsibility to repair/replace non-passing links, at the direction of the District, and the links to re-verify and resubmitted. A 20% random sample shall then be conducted to ensure proper performance of the system.
20. Should there be failure in this re-test, the Contractor shall be responsible to repeat the re-test procedure until such time as all cabling is verified.

### 3.7 COMPLETION OF WORK:

- A. At the completion of the Systems, the Contractor shall restore to its former condition, all aspects of the project site and on a daily basis, shall remove all waste and excess materials, rubbish debris, tools and equipment resulting from or used in the services provided under this Contract.
- B. All clean up, restoration, and removal noted above will be by the Contractor and at no cost to Owner. If the Contractor fails in its duties under this paragraph, Owner may upon notice to the Contractor perform the necessary clean up and deduct the costs thereof from any amounts due or to become due to the Contractor. It shall be the Contractor's responsibility to remove trash from the areas it is working in and bring trash and debris to the Contractor provided dumpster.

### 3.8 INSPECTION

- A. On-going inspections shall be performed during construction by the District's representative. All work shall be performed in a high quality manner and the overall appearance shall be clean, neat and orderly. Any work that does not meet the District's representative's approval shall be removed and reinstalled by the Contractor at no additional cost to the District.

### 3.9 LABELING REQUIREMENTS

- A. Numbers must be assigned to each outlet location using a logical designation convention. Blueprints with the outlet placement and configuration information have been furnished to the Contractor. Contractor will provide the equipment as necessary to generate Panduit PAN-CODE (or Equal) laser printer generated self-laminating labels using the numbering convention shown below and as specified herein. Before any permanent labels are installed on blocks, face plates or cables, Contractor shall submit a sample label of each various type listed below to District's Project Manager for written approval to ensure compliance with the labeling scheme, legibility, etc. Contractor is responsible to provide the labeling scheme as described herein.
  - 1. Plate numbering advances clockwise around room. Plate 01 begins on the left side closest to the entrance door. Numbering restarts for each subroom.
- B. Station Faceplate (Telecommunications Outlet) Labeling. The following is illustrative of the number convention to be used:
  - 1. Top Window Example: LE2.1-E261-01
    - a. "LE2.1" = IDF room identifier where cables originates within the building.
    - b. "E261" = The work area room number
    - c. "01" = outlet faceplate number. Sequential outlet number with the room.
  - 2. Bottom Window: blank. For future use.
  - 3. Faceplate jacks shall be numbered sequentially from top to bottom, and left to right. Individual jack labels shall restart per outlet/faceplate.
- C. Network Switch Labeling. All rack mounted Ethernet edge switches shall be sequentially numbered. Number shall be printed and attached to the left edge and centered. Numbers shall be minimum 1/2" high and printed white on a black background.
- D. Patch Panel Labeling. All copper category 6A rack mounted patch panels shall be sequentially numbered, beginning with the uppermost panel in the rack. Patch panel number shall be printed and attached to both left and right edges and centered. Numbers shall be minimum 1/2" high and printed white on a black background. Patch panel ports shall be labeled with the corresponding room number where the cable's faceplate is located. Cables shall be terminated sequentially by room number and faceplate order.

- E. Station Cable Jacket Labeling. All Category 6A cables shall be labeled within four inches of each termination end (e.g., at both ends, outlet end and MDF/IDF end) using machine-generated, "P-Touch" type, self-laminating cable markers.
1. Example: LE2.1-E261-01-D1-CAT6A
  2. "LE2.1" = IDF room identifier. location where cable originates.
  3. "E261" = Work area room number.
  4. "01" = Outlet/faceplate identifier in work area room
  5. "D1" = Port Identifier. First data port on outlet
  6. "CAT6A" = Cable type.
- F. Backbone Cable Labeling. All backbone cables (copper, fiber, coax, etc) will be labeled to reflect the origin and destination abbreviation for the cable and pair counts on large font (16 pitch) self-laminating labels, which shall be located within 18 inches of each end of the cable. Labels shall be placed on the cable to be visible without relocating surrounding cables.
1. Example #1: AD1.1-AD3.1-F6-01-12
  2. "AD1.1" = The originating room ID.
  3. "AD3.1" = The Destination room ID
  4. "F6" = the cable type.
    - a. Type Code : "F" = Fiber optic, "T" = Twisted pair
    - b. Type Code : "S" = Singlemode, "5" = 50/125 multimode, "6" = 52.5/125 multimode
  5. "01": Beginning strand count served from originating room.
  6. "12" ending strand count served from originating room.
- G. Multipair Cable Termination Block Labels. All multipair cables will be labeled using appropriate terminal-block label strip with label holders. Termination blocks shall be labeled in such a manner to indicate Termination Block number (ex: W1, W2, etc) and type of cables (ex. Fire Alarm-FA, Security Alarm-SE, Paging-PA, FAX machine, etc.).
1. Termination Block Label:
  2. Example: W1 – Alarm Cables 1st Floor
  3. W1: Wall Field 100-pair 110-block #1
  4. Individual cable numbers on label strip:

5. Example: 001
6. Station #1
- H. Multipair Cable Termination Block Labels. All multipair riser blocks shall be labeled using appropriate terminal-block label strip with label holders and shall follow the labeling scheme outlined above. Building interconnect cable termination block labels shall be per ANSI/TIA/EIA-606-B. Final label scheme shall be determined by the District's decision.
- I. Fiber Enclosure Labels. All fiber enclosures and panels will be labeled using self-laminating laser label markers. Fiber labels shall include all information as specified by the District. Contractor is responsible to provide a labeling scheme that meets with the District's satisfaction. At a minimum, the fiber enclosure label card shall indicate: destination of connected cables, hyphen (-), origination of connected cables, hyphen (-), and the fiber enclosure number and port number.
  1. Example: MDF-IDF2-1-1
  2. MDF: Destination Patch Panel Location Designation
  3. IDF2: Origination Patch Panel Location Designation
  4. 1-1 Indicates fiber enclosure number and fiber port number on both origin and destination fiber enclosures.
- J. Equipment Rack/Cabinet Labeling: All equipment racks/cabinets shall be labeled according to their room identifier and a two-digit number. The labels will be engraved plastic plates, with 1"-high white letters on black background. The labels will be attached to the cross member at the top front of each frame or rack with appropriately sized sheet metal screws. Self-adhesive strips, glues, etc. are unacceptable. Racks and cabinets within the same room shall be numbered sequentially from left to right, when facing the front of the racks/cabinets.
  1. Example: LE2.1-R05
  2. IDF Room Designation : LE2.1 : "L" = Laney Campus, "E" = Building E, "2" = Second Floor, ".1" = First telecom room on floor.
  3. Rack Identifier: "R05" = fifth rack in IDF room.
- K. Innerduct and Fiber Cable Warning Labeling. The Contractor shall provide and install tags of stamped plastic for tube cable and innerduct. The labeling convention described above within Paragraph E shall apply. Additionally, the Contractor will also install fiber optic warning tags (Panduit #PST-FO) every 12 feet on all exposed fiber optic cable and on innerduct containing fiber optic cable installed within the building, also on innerduct and cable visible in each pull box, manhole, and vault.
- L. IDF Floor Plan Mounting Frame: Provide wall mountable floor plan mounting frame with removable Plexiglas front cover in IDF. Frame and cover shall be sized to house 30"x42" floor plan drawing. Coordinate location of frame with District's Project Manager prior to installation.

- M. Telecommunications Main Grounding Busbars (TMGB, TGB): All telecom grounding busbars shall be labeled using large font (16 pitch) self-laminating labels. Labels shall indicate "TMGB" or "TGB". If more than 1 busbar is in the room, include a numerical indication (ex: TMGB-1).
- N. Wireless Access Points: All access points shall be labeled using (16 pitch) self-laminating labels. Each access point shall have a unique identifier that matches the existing labeling system found on campus.

### 3.10 MISCELLANEOUS PROJECT REQUIREMENTS

- A. Site Cleaning: Throughout the progress of the plant construction, the Contractor shall keep the working area free from debris of all types and remove from the premises all rubbish resulting from any work done by Contractor. On a daily basis and at the completion of its work, the Contractor shall, to the extent possible, leave the premises in a clean and finished condition.
- B. Conduits: All backbone cabling will run through dedicated conduits. All new conduits will be supplied with a pull string. Contractor shall supply pull string and pull rope for the installation of all cables in existing conduits. For all conduits left with available capacity, Contractor shall replace pull strings with 1/4-inch pull rope during the course of his work. Contractor must seal all underground low voltage conduits within manholes, underground vaults/pull boxes, and underground conduits that enter a facility, with an approved mechanical water/gas/air tight plug. Unused conduits shall be sealed with a blank plug.
- C. Seismic Requirements: Contractor will install all equipment racks, equipment cabinet enclosures, cable runways, etc. according to DSA and local, state and/or federal code. Contractor will notify District's Project Manager of such requirements and shall provide such bracing as required. Contractor to coordinate all installation with the structural Engineer of Record.
- D. Safety Requirements: Contractor will utilize appropriate personnel and display warning signs, signals, flags and/or barricades at the work site to ensure adherence to safety regulations and as prudence requires.
- E. Specification/Drawing Status: All specifications and drawings related to this project will be "frozen" after shop drawing approval. The District reserves the right to negotiate any future changes with the Contractor at any time.

### 3.11 MISCELLANEOUS SUPPORT REQUIREMENTS

- A. Upon approval of shop drawings, Contractor shall immediately place orders for all required materials, components, and supplies. In addition, Contractor shall secure and forward written confirmations (including orders and shipping dates) direct from each manufacturer/vendor to the District's Project Manager.
- B. Contractor shall expedite shipment of all materials, components and supplies, as necessary to ensure the successful completion of the Project by the date required. All costs for expediting shall be included within Contractor's pricing as provided below.

- C. The system cost herein shall include administration/maintenance training for at least six (6) District representatives with a minimum allotment of two (1) four-hour sessions. All training shall include written and/or video materials that shall remain the property of District. If materials are written, they shall be provided in quantities sufficient for each person trained; if materials are video, one (1) copy of each will be required. The administration/maintenance training shall include, but not be limited to, the following:
1. Review of as-built documentation, including a site demonstration.
  2. All warranty information.
- D. Minimum standards for maintenance purposes shall include optional access to service on a 24 hour-a-day, 365 day-a-year basis. In addition, Contractor shall, upon notification, respond as follows:
1. Emergency Response: Contractor must respond by utilizing remote diagnostics capabilities (as applicable) within thirty minutes of notification. If necessary, Contractor must dispatch at least one certified technician for arrival on-site within two hours of notification.
  2. Non-Emergency Response: Contractor shall respond by utilizing remote diagnostics capabilities and or cause dispatch of at least one certified technician for arrival on-site within one business day of notification.
  3. Definition of "Emergency": For maintenance purposes, "emergency" shall be defined as one or more of the following conditions:
    - a. Defects of any riser pairs and/or components involving at least ten percent (10%) of any riser cable's capacity.
    - b. Defects of station cable pairs and/or components involving at least ten percent (10%) of any department or group of voice and/or data stations.
    - c. Defects significantly impairing any single attendant console.
    - d. Defects of any fiber optic cable and/or components involving at least ten percent (10%) of any department or group's fiber-based systems and/or stations.
    - e. Any pre-defined failure as submitted by District and agreed to be Contractor.

### 3.12 FINAL ACCEPTANCE

- A. The District or District's representative may visit the site during the installation of the system to ensure that correct installation practices are being followed.
- B. The District or District's representative will conduct a final job review once the Contractor has finished the job. This review will take place within one (1) week after the Contractor notifies the District.
- C. Two (2) copies of all certification data and drawings for all identifications shall be provided to the District before the District's review.

- D. The District or District's representative will review the installation and certification data prior to the system acceptance.
- E. The District or District's representative may test some of the systems features to ensure that the certification data is correct. If a substantial discrepancy is found, the District reserves the right to have an independent consultant perform a certification of the entire system. If such a procedure is undertaken, the cost of the testing will be billed back to the Contractor.
- F. In the event that repairs or adjustments are necessary, the Contractor shall make these repairs at his own expense. All repairs shall be completed within ten (10) days from the time they are discovered.
- G. The Contractor shall provide two (2) copies of an "operating and servicing manual" for the system within fourteen (14) calendar days of District's final acceptance of the system. The manuals shall be bound in flexible binders. All data shall be printed material or typewritten. Each manual shall include the following: instructions necessary for the proper operation and servicing of the system; complete as-built installation drawings of the system (11"x17"); equipment specification cut sheets, complete performance test data, complete warrantee information and replacement parts list with current prices listed, contact information for repair and warranty work requests.
  - 1. The Contractor shall mount a full size 30" x 42" bond copy of each scaled Site Plan within MDF room and each IDF room with removable Plexiglas front cover. Frame and cover shall be sized to house the site plan and floor plan drawings. Coordinate location of frame with District's Project Manager prior to installation.
  - 2. The Contractor shall hand to the District a copy of any applicable installation specific software configurations including all log-in passwords in CD format.
  - 3. Warranty- Contractor shall provide hard copies of system warranties, as defined and described elsewhere in this document.

**END OF SECTION**

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**SECTION 28 00 00**

**DIGITAL, ADDRESSABLE FIRE ALARM SYSTEM**

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**PART 1- GENERAL**

**1.1 SCOPE**

- A. Fire alarm system shall be manufactured by Simplex per District Standard. No other manufacturers are acceptable.
  - B. The contractor shall furnish and install an analog addressable fire alarm system with integral Emergency Voice/Alarm Communication System, IDP protocol addressable initiation devices and synchronized notification devices. The system shall be Board of Education approved District Standard for Fire Alarm Systems. The Fire Alarm System shall be UL 864, 9th edition compliant and California State Fire Marshal listed.
  - C. By submission of a Prime Bid for this project, the Prime Bidder assumes complete and total responsibility for himself and his subcontractors' compliance with this specification in its entirety. If found to be not in compliance with any part of this specification, the Prime Bidder shall bear any burden, financial or otherwise, required to complete the work of this specification to the total satisfaction of Torrance Unified School District.
- 1. The Fire Alarm System shall be furnished and installed by an Authorized Systems Distributor in good standing at the time of the bid. Upon demand by the owner or his representative, the Prime Contractor shall provide proof that he or his listed subcontractor was a Systems Distributor at the time of the bid. Failure to produce said proof shall render the Prime Contractor's bid non-responsive and shall be considered grounds for immediate disqualification of his prime bid.
    - a. For the purposes of this bid, Prime Bidders shall include the Fire Alarm Contractor on their List of Subcontractors that is submitted with their bid, regardless of subcontractor tier. Failure to list the Fire Alarm Contractor shall render the Prime Bidder in non-compliance with this specification and shall render his bid non-responsive and shall be considered grounds for immediate disqualification of his prime bid.
    - b. The Systems Distributor shall furnish all labor, materials, appliances, cabling, tools, equipment, facilities, transportation and services necessary for and incidental to the performance of all operations in connection with furnishing, delivery and installation of all equipment, cabling, programming, configuration, testing and training required by this Section, complete as indicated in the applicable Contract Drawings and/or specified herein.
  - 1) Systems furnished and/or installed by contractors who are not Authorized Systems Distributor shall be considered in non-compliance with this specification and subject to replacement at the expense of the Prime Contractor.



D. This specification provides the requirements for the installation, programming, configuration, testing and maintenance of a complete analog addressable fire alarm system. This system shall include, but shall not be limited to:

1. Main Fire Alarm Control Panel (FACP)
  - a. Network Nodes (on network systems only)
    - 1) Network Interface Module
    - 2) Fiber optic or copper network connection circuits
  - b. System cabinet
  - c. Power supply
2. Digital Signaling Line Circuits (SLC)
3. Notification Appliance Circuits (NAC)
4. RS-485 Serial Communication Bus (S-bus)
5. Voice Communication Bus (V-bus, on systems with voice evacuation only)
6. Annunciators both integral and remote
7. Batteries
8. Wiring
9. Conduit
10. Associated peripheral devices and modules
11. Other relevant components and accessories required to furnish and install a complete and operational fully automatic, addressable reporting Life Safety System.

E. The fire alarm system shall be capable of providing, at a minimum, the following:

1. Fire Alarm Control Panel (FACP)
  - a. Integral Digital Alarm Communications Transmitter (DACT).
  - b. Network Interface capability via copper and/or fiber optic network.
2. Analog addressable initiation devices
3. Analog addressable monitor and/or control modules
4. Notification appliances
5. Notification Appliance Circuit (NAC) remote power supply

- a. Remote Power Supply
  - b. Combination audible / visual devices
  - c. Built-in synchronization capabilities
6. Integral Voice Evacuation capability
  7. Firefighter Telephone capability
- F. Any material and/or equipment necessary for the proper operation of the system, which is not specified or described herein, shall be deemed part of this Specification.
- G. The Analog Addressable Fire Alarm System specified herein shall be connected to a UL Listed Central Station Monitoring Company via UL and California State Fire Marshal listed radio transmitter.
1. Radio Transmitter for Central Station Monitoring shall be provided
- H. Contractor shall offer code required fire alarm system inspection and maintenance contract.

## 1.2 QUALIFICATIONS

### A. Equipment

1. This specification is based on the equipment of manufacturer(s) who have been approved by the Owner and the Manufacturer(s) herein named shall be considered as meeting the requirements of this specification.
2. The equipment manufacturer shall be a United States manufacturer, who has been regularly engaged in the manufacture of fire alarm systems for at least twenty-five (25) years.
3. It is the Contractor's responsibility to meet the entire intent of these specifications. Deviations from the specified items shall be at the risk of the Contractor until the date of final acceptance by the Architect of Record, Engineer of Record and the Owner's representative. All costs for removal, relocation or replacement of a substituted item shall be at the risk of the Prime Contractor.
4. All equipment shall conform to currently adopted applicable codes and ordinances.
5. All equipment shall be California State Fire Marshal (CSFM) listed.
6. All equipment shall bear the label of a Nationally Recognized Testing Laboratory (NRTL) such as Intertek Testing Services NA, Inc. (ITSNA - formerly ETL) or Underwriters Laboratories Inc. (UL) and be listed by their re-examination service.

### B. System Supplier/Installer

7. The system shall be furnished and installed by an Authorized Systems Distributor who is trained and certified by the Manufacturer in the proper installation,

programming, configuration, testing, service and maintenance of the systems specified herein.

8. Subsequent to a successful bid and upon request of the Owner the System Supplier/Installer shall submit a qualification documentation package which shall include the following:
  - a. Evidence of current status as a Systems Distributor.
  - b. Certificate indicating that the contractor employs a minimum of four (4) Certified Technicians.
  - c. Certificates indicating that a minimum of four (4) technicians have attended and completed all requirements of the training course.
  - d. A list of twenty (20) completed projects of equal scope, with associated Owners Representative contact names and telephone numbers.
  - e. Evidence of current State of California Contractor's License, C-10.
  - f. Evidence of current State of California Alarm Company Operator License, ACO.
  - g. Per California law all individuals involved in the installation of the fire alarm system shall hold a valid State of California, Division of Apprenticeship Standards (DAS), Fire/Life Safety Technician Certification.
    - 1) Evidence of DAS certification shall be provided immediately upon request at the project site.
  - h. The System Supplier/Installer shall show satisfactory evidence, upon request, that he maintains a fully equipped service organization capable of furnishing adequate inspection, service and maintenance of the system.
  - i. The System Supplier/Installer shall maintain at his facility the necessary spare parts in the proper proportion as recommended by the manufacturer to maintain and service the equipment being supplied.
  - j. The System Supplier/Installer shall be prepared to offer a service contract for the maintenance of the system beyond the warranty period.
  - k. The System Supplier/Installer shall provide proof that they maintain a complete service and maintenance center within 50 miles of the project address. A complete service center shall include replacement parts in stock in the quantities deemed sufficient by the owner or its representatives.

### 1.3 RELATED SPECIFICATIONS

- A. Refer to Division 1 - General Requirements specifications for all related specifications.

### 1.4 RELATED WORK BY OTHERS

- A. Reference Part 3, sub-section 3.01 of this specification.

### 1.5 RELATED DOCUMENTS

- A. In the event of a conflict between this specification and the construction drawings this specification shall take precedence.

### 1.6 APPLICABLE CODES AND STANDARDS

- A. The Fire Alarm System shall comply with the currently adopted versions of the following:

1. Building Standards Administrative Code, Part 1, Title 24, California Code of Regulations
2. California Building Code (CBC) Part 2, Title 24, California Code of Regulations (International Building Code, with California Amendments)
3. California Electrical Code (CEC) Part 3, Title 24, California Code of Regulations (National Electrical Code with California Amendments)
4. California Mechanical Code (CFC) Part 4, Title 24, California Code of Regulations (Uniform Mechanical Code with California Amendments)
5. California Fire Code (CFC) Part 9, Title 24, California Code of Regulations (International Fire Code with California Amendments)

- B. NFPA Standards

6. The fire alarm system shall comply with the applicable provisions of the following current National Fire Protection Association (NFPA) standards:
  - a. NFPA 12 Carbon Dioxide Extinguishing Systems
  - b. NFPA 12A Halon 1301 Fire Extinguishing Systems
  - c. NFPA 13 Installation of Sprinkler Systems
  - d. NFPA 15 Water Spray Fixed Systems
  - e. NFPA 16 Foam-Water Sprinkler Systems
  - f. NFPA 17 Dry Chemical Extinguishing Systems
  - g. NFPA 17A Wet Chemical Extinguishing Systems

- h. NFPA 72, National Fire Alarm and Signaling Code:
    - 1) Central Station Fire Alarm Systems
    - 2) Local Fire Alarm Systems
    - 3) Auxiliary Fire Alarm Systems
    - 4) Remote Station Fire Alarm Systems
    - 5) Proprietary Fire Alarm Systems
  - i. NFPA 90A, Installation of Air Conditioning and Ventilating Systems
  - j. NFPA 101, Life Safety Code - Safety to Life from Fire in Buildings and Structures
  - k. NFPA 750 Water Mist Fire Protection Systems
  - l. NFPA 2001 Clean Agent Fire Extinguishing Systems
- C. ADA - Americans with Disabilities Act
- D. CAC – California Administrative Code, Title 24
- E. U.L. Standards
- 1. The system shall comply with the applicable provisions of the following U.L. Standards and Classifications:
    - a. UL 38, Manual Signaling Boxes for Fire Alarm Systems
    - b. UL 268, Smoke Detectors for Fire Alarm Systems
    - c. UL 268A, Smoke Detectors for Duct Applications
    - d. UL 346, Waterflow Indicators for Fire Protective Signaling Systems
    - e. UL 464, Audible Signal Appliances
    - f. UL 521, Heat Detectors for Fire Protective Signaling Systems
    - g. UL 864, Control Units and Accessories for Fire Alarm Systems
    - h. UL 1480, Speakers for Fire Alarm Use
    - i. UL 1481, Power Supplies for Fire Protective Signaling Systems
    - j. UL 1635, Digital Alarm Communicator System Units
    - k. UL 1638, Visual Signaling Appliances

- l. UL 1971, Signaling Devices for the Hearing Impaired
- m. UOJZ, Control Units, System
- n. SYZV, Control Units, Releasing Device
- o. UOXX, Control Unit Accessories, System
- p. SYSW, Accessories, Releasing Device Service

## 1.7 SUBMITTALS

- A. Within thirty-five (35) calendar days after the date of the award of the contract, the Contractor shall submit to the Architect for review, eight (8) copies of a complete Submittal Package. The Submittal Package shall consist of the following sections, with each section separated with index tabs.

### 1. Title Page

- a. Project Title
- b. Owner's name
- c. Architect's name
- d. Electrical Engineer's name
- e. Contractor's name

### 2. Index of Submittal Contents

- a. Each Section of the Submittal Package shall be numbered chronologically and shall be summarized in the Index.

### 3. Certifications

- a. Index of Certification Section Contents
- b. Valid State of California Contractors License
- c. Manufacturer's Certifications
  - 1) Authorized Systems Distributor
  - 2) Systems Certified Technician
  - 3) Factory Trained Technician
- d. California DAS, Fire/Life Safety Technician Certifications

### 4. Project List

- a. A substantial list (minimum of 20) of completed projects equal in scope to that specified herein.
  - 1) Contact information shall be made available upon request.
- 5. Product Data
  - a. Index of Equipment Data Sheets
  - b. Manufacturer's Data Sheets including cable types
  - c. Applicable Listings and Approvals

## **PART 2 – PRODUCTS**

### **2.1 SYSTEM REQUIREMENTS**

#### **A. Basic Performance and Capabilities**

- 1. System shall be fully programmable and configurable on site to accommodate system expansions and facilitate changes in operation.
- 2. All software programs shall be stored in non-volatile programmable memory within the FACP.
  - a. Loss of primary and secondary power shall not erase the instructions stored in the memory.
  - b. System programming shall be password protected.
- 3. Alarm, supervisory and trouble signals from analog addressable devices shall be encoded onto NFPA Class B signaling line circuits (SLC).
- 4. Initiation device circuits (IDC) shall be wired NFPA Class B.
- 5. Notification appliance circuits shall be wired NFPA Class B.
- 6. A single ground or open on any system SLC, IDC or NAC shall not cause a system malfunction, loss of operating power or the ability to report an alarm.
- 7. Alarm signals arriving at the main FACP shall not be lost due to a power failure.
- 8. The system shall be provided with sufficient battery capacity to operate the entire system upon loss of 120 VAC power in a normal supervisory mode for a period of twenty four (24) hours with five (5) minutes of alarm indication at the end of this period.
  - a. Systems that include voice evacuation shall provide sufficient battery capacity for twenty-four (24) hours with fifteen (15) minutes of alarm in lieu of the five (5) noted above.

9. The system shall automatically transfer to the standby batteries upon power failure. All battery charging and recharging operations shall be automatic. Batteries, once discharged, shall recharge at a rate that complies with NFPA 72 section 10.6.10.3.

**B. System Functional Operation**

1. The actuation of any approved alarm initiating device shall automatically initiate the following functions:
  - a. Alarm LED on the FACP shall flash.
  - b. Local audible piezo electronic signal in the FACP shall sound.
  - c. The alarm condition description, including the type of point and the location within the protected premises, shall be displayed on the LCD display at the FACP and any remote annunciator(s).
  - d. System shall transmit the condition to a UL Listed Central Station Monitoring Facility. Supervising station shall be approved per CFC section 907.6.6.3 (2016).
  - e. Printing and history storage equipment shall log the information associated with the condition, including the time and date of the alarm occurrence.
  - f. System output programs configured via control-by-event (CBE) programming to be activated by the particular point in alarm shall be executed, and the associated system output (alarm notification appliances and relays) shall be activated on either local outputs or points located on other network nodes.
2. The actuation of any approved supervisory alarm initiating device shall automatically initiate the following functions:
  - a. Supervisory LED on the FACP shall flash.
  - b. Local audible piezo electronic signal in the FACP shall sound.
  - c. The supervisory condition description, including the type of point and the location within the protected premises, shall be displayed on the LCD display at the FACP and any remote annunciator(s).
  - d. System shall transmit the condition to a UL Listed Central Station Monitoring Facility. Supervising station shall be approved per CFC section 907.6.6.3 (2016).
  - e. Printing and history storage equipment shall log the information associated with the condition, including the time and date of the supervisory alarm occurrence.



- f. System output programs configured via control-by-event (CBE) programming to be activated by the particular point in supervisory alarm shall be executed, and the associated system outputs (relays) shall be activated on either local outputs or points located on other network nodes.
3. Whenever a trouble condition is detected and reported the FACP shall automatically initiate the following functions:
  - a. Trouble LED on the FACP shall flash.
  - b. Local audible piezo electronic signal in the FACP shall sound.
  - c. The trouble condition description, including the type of point and the location within the protected premises, shall be displayed on the LCD display at the FACP and any remote annunciator(s).
  - d. System shall transmit the condition to a UL Listed Central Station Monitoring Facility. Supervising station shall be approved per CFC section 907.6.6.3 (2016).
  - e. Printing and history storage equipment shall log the information associated with the condition, including the time and date of the trouble condition occurrence.
  - f. System output programs configured via control-by-event (CBE) programming to be activated by the particular point in trouble condition shall be executed, and the associated system outputs (relays) shall be activated on either local outputs or points located on other network nodes.

#### C. Test Functions

1. A "Lamp Test" or "Indicator Test mode shall be a standard feature of the FACP and shall test all LED's and the LCD display on the main FACP and remote annunciators.
2. A "Walk Test" mode shall be a standard feature of the FACP.
  - a. The Walk Test feature shall function so that each alarm input tested shall operate the associated notification appliance for two seconds. The FACP will then automatically reset and confirm normal device operation.
  - b. The event memory shall contain the information on the point tested, the zone tripped, the zone restore and the individual point's return to normal.
3. A "Fire Drill mode shall allow the manual testing of the Fire Alarm System notification circuits. The Fire Drill shall be capable of being initiated at the main annunciator, remote annunciators and via a remote contact input.
4. "Bypass Mode" shall allow for any point or NAC circuit to be bypassed without affecting the operation of the total Fire Alarm System.

**D. Remote Monitoring Connection**

5. The fire alarm system shall be connected via Digital Alarm Communicator Transmitter (DACT) and an NFPA 72, Chapter 26 compliant transmission channel(s) to a UL Listed Central Station Monitoring Company.
  - a. The fire alarm control panel shall provide an integral Digital Alarm Communicator Transmitter (DACT) for signaling to a UL Listed Central Station Monitoring Company.
    - 1) The fire alarm system shall transmit alarm, supervisory alarm and trouble signals with the alarms having priority over the trouble signal.

**2.2 SYSTEM COMPONENTS**

**A. Fire Alarm Control Panel (FACP)**

- a. The basic control panel shall provide:
  - 1) 9 amp power supply expandable to 45 amps via bus connected expander modules.
  - 2) Network Interface Module (only required if this system is to be a part of a network)
    - (a) The network interface module shall be for fiber optic or unshielded twisted pair cable connections.
      - (1) 16AWG unshielded twisted pair FPL (SLC) cable shall be used for copper wiring network connections up to a maximum distance of 3000 feet.
      - (2) 6-strand, 62.5/125 micron multimode fiber optic cable with ST connectors shall be used for fiber optic cable connections.
        - (i) Installers of fiber optic cable shall be certified by the manufacturer of the cable and connectivity used.
        - (ii) Fiber optic cable shall be tested utilizing and industry standardized method.
        - (iii) Provide fiber optic patch cables as required for a complete and operable system.
  - 3) One (1) Signaling Line Circuit (SLC) capable of supporting 159 addressable detectors and 159 addressable modules
    - (a) Additional SLC's may be added via expander modules to a maximum of 636 addressable points per panel, 10,176 addressable points per network
  - 4) Eight (8) programmable "Flexputs"

- (a) Programmable Flexput Circuits shall be capable of being programmed as supervised reverse polarity notification appliance circuits, supervised auxiliary power circuits (continuous or resettable), door holder power or as input circuits in Class A or Class B configuration to support dry contact devices or compatible two-wire smoke detectors
- 5) 160 character LCD annunciator
  - (a) Capability of supervising 8 additional remote annunciators
- 6) Integral UL listed Digital Alarm Communicator Transmitter (DACT)
- 7) Ability to automatically test smoke detectors in compliance with NFPA Standards to ensure that they are within listed sensitivity parameters
- 8) Compensation for accumulation of contaminants that affect detector sensitivity
- 9) Day/night sensitivity adjustments
- 10) Maintenance alert feature (differentiated from trouble condition)
- 11) Detector sensitivity selection
- 12) Over-current Protection
  - (a) All low-voltage circuits shall be protected by microprocessor-controlled power limiting or have a self-restoring polyswitch.
- 13) Ground Fault Detection
  - (a) The ground fault detector shall operate the general trouble devices as specified but shall not cause an alarm to be sounded.
  - (b) Ground fault shall not interfere with the normal operation of the system, such as alarm or trouble conditions.
- 14) Auto-programming mode (Jumpstart)
  - (a) Jumpstart feature shall automatically enroll all properly connected devices into a functional system within 60 seconds of power up of the panel
- 15) Ability to upgrade the core operating software on site or over the telephone
- 16) RS-485 Serial Communication Bus (S-bus). Systems that do not communicate with Intelligent Modules via RS-485 Serial Communication Bus shall not be deemed equal and shall not be acceptable for this project.

- (a) S-bus shall be of Class A or Class B configuration with a total bus length of 6000 feet.
- 2. The FACP shall be capable of operating and supervising notification appliance devices as well as addressable initiating detection devices and an integrated supervised dual line digital communicator.
- B. Fire Alarm Control Panel with integral Emergency Voice/Alarm Communication System.
  - a. Remote Voice Evacuation Amplifiers
- C. Network Nodes
  - a. All Network systems shall have at least one node for compliance with CFC required Emergency Voice/Alarm Communication in K -12 schools.
  - b. All Network Nodes shall have the capability of being connected with either copper cable or fiber optic cable.
- D. Remote Annunciator
  - a. The remote annunciator shall have 160 character LCD display and 5 LED's for general alarm, supervisory, systems trouble, system silence and system power.
  - b. The remote annunciator shall have the same control and display layout as the integrated annunciator at the FACP.
  - c. The remote annunciator shall have the same functionality and operation as the integrated annunciator at the FACP.
  - d. The remote annunciator shall have twenty (20) levels of user codes to limit access to the system to authorized individuals.
  - e. The remote annunciators shall be capable of operating at a maximum wiring distance of 6,000 feet from the control unit on unshielded, non-twisted cable.
  - f. The system shall support a maximum of eight (8) remote annunciators.
- E. The Serial/Parallel Interface Gateway Module
  - 1. The 5824 shall be connected to the S-bus and provide serial and parallel ports for connection to peripheral devices.
- F. Signaling Line Circuit (SLC) Devices
  - 1. Each SLC shall be capable to accommodating 159 addressable detectors and 159 addressable modules.

2. Provide SLC devices as indicated on the construction drawings. All devices shall be listed for compatibility.
- G. Notification Appliance Circuit (NAC) Devices
- H. Line-Voltage Isolation Relay
- a. California State Fire Marshal (CSFM) listed.
- I. System Wire/Cable
1. All Fire Alarm System Wire and Cable shall be installed in conduit, unless noted otherwise.
    - a. Interior
      - 1) SLC cable shall be #16AWG, 2-conductor, unshielded, FPL, red jacket by Falcon Fine Wire #450216R or equal.
      - b. SLC cable shall be California State Fire Marshal (CSFM) listed.
        - 1) NAC Wire shall be #12 AWG THHN/THWN, stranded color red and black.
        - 2) S-bus cable shall be #16AWG, 4-conductor, unshielded, FPL, red or black jacket by Falcon Fine Wire #450416R or equal.
          - (a) S-Bus cable shall be California State Fire Marshal (CSFM) listed.
        - 3) Speaker cable shall be #16AWG, 2-conductor, shielded, FPL, red jacket by Falcon Fine Wire #460216R or equal.
          - (a) Speaker cable shall be California State Fire Marshal (CSFM) listed.
        - 4) Network Fiber Optic Cable shall be 6-strand 62.5/125 micron multimode loose tube Indoor/Outdoor AMP 1-1664234-5 or equal.
      - c. Exterior
        - 1) SLC cable shall be #16AWG, 2-conductor, unshielded, FPL, water-blocked, black jacket by Falcon Fine Wire #400216H2O or equal.
          - (a) SLC cable shall be California State Fire Marshal (CSFM) listed.
        - 2) NAC Wire shall be #12 AWG THHN/THWN, stranded color red and black.
        - 3) S-bus cable shall be #16AWG, 4-conductor, unshielded, FPL, water-blocked, black jacket by Falcon Fine Wire #400416H2O or equal.
          - (a) S-Bus cable shall be California State Fire Marshal (CSFM) listed.

- 4) Speaker cable shall be #16AWG, 2-conductor, shielded, FPL, water-blocked, black jacket by Falcon Fine Wire #410216H2O-00 or equal.
  - (a) Speaker cable shall be California State Fire Marshal (CSFM) listed.
- 5) Network Fiber Optic Cable shall be 6-strand 62.5/125 micron multimode loose tube OSP Belden #B9B510T or equal with ST connectors.

## **PART 3 - EXECUTION**

### **3.1 DIVISION OF WORK**

- A. While all work included under this specification is the complete responsibility of the Electrical Contractor, the division of actual work listed following shall occur.
  1. All conduits with pull cords, all electrical pull boxes, grounding rods, all outlet boxes, terminal cabinets, backboards, etc., which form part of the rough-in work shall be provided and installed completely by the Electrical Contractor. Coordinate as necessary for proper installation.
    - a. Equipment specific boxes provided by the system manufacturer shall be provided by System Supplier/Installer and installed by the Electrical Contractor.
  2. The balance of the system, including installation of initiating devices, notification appliances and equipment, making all connections, etc., shall be performed by the System Supplier/Installer.
  3. All 120VAC power conductors and conduits associated with power circuits to all fire alarm system equipment locations shall be provided and installed by the Electrical Contractor.
  4. An insulated stranded copper ground wire shall be provided from each control unit to the building grounding system, in compliance with CEC Article 250, by the Electrical Contractor.
  5. Labeling of pullboxes and terminal cabinets shall be provided and installed by the Electrical Contractor.
  6. HVAC Unit Shut-down
    - a. Conduit for code required HVAC unit shut-down shall be provided and installed by the Electrical Contractor.
    - b. Conductors for code required HVAC unit shut-down shall be provided, installed and terminated by the Mechanical Contractor.
    - c. Addressable Relay Modules for code required HVAC unit shut-down shall be provided and installed by the Fire Alarm System Supplier/Installer.

### 3.2 INSTALLATION

- A. All work shall be completed in strict accordance with all applicable codes and ordinances, by an Authorized Systems Distributor.
- B. Cable/Wire
  - 1. All cable/wire for the system specified herein shall be new, unless otherwise noted on plans.
  - 2. System cable/wire and equipment installation shall be in accordance with good engineering practices as established by the California Electrical Code (CEC). Wiring shall meet all applicable electrical codes. All cable/wire shall test free from all grounds and shorts.
    - a. All cable/wire shall be continuous between terminals with no splices.
  - 3. All cable/wire shall be labeled at all points of termination. All labeling shall be based on the room numbers as provided by the District/Owner or his representative.
  - 4. Underground cables
    - a. Any cable/wire pulled through manholes or pullboxes located below grade, shall be continuous between terminals with no splices underground. The cable/wire shall be intact with no cuts in the protective outer jacket.
    - b. All cable/wire in underground vaults/boxes shall be neatly dressed with service loops attached to the sides of the vault/box. Cable/wire shall not come in contact with the ground.

### 3.3 SYSTEM START-UP

- A. All start-up programming and system commissioning shall be performed by a manufacturer's trained and certified technician currently employed by the System Supplier/Installer.

### 3.4 SYSTEM VERIFICATION

- A. Subsequent to system start-up the system installer shall perform a 100% system pre-test to verify that the following features are functioning properly.
  - 1. All notification appliances
  - 2. All initiation devices
  - 3. All control modules
  - 4. All monitor modules
  - 5. Communication link to monitoring service

**3.5 ACCEPTANCE TESTING**

- A. The system installer shall, in the presence of the Inspector of Record (IOR), perform 100% testing as noted in System Verification above.

**3.6 IN SERVICE TRAINING**

- A. The Contractor shall instruct personnel designated by the District/Owner in the proper use, basic care and maintenance of the system beyond the warranty period. Contractor shall provide up to eight hours of in-service training with this system.

**3.7 FACTORY TRAINING AND CERTIFICATION**

- A. When requested by Owner, provide Factory Training for a maximum of two District Technicians.

**3.8 RECORD DRAWINGS AND CLOSE-OUT DOCUMENTATION**

- A. System supplier/installer shall periodically update the General Contractor's master set of record drawings kept on site.
- B. Contractor shall provide the following at close-out.
  - 1. Three (3) hard copies of manufacturer's maintenance and operation manuals.
  - 2. Three (3) wet signed copies of system warranty.

**3.9 WARRANTY**

- A. The Contractor shall warrant the equipment and/or materials to be new and free from defects in material and workmanship, and will, within three (3) years from the date of final acceptance, repair or replace any equipment and/or materials found to be defective. This warranty shall not apply to any equipment or materials that have been subject to misuse, abuse, negligence or modification by owner or contractors other than the original installer that provided this warranty.

**END OF SECTION**



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**SECTION 31 11 00**

**CLEARING AND GRUBBING**

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**PART 1 - GENERAL**

1.01 SUMMARY

- A. Clearing vegetation, debris, trash and other materials within limits indicated.
- B. Grubbing of vegetation within limits indicated.

1.02 RELATED DOCUMENTS

- A. Caltrans Standard Specifications: Clearing and Grubbing.
- B. California Building Code: Site Work, Demolition and Construction.

**PART 2 - PRODUCTS**

2.01 NOT USED

**PART 3 - EXECUTION**

3.01 PREPARATION

- A. Locate and clearly flag vegetation to remain or to be relocated.

3.02 RESTORATION

- A. Repair or replace vegetation indicated to remain that is damaged by construction operations, as directed by the Owner.
- B. Employ a qualified arborist, licensed in jurisdiction where the Project is located, to submit details of proposed repairs and to repair damage to shrubs.

3.03 CLEARING AND GRUBBING

- A. Remove obstructions, trees, shrubs, grass, and other vegetation to permit installation of new construction. Removal includes digging out stumps and obstructions and grubbing roots.
- B. Remove trash, debris, logs, concrete, masonry and other waste materials.
- C. Do not remove trees, shrubs, and other vegetation indicated to remain or to be relocated.
- D. Completely remove stumps, roots, obstructions, and debris extending to a depth of 18-inches below subgrade.
- E. Use only hand methods for grubbing within drip line of remaining trees.

**END OF SECTION**

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**SECTION 31 20 00**  
**EARTHWORK**

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**PART 1 – GENERAL**

**1.01 WORK SPECIFIED IN THIS SECTION**

- A. Work of this section includes all required excavation, grading, preparation of subgrade for fills, proper placement of fills, including backfilling and compaction, the watering, rolling and compacting of fill material in place and the finish grading all as required by the drawings and as specified herein.
- B. All grading work shall be performed in accordance with:
  - 1. Title 24, Part 2, C.C.R., 2016 C.B.C., 2015 I.B.C. with California Amendments & Supplements
  - 2. The grading code of the County and any special requirements of the permit.
  - 3. Provide special inspection for engineered fill and compaction, Title 24, Part 2, C.C.R., 2016 C.B.C., 2015 I.B.C. with California Amendments & Supplements

**1.02 PRINCIPAL ITEMS OR WORK INCLUDED HEREIN.**

- A. Excavation
- B. Filling
- C. Backfilling
- D. Grading
- E. Miscellaneous related work necessary for a complete job.
- F. Special Requirements.

**1.03 SCHEDULING**

- A. **PAD GRADING:** It is imperative that Building construction commence as quickly as possible, therefore, contractor shall submit a schedule of grading that clearly establishes the construction of the Building Pad area as a priority of grading construction along with providing appropriate or required reports and certifications from the Civil Engineer, and governmental authority necessary to commence foundation excavation and building construction.

**1.04 RELATED WORK SPECIFIED IN OTHER SECTIONS.**

- A. Clearing and Grubbing: Section 31 11 00
- B. Final subgrade preparation for asphalt paving: Section 32 12 00. Flexible Paving.
- C. Aggregate base beneath asphalt paving is specified under Flexible Paving, Section 32 12 00.
- D. Excavation and backfill for utility lines specified under Mechanical and Electrical

Sections, shall be performed as specified in this Section.

## **PART 2 - PROTECTION**

- 2.01 Contractor shall protect adjacent properties, roads, right-of-ways, easements and existing improvements from damage during the life of the grading operation and prevent caving, sloughing or the placing of materials or stock piles on adjacent properties.
- 2.02 Provide cribbing, sheathing, and shoring necessary to safely retain the earth banks and protect excavations and adjoining grades from caving and other damage resulting from excavating, together with suitable forms of protection against bodily injury to personnel employed on the work and the general public. The responsibility for the design, installation, and maintenance of required cribbing and shoring shall be entirely that of the Contractor and shall meet the approval of the State Division of Industrial Safety and local governing agencies' requirements.
- 2.03 Utility lines and structures shown shall be protected and treated as indicated. Where work not shown is encountered, report it to the Architect before proceeding with excavation. The Contractor shall bear the costs for all repairs to damaged or broken utilities and any damages related thereto.
- 2.04 It shall be the Contractor's full responsibility to take all measures necessary during grading to protect slope areas, both cut and fill, existing improvements and adjacent properties from storm damage and flood hazard originating on this project until final acceptance by the Owner. It shall be the Contractor's responsibility to maintain completed slopes until all slopes are in satisfactory compliance with the job specifications, all berms have been properly constructed, and all associated drainage devices have met the requirements of the Architect. It shall also be the Contractor's responsibility to prevent silt run-off from the limits of work.

## **PART 3 - TESTS AND REPORTS**

- 3.01 A representative designated by the Owner will be engaged to perform continuous inspection of the placing and compacting of all fills and backfills within the limits of grading of this project. All work shall be done in accordance with these specifications and as recommended and approved by the Owners representative. Costs for all such inspections and tests shall be paid by the Owner. The Contractor shall be responsible for notifying the Owners representative in advance so that he may be present to perform his services as needed. The Owners representative shall approve all subgrades prior to placement of fill or placement of forms and reinforcing.
- 3.02 The Owners representative shall also make an investigation of the fill material to establish the ability of the soil to sustain the vertical loads to be imposed on the fill by the proposed structure.
- 3.03 The Owners representative shall submit compaction reports to the Architect and the Civil Engineer at the completion of the work, including test results and plot plans indicating the

locations from which the tested samples of fill were taken. The Owners representative shall keep the Architect informed on the progress of the grading work.

- 3.04 No clearing, demolitions, filling and backfilling, or grading operations shall be performed without the presence of a representative of the Owner. Operations undertaken at the site without the Owners representative present may result in exclusions of affected areas from the final compaction report for the project. The presence of the Owners representative will be for the purpose of providing observation and field testing, and will not include any supervising or directing of the actual work of the Contractor, directing his/her employees or agents. Neither the presence of the field representative nor the observations and testing by the Owners representative shall excuse the Contractor in any way for defects discovered in the Contractor's work. The Owners representative shall not be responsible for job or site safety on this project, which shall be the sole responsibility of the Contractor.
- 3.05 The existing soil conditions at this site have been investigated, and a report of findings is on file at the Owners office for review by the Contractors during the bidding period. This information is offered as supplemental information only, and no guarantee of existing soil or other conditions is intended.

#### **PART 4 - MATERIALS**

- 4.01 All imported material and sources for import material shall be approved by the Owners representative prior to hauling on site. Contractor shall be responsible for communicating the necessary information to the Owners representative in a timely manner so appropriate testing and reporting is performed.
- 4.02 The Contractor shall import any and all additional fill material required to complete the grading on this project. Imported fill soils shall be non-expansive, granular soils meeting the USCS classifications of SM, SP-SM or SW-SM with a maximum rock size of 3 inches and 5 to 35% passing the No. 200 sieve. The Owners representative shall evaluate the import fill soils before hauling to the site. The imported fill shall be placed in lifts no greater than 8 inches in loose thickness and compacted to at least 90% relative compaction (ASTM D1557) near optimum moisture content.
- 4.03 Fill material within new building and paved areas shall be clean, well-pulverized soil free of vegetation matter, rocks larger than 3 inches in any dimension, and other debris, and shall be subject to approval by the Owners representative.
- 4.04 Backfill material for storm drain and utility lines shall be non-expansive granular materials, such as clean sand, and shall be placed in a minimum thickness of 6 inches for bedding and backfilled to 12 inches above top of pipe. Bedding sand shall have a sand equivalent value of 30 or greater determined in accordance with Cal-Trans Test Method # 217.

#### **PART 5 - SURPLUS EARTH MATERIAL**

- 5.01 All surplus earth material not needed for the completion of the grading shall be removed from the site by the Contractor and disposed of in a legal manner.

## **PART 6 - INADEQUATE SOIL CONDITIONS**

- 6.01 Should soil of inadequate density and bearing capability be encountered at the elevations indicated on the drawings, or where new fill is to be placed upon existing loose fill material exposed by excavation, the excavation shall be carried to the depth required to attain soil of bearing quality as determined by the Owners representative. The adequacy of all soil bearing value shall be determined by the Owners representative.

## **PART 7 - EXECUTION**

### **7.01 PRE JOB CONFERENCE**

An onsite pre job meeting with Architect, the Construction Manager, Civil Engineer, Inspector, and the Utility Line and Earthwork Subcontractor(s) is required prior to all grading related operations. ATTENDANCE IS MANDATORY.

### **7.02 PREPARATION**

- A. Protect adjacent property and existing improvements and structures as necessary to prevent undermining, caving of cuts, and miscellaneous damage, or sloughing of material onto adjacent property.
- B. Provide cribbing, sheathing, and shoring necessary to safely retain the earth banks and protect excavations and adjoining grades from caving and other damage resulting from excavation together with suitable forms of protection against bodily injury to personnel employed on the work and the general public. Be responsible for the design, installation, and maintenance of required cribbing and shoring and same shall meet the approval of the State Division of Industrial Safety and local governing agencies' requirements.
- C. Protect existing improvements and adjacent properties from storm damage and flood hazard originating on this project until final acceptance by the Owner. Prevent silt runoff from the limits of work in accordance with governmental requirements, and the S.W.P.P.P.
- D. Borrow pits, if any, shall meet all requirements of these Specifications for over-excavation and backfill.

### **7.03 DUST CONTROL**

During all grading operations, water shall be applied to the surfaces in the working area at frequent intervals and in sufficient quantities to allay the dust and for proper compaction. No other method will be permitted.

### **7.04 CLEAN-UP**

Upon completion of work in this Section, remove rubbish, trash, and debris resulting from operations. Remove disused equipment and implements of service, and leave entire area involved in a neat, clean, and acceptable condition.

## 7.05 EXCAVATION

- A. Prior to any excavation or filling operation, the entire area within the limits of work containing vegetation shall be excavated to a minimum depth to ensure removal of all vegetation. This material shall be disposed of off the site in a legal manner.
- B. Excavate to the depths, lines, and grades indicated. Excavate sufficiently over-size to permit installation and removal of concrete forms and all other required work.
- C. Footing pads, if poured neatly, may be excavated to the net pad widths plus two inches if approved by the Architect. Approval will not be given until the completed excavation has been inspected.
- D. Should footing excavations exceed reburied dimensions or should sloughing occur, fill such extra space with concrete at no additional cost to the contract. If unsuitable material is found at the indicated depths, immediately notify the Architect.
- E. Sequencing of the work to ensure that one part of the excavating does not interfere with another part rests with the Contractor.
- F. Notify the Structural Engineer 48 hours before foundation excavations are ready for inspection.
- G. The bottoms of footings shall be free of loose material, debris, and water before concrete is placed.
- H. Cut banks shall be neatly trimmed to the required finish surface as the cut progresses, or the Contractor shall have the option of leaving the cuts full and finish grading by mechanical equipment which will produce the finish surfaces as shown on the drawings.
- I. All cut or "at grade" building, concrete and asphalt pavement areas shall be scarified to a minimum depth of 8 inches below subgrade brought to an optimum moisture content, and compacted to a density of not less than 90% of maximum dry density.

## 7.06 FILLING

- A. Prior to placing new fill in all other areas, the exposed cleared surface should be plowed, scarified, or otherwise processed to a depth of at least 24 inches, watered and/or aerated, as required, thoroughly mixed to a uniform, near optimum moisture condition, and recompacted to at least 90 percent of the ASTM D1557 test standard.
- B. All recompacted and new fill required to secure final subgrade elevations should be spread, water and/or aerated as required, thoroughly mixed to a uniform near optimum moisture condition, and compacted in approximated 8-inch thick lifts to at least 90 percent. Backfilling of excavations made for removal of any existing buried elements during site clearing should also be performed in this manner.

- C. Imported fill materials should consist of clean soils, free from vegetation, debris, or rocks larger than 3 inches. The Expansion Index value should not exceed a maximum of 50 ("Low" expansive per UBC Table 18-1-B.)
- D. Where fills are placed on existing slopes exceeding a slope of five horizontal to one vertical, the slopes shall be benched in accordance with the Owners representative's requirements and local governing public agencies' requirements, and compacted as herein specified before placing fill material on same, so that all fills shall be placed in horizontal layers as specified. Widths of benches shall be as directed by the Owners representative.
- E. Rock encountered in the excavation on this site may, at the option of the Contractor, be broken up into pieces not larger than three inches in maximum dimension, and be incorporated in the fill material if spread as directed by the Owners representative. Otherwise, all rocks larger than three inches in maximum dimensions shall be removed from the site. Rocks and stones larger than one inch in maximum dimension will not be permitted within the top 12 inches of finished grade in non-paved areas.
- F. Fill banks shall be graded full and compacted beyond the grade of the finish bank. After the banks have been filled, they shall be trimmed to the finish grades and limits shown on the drawings.

#### 7.07 BACKFILLING

- A. Place no backfill until work in excavations has been approved. Remove cave-ins and loose soil to permit inspection.
- B. Place backfill in layers which will compact to six inches maximum, concurrently on both sides of footings and walls. Thoroughly compact each layer with mechanical tampers, adding water as required to obtain optimum moisture content, and compact as set forth in paragraph 7.9 herein.
- C. Backfill placed in narrow, restricted areas, such as along utility trenches, may possibly be placed in up to 12-inch thick lifts, depending on the materials, procedures and equipment being employed. Backfill consolidation by flooding or jetting is prohibited unless approved by the Owners representative. In any case, all backfill should be mechanically compacted to at least 90 percent of the aforementioned test standard.

#### 7.08 FINISH GRADING

- A. The entire area within the limits of grading as indicated on the Drawings shall be constructed to the lines, grades, elevations, slopes, and cross sections indicated on the Drawings. When the grading has been completed, the areas shall be rolled smooth with a steel tandem roller or equal.
- B. Fine grade to bring areas to required lines and grades. The subgrade elevation within the building area for slabs on grade (without a base course) shall be within 0.50 inch along a 10-foot straight edge.

- C. Slope finish grades to drain surface water away from buildings, walks, paving, and other structures. Generally, grade with uniform slope between points where elevations are given, or between such points and existing grades. Excavate and grade swales to provide drainage away from and around buildings.
- D. Areas to Receive Paving or Surfacing: Review plans and details for each area. See plans for paving and base course thickness. Review Drawings for site work details.
- E. Areas to Receive Interior Building Slab-on-Grade: Review plans and details for thickness of slabs and granular fill under slabs.
- F. Areas to receive Topsoil and/or Planting: Where not otherwise indicated, areas outside of buildings shall be given uniform slopes between points for which finish grades are shown, or between such points and existing established grade, except that vertical curves or roundings shall be provided at abrupt changes in slope.
- G. Rocks or cobbles larger than 1-inch in diameter shall not be placed in the upper 12-inches of planting area fill, rocks, or cobbles larger than 3/4 inch shall not appear on the finish graded surface.
- H. It shall be the Contractor's full responsibility to take all measures necessary during grading to protect slope areas, both cut and fill, and adjacent properties from storm damage and flood hazard originating on this project until final acceptance by the Owner. It shall be the Contractor's responsibility to maintain completed slopes until all slopes are in satisfactory compliance with the job specifications.

#### 7.09 COMPACTION

- A. All fills shall be compacted to at least 90 percent of maximum density obtainable using the ASTM test procedure D1557. All areas, which are scarified, shall be recompacted to these same requirements.
- B. All earthwork operations should be subject to compaction monitoring field observation and testing by the Owners representative. The Owners representative should be notified at least two days in advance of the start of grading. A joint meeting between a representative of the Client, and the Contractor is recommended prior to grading to discuss specific procedures and scheduling.
- C. Compaction by flooding or jetting is prohibited unless approved by the Owners representative.

#### 7.10 SPECIAL REQUIREMENTS

- A. REMEDIAL GRADING
  - 1. Building slabs and Footings  
Overexcavate to a depth of 2 feet below existing grade or the bottom of building footings, whichever is greater, to extend a minimum of 5 feet



- beyond the outer edge of the building slabs or footings (including column supports).
2. Garden and Retaining walls  
Overexcavate to a depth of 2 feet below existing grade or the bottom of footings, whichever is greater, to extend a minimum of 2 feet beyond the face of the footing.
  3. Areas to receive fill, pavements or hardscape  
The top 18 inches of the native subgrade shall be overexcavated. The bottom of overexcavation shall be scarified an additional 6 inches, moisture conditioned and compacted to 90% relative compaction per ASTM D1557.
- B. A representative of the Owner shall observe the bottom of all excavations. Artificial fill, soft soils, organic soils, or other unsuitable material remaining in the bottom of the excavations shall be overexcavated until competent natural material is encountered. Competent natural soil is defined as undisturbed material exhibiting a relative compaction of at least 85 percent.
- C. Prior to replacing compacted fill in over-cut building, concrete flatwork and A.C. paved areas, the exposed over-cut surface should be plowed, scarified, or otherwise processed to an additional depth of at least 12 inches, water and/or aerated as required, thoroughly mixed to a uniform, near optimum moisture condition, and recompacted to at least 90 percent of maximum dry density obtainable using the ASTM D1557 test standard.
- D. All recompacted and new fill should be spread, watered, mixed and compacted by mechanical means in approximate 8 inch thick lifts to at least 90 percent of the aforementioned standard.
- E. Completed building, exterior concrete pavement, and A.C. pavement subgrades should be trimmed and rolled to a firm smooth surface. Final watering and rolling should be performed immediately prior to placing concrete or paving.
- F. Prior to placing backfill within the remaining excavation behind new retaining walls, these areas should first be cleared of all significant vegetation, construction debris, loose and/or disturbed soils, etc. All new backfill should be spread, watered or aerated as required, thoroughly mixed to a uniform near optimum moisture condition and compacted by mechanical means in approximate 6 to 8 inch thick lifts. The degree of compaction obtained should be at least 90 percent of maximum dry density per the ASTM D1557 laboratory test standard.
- G. The top 12 inches of soil within all designated planted areas shall be imported topsoil or stockpiled existing site soil capable of supporting plant growth. The 12-inch layer shall be measured down from the finish grade shown on the project drawings.
- H At the completion of grading operations and prior to building, A.C. pavement and concrete paving construction, Contractor shall provide an as-built grading plan at his own expense. As-built grading plan shall be prepared, signed and dated by a

licensed land surveyor or Registered Civil Engineer licensed to practice land surveying.

- I. The upper 6 inches of subgrade soils shall be compacted to 95% of maximum dry density when no aggregate base material is specified for asphalt paving.

**END OF SECTION**

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**SECTION 31 23 00**

**EXCAVATION AND FILL**

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**PART 1 - GENERAL**

**1.01 SECTION INCLUDES**

- A. Excavation and/or embankment from existing ground to subgrade, including soil sterilant, for roadways, driveways, parking areas, walks, paths, or trails and any other site improvements called for on the Plans.

**1.02 SECTION EXCLUDES**

- A. Earthwork related to underground utility installation, see Section 31 23 33 – Trenching and Backfilling.

**1.03 RELATED DOCUMENTS**

**A. ASTM:**

- 1. D 1557, Standard Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft<sup>3</sup> (2,700 kN-m/m<sup>3</sup>)).
- 2. D 1586, Standard Test Method for Standard Penetration Test (SPT) and Split-Barrel Sampling of Soils.
- 3. D 2487, Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System).
- 4. D 3740, Standard Practice for Minimum Requirements for Agencies Engaged in Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction.
- 5. D 4318. Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
- 6. E 329, Standard Specification for Agencies Engaged in Construction Inspection, Testing or special Inspection.

**B. California Code of Regulation Title 24, Part 2, California Building Code:**

- 1. Accessibility to Public Buildings.
- 2. Safeguards During Construction.

**C. Caltrans Standard Specifications:**

- 1. Watering.
- 2. Earthwork.

- D. CAL/OSHA, Title 8.

#### 1.04 DEFINITIONS

- A. Borrow: Approved soil material imported from off-site for use as Structural Fill or Backfill.
- B. Excavation: Removal of material encountered above subgrade elevations.
  - 1. Authorized Over-Excavation: Excavation below subgrade elevations or beyond indicated horizontal dimensions as shown on plans.
  - 2. Unauthorized Over-Excavation: Excavation below subgrade elevations or beyond indicated horizontal dimensions. Unauthorized excavation shall be without additional compensation.
- C. Structural Backfill: Soil materials used to fill excavations resulting from removal of existing below grade facilities, including trees. Any fill soil or aggregate base or crush rock under the building shall not contain recycled asphalt, asphalt grindings, or soil with petroleum products. See Section 31 23 33 – Trenching and Backfilling.
- D. Structural Fill: Soil materials used to raise existing grades.
- E. Rock: Rock material in beds, ledges, unstratified masses, and conglomerate deposits and boulders of rock material  $\frac{3}{4}$ -cubic yards or more in volume that, according to ASTM D 1586, exceeds a standard penetration resistance of 100 blows/2-inches.
- F. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man made stationary features constructed above or below grade.
- G. Subgrade: Surface or elevation remaining after completing excavation, or top surface of a fill or backfill immediately below subbase, base or topsoil materials.
- H. Unsuitable Material: Any soil material that is not suitable for a specific use on the Project.
- I. Utilities: onsite underground pipes, conduits, ducts and cables.

#### 1.05 SUBMITTALS

- A. Follow submittal procedures outlined in Section 01 33 00 – Submittal Procedures.
- B. Submit material certificates signed by the material producer and the Contractor, certifying that that each material item complies with, or exceeds the specified requirements.

#### 1.06 QUALITY ASSURANCE

- A. Conform all work to the appropriate portion(s) of the California Code of Regulations, Title 24 and Caltrans Standard Specifications.
- B. Percentage of compaction specified shall be the minimum acceptable. The percentage represents the ratio of the dry density of the compacted material to the maximum dry density of the material as determined by the procedure set forth in ASTM D 1557.

- C. Upon completion of the construction work, certify that all compacted fills and foundations are in place at the correct locations, and have been constructed in accordance with sound construction practice. In addition, certify that the materials used are of the types, quality and quantity required by these Technical Specifications. The Contractor shall be responsible for the stability of all fills and backfills constructed by his forces.
- D. Finish soil grade tolerance at completion of grading:
  - 1. Building and paved areas: +0.05
  - 2. Other areas:  $\pm 0.10$  feet.
- E. The project geotechnical engineer shall be notified of the construction schedule at least one week prior to the beginning of major site construction, and notified at least 48 hours (working days) before being required to perform field observation and testing.

#### 1.07 PROJECT CONDITIONS

- A. Promptly notify the Owner of surface or subsurface conditions differing from those disclosed in the construction documents. First notify the Owner verbally to permit verification and extent of condition and then in writing. No claim for conditions differing from those anticipated in the Contract Documents will be allowed unless the Contractor has notified the Owner in writing of differing conditions prior to the Contractor starting work on affected items.
- B. Protect open excavations, trenches, and the like with fences, covers and railings to maintain safe pedestrian and vehicular traffic passage.
- C. Prevent erosion of freshly graded areas during construction and until such time as permanent drainage and erosion control measures have been installed.
- D. Temporarily stockpile fill material in an orderly and safe manner and in a location approved by the Owner.
- E. Provide dust and noise control in conformance with Division 1 General Requirements for Cleaning and Waste Management.
- F. Environmental Requirements: When unfavorable weather conditions necessitate interrupting earthwork operation, areas shall be prepared by compaction of surface and grading to avoid collection of water. Provide adequate temporary drainage to prevent erosion. After interruption, compaction specified in last layer shall be re-established before resuming work.

**PART 2 - PRODUCTS****2.01 SOIL MATERIALS**

- A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from on-site excavations.
- B. On-Site Structural Fill and Structural Backfill: Soil or soil-rock mixture from on site excavations, free from organic matter or other deleterious substances. On-site structural fill and backfill shall not contain rocks or rock fragments over 4 inches in greatest dimension and not more than 15 percent shall be over 2-1/2 inches in greatest dimension and with an organic content less than 3.0 percent by weight.
- C. Imported Structural Fill and Structural Backfill: Conform to the requirements of on-site structural fill. Material shall also be a non-expansive and predominantly granular soil or soil-rock mixture with plasticity index of 15 or less in accordance with ASTM D 4318 and an R-Value of 25 or greater.

**PART 3 - EXECUTION****3.01 GENERAL**

- A. Earthwork: conform to Caltrans Standard Specifications as modified by the Contract Documents.
- B. Placement and compaction of material by flooding, ponding, or jetting will not be permitted.
- C. The use of explosives will not be permitted.

**3.02 CONTROL OF WATER AND DEWATERING**

- A. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding the site and surrounding area. Provide dewatering equipment necessary to drain and keep excavations and site free from water.
- B. Dewater during backfilling operation so that groundwater is maintained a least one foot below level of compaction effort.
- C. Obtain the Owner's approval for proposed control of water and dewatering methods.
- D. Protect subgrades from softening, undermining, washout and damage by rain or water accumulation.
- E. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations.
- F. Maintain dewatering system in place until dewatering is no longer required.

**3.03 WET WEATHER CONDITIONS**

- A. Do not prepare subgrade, place or compact soil materials if above optimum moisture content.

**3.04 BRACING AND SHORING**

- A. Conform to California and Federal OSHA requirements.
- B. Place and maintain such bracing and shoring as may be required to support the sides of the excavations for the proper protection of workmen; to facilitate the work; to prevent damage to the facility being constructed; and to prevent damage to adjacent structures or facilities. Remove all bracing and shoring upon completion of the work.
- C. Be solely responsible for all bracing and shoring and, if requested by the Owner, submit details and calculations to the Owner. The Owner may forward the submittal to the Consulting Engineer and/or the California Division of Industrial Safety for their review. The Contractor's submittal shall include the basic design, assumed soils conditions and estimation of forces to be resisted, together with plans and specifications of the materials and methods to be used, and shall be prepared by a civil engineer or structural engineer registered in California. No excavations related to the proposed facility shall precede a response to the submittal by the Owner.
- D. Be solely responsible for installing and extracting the sheathing in a manner which will not disturb the position or operation of the facility being constructed or adjacent utilities and facilities.

**3.05 EXCAVATION**

- A. Excavate earth and rock to lines and grades shown on drawings and to the neat dimensions indicated on the Plans, required herein or as required to satisfactorily compact backfill.
- B. Remove and dispose of large rocks, pieces of concrete and other obstructions encountered during excavation.
- C. Where forming is required, excavate only as much material as necessary to permit placing and removing forms.
- D. Provide supports, shoring and sheet piles required to support the sides of excavations or for protection of adjacent existing improvements.

**3.06 REMOVAL OF EXISTING FILLS AND UNSUITABLE MATERIAL**

- A. Over-excavate areas of existing fills and other unsuitable material encountered during mass grading.
- B. Compensation for increased removal widths and depths that are not required will not be considered, except when such increase is necessary for protection of life and property as determined by and approved by the Owner.

**3.07 GRADING**

- A. Uniformly grade the Project to the elevations shown on plans.
- B. Finish ditches, gutters and swales to the sections, lines and grades indicated and to permit proper surface drainage.
- C. Round tops and bottoms of slopes as indicated or to blend with existing contours.

**3.08 SUBGRADE PREPARATION**

- A. Install underground utilities and service connections prior to final preparation of subgrade and placement of base materials for final surface facilities. Extend services so that final surface facilities are not disturbed when service connections are made.
- B. Prepare subgrades under paved areas, curbs, gutters, walks, structures, other surface facilities and areas to receive structural fill.
- C. Prepare subgrades for paved areas, curbs and gutters by plowing or scarifying surface at least 6 inches below final subgrade elevations and 5-feet beyond edge of pavement. Uniformly moisture condition to obtain optimum moisture contents. Break clods and condition surface by harrowing or dry rolling. Remove boulders, hard ribs and solid rock. Prepare earth uniform for full depth and width of subgrade.
- D. Protect utilities from damage during compaction of subgrades and until placement of final pavements or other surface facilities.

**3.09 PLACEMENT OF STRUCTURAL FILL**

- A. Place structural fill on prepared subgrade.
- B. Spread structural fill material in uniform lifts not more than 8-inches in un-compacted thickness and compact.
- C. Place structural fill material to suitable elevations above grade to provide for anticipated settlement and shrinkage.
- D. Overbuild fill slopes to obtain required compaction. Remove excess material to lines and grades indicated.
- E. Do not drop fill on structures. Do not backfill around, against, upon concrete, or masonry structures until structure has attained sufficient strength to withstand loads imposed and the horizontal structural system had been installed.
- F. Backfill in uniform lifts not exceeding 8 inches in uncompacted thickness. Each lift should be brought to a uniform moisture content of at least 1 percent above optimum prior to compacting by either spraying the soil with water if it is too dry or aerating the material if it is too wet.



**3.10 KEYWAYS AND BENCHES**

- A. Provide keyways as indicated for fill slopes steeper than 6 horizontal to 1 vertical. Extend keyway -feet minimum into competent, undisturbed soil or 3-feet minimum into competent, undisturbed rock.
- B. Place subsurface drains in bottom of keyway in conformance with Section 33 46 00 – Subdrainage.
- C. Bench subgrade as indicated above toe of fill.
- D. Place subsurface drains at benches every 20 vertical feet.

**3.11 LOT FINISH GRADING**

- A. Blade finish lots to lines and grades indicated.

**3.12 COMPACTION AND TESTING**

- A. Do not compact by ponding, flooding or jetting.
- B. Compact soils at optimum water content. Aerate material if it is too wet. Add water to material if it is too dry. Thoroughly mix lifts before compaction to ensure uniform moisture distribution.
- C. Perform compaction using rollers, pneumatic or vibratory compactors.
- D. Compaction requirements:
  - 1. Compact structural fills less than 5-feet thick to 90 percent compaction.
  - 2. Compact structural fill 5-feet thick or greater to 95 percent compaction.
  - 3. Compact the upper 6 inches of subgrade soils beneath pavements, curbs and gutters to 95 percent compaction. Extend compaction 5-feet beyond pavement.
  - 4. Compact the upper 6-inches of subgrade soils to the following percentage of compaction: 95 percent under walks and pavements; 93 percent for foundations; and 90 percent for areas to receive structural fill.”

**3.13 DISPOSAL**

- A. Lawfully dispose of all unsuitable and excess or surplus material off-site at no cost to the Owner.

**END OF SECTION**

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**SECTION 31 23 33**

**TRENCHING AND BACKFILLING**

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**PART 1 - GENERAL**

**1.01 SECTION INCLUDES**

- A. Excavation, bedding, and backfill for underground storm drain, sanitary sewer, and water piping and associated structures.

**1.02 SECTION EXCLUDES**

- A. Drainage fill material and placement around subdrains.
- B. Trenching and backfill for other utilities such as underground HVAC piping, electrical conduit, telephone conduit, gas piping, cable TV conduit, etc.

**1.03 RELATED DOCUMENTS**

**A. ASTM:**

- 1. C 33, Standard Specification for Concrete Aggregates.
- 2. C 150, Standard Specification for Portland Cement.
- 3. C 260, Standard Specification for Air-Entraining Admixtures for Concrete.
- 4. C 618, Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete.
- 5. D 1557, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft<sup>3</sup> (2,700 kN-m/m<sup>3</sup>)).
- 6. D 2321, Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications.
- 7. D 2487, Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System).
- 8. D 3740, Standard Practice for Minimum Requirements for Agencies Engaged in Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction.
- 9. E 329, Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection.

**B. California Code of Regulation Title 24, Part 2, California Building Code:**

- 1. Accessibility to Public Buildings.
- 2. Safeguards During Construction.

C. Caltrans Standard Specifications:

1. Earthwork.
2. Aggregate Bases.
3. Subsurface Drains.
4. Geosynthetics.

D. CAL/OSHA, Title 8.

1.04 DEFINITIONS

- A. AC: Asphalt Concrete.
- B. ASTM: American Society for Testing and Materials.
- C. Bedding: Material from bottom of trench to bottom of pipe.
- D. CDF: Controlled Density Fill.
- E. DIP: Ductile Iron Pipe.
- F. Initial Backfill: Material from bottom of pipe to 12-inches above top of pipe.
- G. PCC: Portland Cement Concrete.
- H. RCP: Reinforced Concrete Pipe.
- I. Springline of Pipe: Imaginary line on surface of pipe at a vertical distance of  $\frac{1}{2}$  the outside diameter measured from the top or bottom of the pipe.
- J. Subsequent Backfill: Material from 12-inches above top of pipe to subgrade of surface material or subgrade of surface facility or to finish grade.
- K. Trench Excavation: Removal of material encountered above subgrade elevations and within horizontal trench dimensions.
  - 1. Authorized Trench Over-Excavation: Excavation below trench subgrade elevations or beyond indicated horizontal trench dimensions as shown on plans.
  - 2. Unauthorized Trench Over-Excavation: Excavation below trench subgrade elevations or beyond indicated horizontal trench dimensions. Unauthorized excavation shall be without additional compensation.
- L. Utility Structures:
  - 1. Storm drainage manholes, catch basins, drop inlets, curb inlets, vaults, etc.
  - 2. Sanitary sewer manholes, vaults, etc.
  - 3. Water vaults, etc.

**1.05 SUBMITTALS**

- A. Follow submittal procedures outlined in Section 01 33 00 – Submittal Procedures.
- B. Product Data:
  - 1. Grading and quality characteristics showing compliance with requirements for the Work.
  - 2. Certify that material meets requirements of the Project.
- C. Samples:
  - 1. If required, provide 40-pound samples of all imported trench bedding and backfill material sealed in airtight containers, tagged with source locations and suppliers of each proposed material.
  - 2. Provide materials from same source throughout work. Change of source requires approval of the Owner.

**1.06 QUALITY ASSURANCE**

- A. Conform all work to the appropriate portion(s) of the Caltrans Standard Specifications, Section 19.
- B. Percentage of compaction specified shall be the minimum acceptable. The percentage represents the ratio of the dry density of the compacted material to the maximum dry density of the material as determined by the procedure set forth in ASTM D 1557.
- C. Conform work to the requirements of the California Building Code: Pipe and Trenches.

**1.07 PROJECT CONDITIONS**

- A. Promptly notify the Owner of surface or subsurface conditions differing from those disclosed in the construction documents. First notify the Owner verbally to permit verification and extent of condition and then in writing. No claim for conditions differing from those anticipated in the Contract Documents will be allowed unless Contractor has notified the Owner in writing of differing conditions prior to contractor starting work on affected items.
- B. Protect open, trenches, and utility structure excavations with fences, covers and railings to maintain safe pedestrian and vehicular traffic passage.
- C. Stockpile on-site and imported backfill material temporarily in an orderly and safe manner.
- D. Provide dust and noise control in conformance with Division 1 General Requirements for Cleaning and Waste Management.

**PART 2 - PRODUCTS**

**2.01 PIPE BEDDING AND INITIAL BACKFILL**

- A. ASTM D 2321, Class IA, IB or II.
  - 1. Clean and free of clay, silt or organic matter.
- B. Permeable Material: Conform to Caltrans Standard Specifications, Class 2 permeable.
- C. Class 2 Aggregate Base: Conform to Caltrans Standard Specifications, ¾-inch maximum. Material shall also be non-expansive and predominantly granular soil or soil-rock mixture "(percent of passing #200: 50 maximum, 5 minimum)" with plasticity index of 15 or less.
- D. Sand: Conform to Caltrans Standard Specifications.

**2.02 WARNING TAPE**

- A. See Section 33 10 00 – Water Utilities.

**2.03 SUBSEQUENT BACKFILL**

- A. Conform to on-site or imported structural backfill in Section 31 23 00 – Excavation and Fill.

**2.04 CONTROLLED DENSITY FILL (CDF) (IN TRENCHES)**

- A. Provide non-structural CDF, from bottom of trench to finish subgrade of subbase or base material, that can be excavated by hand and produce unconfined compressive 28-day strengths from 50-psi to a maximum of 150-psi. Provide aggregate no larger than 3/8-inch top size. The 3/8-inch aggregate shall not comprise more than 30% of the total aggregate content.
- B. Cement: Conform to the standards as set forth in ASTM C-150, Type II Cement.
- C. Fly Ash: Conform to the standards as set forth in ASTM C-618, for Class F pozzolan. Do not inhibit the entrainment of air with the fly ash.
- D. Air Entraining Agent: Conform to the standards as set forth in ASTM C-260.
- E. Aggregates need not meet the standards as set forth in ASTM C-33. Any aggregate, producing performances characteristics described herein will be accepted for consideration. The amount of material passing a #200 sieve shall not exceed 12% and no plastic fines shall be present.
- F. Provide CDF that is a mixture of cement, Class F pozzolan, aggregate, air entraining agent and water. CDF shall be batched by a ready mixed concrete plant and delivered to the job site by means of transit mixing trucks.
- G. The Contractor shall determine the actual mix proportions of the controlled density fill to meet job site conditions, minimum and maximum strengths, and unit weight. Entrained air content shall be a minimum of 4.0%. The actual entrained air content shall be

established for each job with the materials and aggregates to be used to meet the placing and unit weight requirements. Entrained air content may be as high as 20% for fluidity requirements.

## 2.05 CONCRETE STRUCTURE BEDDING AND BACKFILL

- A. Precast Structures: Same materials to the same heights as specified for pipe bedding and backfill.
- B. Poured-in-Place Structures:
  - 1. Bedding: In general, bedding is not required, pour bases against undisturbed native earth in cut areas and against engineered fill compacted to 90% relative compaction in embankment areas.
  - 2. Side Backfill: On-site or imported structural fill meeting the requirements given in Section 31 23 00 – Excavation and Fill.

## 2.06 FILTER FABRIC

- A. Filter Fabric:
  - 1. Filter Fabric: per Caltrans Standard Specifications.

# PART 3 - EXECUTION

## 3.01 TRENCHING AND EXCAVATION

- A. Existing PCC or AC Areas: Cut PCC or AC to full depth at a minimum distance of 12-inches beyond the edge of the trench.
- B. Excavate by hand or machine. For gravity systems begin excavation at the outlet end and proceed upstream. Excavate sides of the trench parallel and equal distant from the centerline of the pipe. Hand trim excavation. Remove loose matter.
- C. Excavation Depth for Bedding: Minimum of 4-inches below bottom, except that bedding is not required for nominal pipe diameters of 2-inches or less.
- D. Excavation Width at Springline of Pipe:
  - 1. Up to a nominal pipe diameter of 24-inches: Minimum of twice the outside pipe diameter.
  - 2. Nominal pipe diameter of 30-inches through 36-inches: Minimum of the outside pipe diameter plus 2-feet.
  - 3. Nominal pipe diameter of 42-inches through 60-inches: Minimum of the outside pipe diameter plus 3-feet.
- E. Over-Excavations: Backfill trenches that have been excavated below bedding design subgrade, with approved bedding material.

- F. Comply with the Owner's limitations on the amount of trench that is opened or partially opened at any one time. Do not leave trenches open overnight without the approval of the Owner.
- G. Where forming is required, excavate only as much material as necessary to permit placing and removal of forms.
- H. Grade bottom of trench to provide uniform thickness of bedding material and to provide uniform bearing and support for pipe along entire length. Remove stones to avoid point bearing.

### 3.02 CONTROL OF WATER AND DEWATERING

- A. Be solely responsible for dewatering trenches and excavations and subsequent control of ground and surface water. Provide and maintain such pumps or other equipment as may be necessary to control ground water.
- B. Dewater during backfilling operation so that groundwater is maintained a least one foot below level of compaction effort.
- C. Reroute surface water runoff away from open trenches and excavations. Do not allow water to accumulate in trenches and excavations.
- D. Maintain dewatering system in place until dewatering is no longer required.

### 3.03 BRACING AND SHORING

- A. Conform to California and Federal OSHA requirements.
- B. Place and maintain such bracing and shoring as may be required to support the sides of the excavations for the proper protection of workmen; to facilitate the work; to prevent damage to the pipes and appurtenances being constructed; and to prevent damage to adjacent structures or facilities. Remove all bracing and shoring upon completion of the work.
- C. Be solely responsible for all bracing and shoring and, if requested by the Owner, submit details and calculations to the Owner. The Owner may forward the submittal to the Consulting Engineer and/or the California Division of Industrial Safety for their review. The Contractor's submittal shall include the basic design, assumed soils conditions and estimation of forces to be resisted, together with plans and specifications of the materials and methods to be used, and shall be prepared by a civil engineer or structural engineer registered in California. No excavations in trench section or around structures shall precede a response to the submittal by the Owner.
- D. Be solely responsible for installing and extracting the sheathing in a manner which will not disturb the line, grade, or backfill compaction or operation of the utility being installed or adjacent utilities and facilities.

### 3.04 PIPE BEDDING

- A. Accurately shape bedding material to the line and grade called for on the Plans. Carefully place and compact bedding material to the elevation of the bottom of the pipe in layers

not exceeding 8-inches in loose thickness. Compact bedding material at optimum water content to 95% relative compaction unless specified otherwise on the. Compact by pneumatic tampers or other mechanical means. Jetting or ponding of bedding material will not be permitted.

**3.05 WARNING TAPE**

- A. Install in accordance with Section 33 10 00 – Water Utilities.

**3.06 BACKFILLING**

- A. Bring initial backfill up simultaneously on both sides of the pipe, so as to prevent any displacement of the pipe from its true alignment. Carefully place and compact initial backfill material to an elevation of 12-inches above the top of the pipe in layers not exceeding 8-inches in loose thickness. Compact bedding material at optimum water content to 90% relative compaction unless specified otherwise on the. Compact by pneumatic tampers or other mechanical means. Jetting or ponding of initial backfill material will not be permitted.
- B. Bring subsequent backfill to subgrade or finish grade as indicated. Carefully place and compact subsequent backfill material to the proper elevation in layers not exceeding 8-inches in loose thickness. Compact bedding material at optimum water content to 90% relative compaction, unless specified otherwise on the Plans. Compact by pneumatic tampers or other mechanical means. Jetting or ponding of subsequent backfill material will not be permitted.
- C. Do not use compaction equipment or methods that produce horizontal or vertical earth pressures that may cause excessive pipe displacement or damage the pipe.

**3.07 CLEANUP**

- A. Upon completion of utility earthwork all lines, manholes catch basins, inlets, water meter boxes and other structures shall be thoroughly cleaned of dirt, rubbish, debris and obstructions of any kind to the satisfaction of the Owner.
- B. See Section 01 50 13 – Refer to Division 1 General Requirements for Cleaning and Waste Management for further cleanup requirements.

**END OF SECTION**



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SECTION 31 31 19

VEGETATION CONTROL

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**PART 1 - GENERAL**

1.01 SECTION INCLUDES

- A. Application of soil sterilant on subgrades for roadways, driveways, parking areas, walks, paths, trails and any other site improvements called for on the plans.

1.02 RELATED SECTIONS

- A. Section 31 23 00 – Excavation and Fill.

1.03 RELATED DOCUMENTS

- A. CAL/OSHA, Title 8.

1.04 SUBMITTALS

- A. Follow submittal procedures outlined in Section 01 33 00 – Submittal Procedures.

**PART 2 - PRODUCTS**

2.01 SOIL STERILANT

- A. Commercial chemical for weed control, registered by EPA. Provide granular, liquid or wet-able powder form.

**PART 3 - EXECUTION**

3.01 SOIL STERILIZATION

- A. Apply soil sterilant to areas indicated, such as beneath asphalt concrete pavement, brick pavement, concrete pavement and at grade concrete slabs, including sidewalks, curbs and gutters. Also where indicated apply soil sterilant below expansion and control joints and at areas where pipes, ducts or other features penetrate slabs.
- B. Apply soil sterilant uniformly and at the rates recommended by the manufacturer.
- C. Apply soil sterilant to prepared subgrade, or after installation of aggregate base as recommended by the manufacturer.

**3.02 DISPOSAL**

- A. Lawfully dispose of all unsuitable and excess or surplus material off-site at no cost to the Owner.

**END OF SECTION**

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**SECTION 32 05 23**

**CONCRETE FOR EXTERIOR IMPROVEMENTS**

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**PART 1 - GENERAL**

**1.01 SECTION INCLUDES**

- A. Materials for portland cement concrete.
- B. Aggregate and aggregate grading for portland cement concrete.
- C. Water for portland cement concrete.
- D. Admixtures for portland cement concrete.
- E. Proportioning for portland cement concrete.
- F. Mixing and transporting portland cement concrete.
- G. Formwork for cast in place portland cement concrete.
- H. Embedded materials for portland cement concrete.
- I. Steel reinforcement for portland cement concrete.
- J. Placing and finishing portland cement concrete.
- K. Curing portland cement concrete.
- L. Protecting portland cement concrete.

**1.02 RELATED DOCUMENTS**

- A. ASTM Standards
  - 1. A 1064, Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete.
  - 2. A 615, Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
  - 3. C 94, Standard Specification for Ready-Mixed Concrete.
  - 4. C 114, Standard Test Methods for Chemical Analysis of Hydraulic Cement.
  - 5. C 150, Standard Specification for Portland Cement.
  - 6. C 618, Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete.
  - 7. D 1751, Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Non-extruded and Resilient Bituminous Types).
- B. Caltrans Standard Specifications:
  - 1. Concrete Structures.
  - 2. Concrete Curbs and Sidewalks.
  - 3. General section of Concrete section.
- C. California Building Code:
  - 1. Accessibility To Public Buildings, Public Accommodations, Commercial Buildings and Public Housing.
  - 2. Concrete.
  - 3. Safeguards During Construction.

**1.03 DEFINITIONS**

- A. ASTM: American Society for Testing and Materials.

**1.04 SUBMITTALS**

- A. Follow submittal procedures outlined in Section 01 33 00 – Submittal Procedures.

- B. Design Mixes: Have all concrete mixes designed by a testing laboratory and approved by the Consulting Engineer. Conform all mixes to the applicable building code requirement, regardless of other minimum requirements listed herein or on the drawings. Submit mix designs for review before use. Show proportions and specific gravities of cement, fine and coarse aggregate, and water and gradation of combined aggregates.
- C. Reinforcing Steel Shop-Drawings

#### 1.05 QUALITY ASSURANCE

- A. Concrete shall be subject to quality assurance in accordance with Section 90 of the Standard Specifications.
  - 1. Slump tests: Have available, at job site, equipment required to perform slump tests. Make one slump test for each cylinder sample, from same concrete batch. Allowable maximum slump shall be 4 inches for walls and 3 inches for slabs on grade and other work.
- B. Certifications:
  - 1. Provide Owner's Representative at the time of delivery with certificates of compliance signed by both Contractor and Supplier containing the following statements:
  - 2. Materials contained comply with the requirements of the Contract Documents in all respects.
  - 3. Proportions and mixing comply with the design mix approved by the Consulting Engineer. Design mix shall have been field tested in accordance with the herein requirements of the Caltrans Standard Specifications and produces the required compressive strength under like conditions.
  - 4. Statement of type and amount of any admixtures.
  - 5. Provide Owner's Representative, at time of delivery, with certified delivery ticket stating volume of concrete delivered and time of mixing, or time of load-out in case of transit mixers.
- C. Conform to the applicable provisions of the Caltrans Standard Specification and these Technical Specifications.
  - 1. Conform construction of portland cement concrete surface improvements (including curbs, gutters, medians, valley gutters, walks) to the requirements of the Caltrans Standard Specifications unless otherwise required in these Technical Specifications or shown on the Plans.
  - 2. Construct "V" ditches in accordance with Section 72-5.03 of the Standard Specifications; except that finishing shall be in accordance with Standard Specification Section 73 instead of 53, or as otherwise required in these Technical Specifications or shown on the Plans.
  - 3. Conform other construction of portland cement concrete items to the requirements of the Caltrans Standard Specifications unless otherwise required in these Technical Specifications or shown on the Plans.
- D. Conform to the requirements of the California Building Code for testing of reinforcing bars.

#### 1.06 DESIGNATION

- A. General: Whenever the 28-day compressive strength is designated herein or on the plans is greater than 3,600 psi, the concrete shall be considered to be designated by compressive strength. The 28-day compressive strength shown herein or on the

plans which are 3,600 psi or less are shown for design information only and are not considered a requirement for acceptance of the concrete. Whenever the concrete is designated by class or as minor concrete herein or on the plans, the concrete shall contain the cement per cubic meter shown in section 90-1.01 of the Caltrans Standard Specifications.

- B. Unless specified otherwise herein or on the Plans, Portland Cement Concrete for this Project shall be Class "2" as specified in the Caltrans Standard Specifications.

## **PART 2 - PRODUCTS**

### **2.01 PORTLAND CEMENT**

- A. General: Type V or type II (modified) cement conforming to the requirements of ASTM C 150, with the following modifications:
  - 1. Cement shall not contain more than 0.60% by weight of alkalis, calculated as the percentage of  $\text{Na}_2\text{O}$  plus 0.658 times the percentage of  $\text{K}_2\text{O}$  when determined by either 4 intensity flame photometry or by the atomic absorption method. The instrument and procedure used shall be qualified as to precision and accuracy in accordance with the requirements of ASTM C 114.
  - 2. The autoclave expansion shall not exceed 0.50%.
  - 3. Mortar containing the Portland Cement to be used and the sand, when tested in accordance with Test Method No. Calif. 527, shall not expand in water more than 0.010% and shall have an air content less than .048%.
  - 4. Allowable tri-calcium Aluminate ( $\text{C}_3\text{A}$ ) by weight shall not exceed 5%. Allowable tetracalcium aluminoferrite plus twice the tricalcium aluminate ( $\text{C}_4\text{AF}+2\text{C}_3\text{A}$ ) by weight shall not exceed 25%. The sulfate expansion test (ASTM C 452) may be used in lieu of the above chemical requirements, provided the sulfate expansion does not exceed 0.040% at 14 days (max.).
  - 5. Contractor may substitute pozzolan for Portland Cement in amounts up to 15% of the required mix unless high early strength concrete is specified. Pozzolan shall consist of Class F Fly Ash meeting the requirements of ASTM C 618.
- B. Cement for Surface Improvements: Provide a coloring equivalent to ¼ pound of lampblack per cubic yard. Add to the concrete at the central mixing plant.
- C. Liquiblack, as supplied by Concrete Corporation of Redwood City, California, may be used in lieu of lampblack. One pint of liquiblack shall be considered equal to one pound of lampblack.

### **2.02 AGGREGATE AND AGGREGATE GRADING**

- A. General: Conform to the requirements of the Caltrans Standard Specifications.
- B. Aggregate Size and Gradation: Conform to the requirements of the Caltrans Standard Specifications for 25-mm (1-inch) maximum combined aggregate.

### **2.03 WATER**

- A. General: Conform to the requirements of the Caltrans Standard Specifications, for mixing and curing portland cement concrete and for washing aggregates.

### **2.04 CLASSIFICATION OF PORTLAND CEMENT CONCRETE**

- A. Concrete for the following items shall be designated by the following classes per of the Caltrans Standard Specifications:
  - 1. Vehicular Pavement: Class 2.

2. Curbs, Gutters, and Sidewalks: Minor Concrete.
3. Cast in place Concrete Pipe: The concrete shall consist of a minimum of 564 pounds of Portland cement per cubic yard of concrete.
4. Thrust Blocks: The concrete shall have a minimum compressive strength of 3,000 psi.
5. Sign and Fence Footings: The concrete shall consist of a minimum of 376 pounds of Portland cement per cubic yard of concrete.
6. Water, Storm, and Sanitary Structures: The concrete shall consist of a minimum of 564 pounds of Portland cement per cubic yard of concrete.

## 2.05 EXPANSION JOINT MATERIAL

- A. Material for expansion joints in portland cement concrete improvements shall be premolded expansion joint fillers conforming to the requirements of ASTM Designation D 1751. Expansion joint material shall be shaped to fit the cross section of the concrete prior to being placed. Suppliers certificates showing conformance with this specification shall be delivered with each shipment of materials delivered to the job site. Unless noted otherwise herein or on the Plans expansion joint thickness shall be as follows:
  1. Curbs, Curb Ramps, Island Paving, Sidewalks, Driveways and Gutter Depressions: ¼-inch.
  2. Concrete Slope Protection, Gutter Lining, Ditch Lining and Channel Lining: ½-inch.
  3. Structures: As indicated.

## 2.06 REINFORCEMENT AND DOWELS

- A. Bar reinforcement for concrete improvements shall be deformed steel bars of the size or sizes called for on the plans conforming to the requirements of ASTM Designation A 615 for Grade 60 bars. Size and shape for bar reinforcement shall conform to the details shown or called for on the Plans. Substitution of wire mesh reinforcement for reinforcing bars will not be allowed.
- B. Slip dowels, where noted or called for on the plans or detail drawings shall be smooth billet-steel bars as designated and conforming to the requirements of ASTM Designation A 615 for Grade 60 bars. Ends of bars inserted in new work shall be covered with a cardboard tube sealed with cork; no grease or oil shall be used.
- C. Mesh for reinforcement for concrete improvements shall be cold drawn steel wire mesh of the size and spacing called for on the plans conforming to the requirements of ASTM Designation A 1064 for the material and mesh. Size and extent of mesh reinforcement shall conform to the details shown or called for on the plans.
- D. Tie wire for reinforcement shall be eighteen (18) gauge or heavier, black, annealed conforming to the requirements of ASTM Designation A 1064.
- E. Suppliers certificates showing conformance with this specification shall be delivered with each shipment of materials delivered to the job site.

## 2.07 COLOR AND PATTERN FOR DECORATIVE SURFACES

- A. Colors for decorative surfacing shall be CHROMIX admixtures as manufactured by the L. M. Scofield Company, Schedule A-312.05 or approved equal. The specific color shall be as designated or called for on the Plans.
- B. Patterns for decorative surfacing shall be standard "Bomanite" patterns as copyrighted by the Bomanite Corporation of Palo Alto, California or equal. The

specific pattern shall be as designated or called for on the Plans.

**2.08 ACCESSORY MATERIALS**

- A. Conform water stops and other items required to be embedded in of Portland Cement Concrete structures to the applicable requirements of the Caltrans Standard Specifications unless otherwise specifically noted or called for on the Plans or detail drawings.
- B. Curing Compounds:
  - 1. Regular Portland Cement Concrete: "Non-Pigmented Curing Compound - chlorinated Rubber Base-Clear" conforming to the requirements contained in the Caltrans Standard Specifications.
  - 2. Color Conditioned Decorative Portland Cement Concrete: LITHOCHROME colorwax as manufactured by the L. M. Scofield Company or approved equal.

**2.09 FORMS**

- A. Conform to the requirements of the Caltrans Standard Specifications.

**2.10 PRECAST CONCRETE STRUCTURES**

- A. Conform to the following Sections of Caltrans Standard Specifications:
  - 1. Minor Structures.
  - 2. Flared End Sections.
  - 3. Precast Concrete Structures.

**2.11 PORTLAND CEMENT CONCRETE VEHICULAR PAVEMENT**

- A. General: See Section 32 13 00 – Rigid Paving.

**PART 3 - EXECUTION**

**3.01 STRUCTURAL EXCAVATION**

- A. Structural excavation may be either by hand, or by machine and shall be neat to the line and dimension shown or called for on the plans. Excavation shall be sufficient width to provide adequate space for working therein, and comply with CAL-OSHA requirements.
- B. Where an excavation has been constructed below the design grade, refill the excavation to the bottom of the excavation grade with approved material and compact in place to 95% of the maximum dry density.
- C. Remove surplus excavation material remaining upon completion of the work from the job site, or condition it to optimum moisture content and compact it as fill or backfill on the site.

**3.02 SOIL STERILANT**

- A. Furnish and apply to areas indicated in accordance with Section 31 31 19 – Vegetation Control.

**3.03 BRACING AND SHORING**

- A. Conform to California and Federal OSHA requirements.
- B. Place and maintain such bracing and shoring as may be required to support the sides of the excavations for the proper protection of workmen; to facilitate the work; to prevent damage to the facility being constructed; and to prevent damage to adjacent structures or facilities. Remove all bracing and shoring upon completion of the work.

- C. Be solely responsible for all bracing and shoring and, if requested by the Owner's Representative, submit details and calculations to the Owner's Representative. The Owner's Representative may forward the submittal to the Consulting Engineer and/or the California Division of Industrial Safety for their review. The Contractor's submittal shall include the basic design, assumed soils conditions and estimation of forces to be resisted, together with plans and specifications of the materials and methods to be used, and shall be prepared by a civil engineer or structural engineer registered in California. No excavations related to the proposed facility shall precede a response to the submittal by the Owner's Representative.
- D. Be solely responsible for installing and extracting the sheathing in a manner which will not disturb the position or operation of the facility being constructed or adjacent utilities and facilities.

### 3.04 PLACING CONCRETE FORMS

- A. Form concrete improvements with a smooth and true upper edge. Side of the form with a smooth finish shall be placed next to concrete. Construct forms rigid enough to withstand the pressure of the fresh concrete to be placed without any distortion.
- B. Thoroughly clean all forms prior to placement and coat forms with an approved form oil in sufficient quantity to prevent adherence of concrete prior to placing concrete.
- C. Carefully set forms to the alignment and grade established and conform to the required dimensions. Rigidly hold forms in place by stakes set at satisfactory intervals. Provide sufficient clamps, spreaders and braces to insure the rigidity of the forms.
- D. Provide forms for back and face of curbs, lip of gutters and edge of walks, valley gutters or other surface slabs that are equal to the full depth of the concrete as shown, noted or called for on the Plans. On curves and curb returns provide composite forms made from benders or thin planks of sufficient ply to ensure rigidity of the form.

### 3.05 PLACING STEEL REINFORCEMENT

- A. Bars shall be free of mortar, oil, dirt, excessive mill scale and scabby rust and other coatings of any character that would destroy or reduce the bond. All bending shall be done cold, to the shapes shown on the plans. The length of lapped splices shall be as follows:
  - 1. Reinforcing bars No. 8, or smaller, shall be lapped at least 45 bar diameters of the smaller bar joined, and reinforced bars Nos. 9, 10, and 11 shall be lapped at least 60 bar diameters of the smaller bars joined, except when otherwise shown on the plans.
  - 2. Splice locations shall be made as indicated on the plans.
- B. Accurately place reinforcement as shown on the plans and hold firmly and securely in position by wiring at intersections and splices, and by providing precast mortar blocks or ferrous metal chairs, spacers, metal hangers, supporting wires, and other approved devices of sufficient strength to resist crushing under applied loads. Provide supports and ties of such strength and density to permit walking on reinforcing without undue displacement.
- C. Place reinforcing to provide the following minimum concrete cover:
  - 1. Surfaces exposed to water: 4-inches.
  - 2. Surfaces poured against earth: 3-inches.
  - 3. Formed surfaces exposed to earth or weather: 2-inches.



4. Slabs, walls, not exposed to weather or earth: 1-inch.
- D. Minimum spacing, center of parallel bars shall be two and one half (2-1/2) times the diameter of the larger sized bar. Accurately tie reinforcing securely in place prior to pouring concrete. Placing of dowels or other reinforcing in the wet concrete is not permitted.

### 3.06 MIXING AND TRANSPORTING PORTLAND CEMENT CONCRETE

- A. Transit mix concrete in accordance with the requirements of ASTM Designation C 94. Transit mix for not less than ten (10) minutes total, not less than three (3) minutes of which shall be on the site just prior to pouring. Mix continuous with no interruptions from the time the truck is filled until the time it is emptied. Place concrete within one hour of the time water is first added unless authorized otherwise by the Owner's Representative.
- B. Do not hand mix concrete for use in concrete structures.

### 3.07 PLACING PORTLAND CEMENT CONCRETE

- A. Thoroughly wet subgrade when concrete is placed directly on soil. Remove all standing water prior to placing concrete.
- B. Do not place concrete until the subgrade and the forms have been approved.
- C. Convey concrete from mixer to final location as rapidly as possible by methods that prevent separation of the ingredients. Deposit concrete as nearly as possible in final position to avoid re-handling.
- D. Place and solidify concrete in forms without segregation by means of mechanical vibration or by other means as approved by the Owner's Representative. Continue vibration until the material is sufficiently consolidated and absent of all voids without causing segregation of material. The use of vibrators for extensive shifting of fresh concrete will not be permitted.
- E. Concrete in certain locations may be pumped into place upon prior approval by the Owner's Representative. When this procedure requires redesign of the mix, such redesign shall be submitted for approval in the same manner as herein specified for approval of design mixes.

### 3.08 PLACING ACCESSORY MATERIALS

- A. Place water stops and other items required to be embedded in of portland cement concrete structures at locations shown or required in accordance with the Caltrans Standard Specifications unless otherwise specifically noted or called for on the Plans.
- B. Curing Compounds:
  1. Regular Portland Cement Concrete: Apply "Non-Pigmented Curing Compound - chlorinated Rubber Base-Clear" in accordance with Caltrans Standard Specifications.
  2. Color Conditioned Decorative Portland Cement Concrete: Apply LITHOCHROME colorwax in accordance with the manufactures instructions.

### 3.09 EXPANSION JOINTS

- A. Construct expansion joints incorporating premolded joint fillers at twenty (20) foot intervals in all concrete curbs, gutters, sidewalks, median/island paving, valley gutters, driveway approaches and at the ends of all returns. At each expansion joint install one-half inch by twelve inch (1/2" x 12") smooth slip dowels in the positions shown or noted on the detail drawings.

- B. Orient slip dowels at right angles to the expansion joint and hold firmly in place during the construction process by means of appropriate chairs.

### 3.10 WEAKENED PLANE JOINTS

- A. Construct weakened plane joints in concrete curbs, gutters, sidewalks, median/island paving and valley gutters between expansion joints at ten (10) foot intervals throughout, or as otherwise indicated. Depth of joint score depth to be one-fourth (25%) the thickness of the concrete.
  - 1. Grooved Joints: Form weakened plane joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8-inch. Repeat grooving of weakened plane joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.

### 3.11 FINISHING CONCRETE

- A. Finish curb and gutter in conformance with the applicable requirements of the Caltrans Standard Specifications as modified herein.
- B. Where monolithic curb, gutter and sidewalk is specified, separate concrete pours will not be allowed.
- C. Provide a medium broom finish to all horizontal surfaces unless otherwise shown.

### 3.12 FORM REMOVAL

- A. Remove forms without damage to the concrete. Remove all shores and braces below the ground surface, before backfilling.
- B. Do not backfill against concrete until the concrete has developed sufficient strength to prevent damage.
- C. Leave forms for cast-in-place walls in place at least 72 hours after pouring.
- D. Leave edge forms in place at least 24 hours after pouring.

### 3.13 CONSTRUCTION

- A. Form, place and finish concrete walkways, island paving, valley gutters and driveway approaches in conformance with the applicable requirements of the Caltrans Standard Specifications as modified herein.
- B. Construct new concrete curb, curb and gutter and valley gutters against existing asphalt concrete by removing a minimum of 12-inches of the asphalt concrete to allow placement of curb or gutter forms. Patch pavement with a 6-inch deep lift of asphalt concrete after gutter form is removed.

### 3.14 CONNECTING TO EXISTING CONCRETE IMPROVEMENTS

- A. New curb, gutter, or sidewalk is to connect to existing improvements to remain by saw cutting to existing sound concrete at the nearest score line, expansion joint or control joint. Drill and insert ½-inch diameter by 12-inch long dowels at 24-inches on center into existing improvements. Install pre-molded expansion joint filler at the matching joint.
- B. A cold joint to the existing curb is not acceptable.

### 3.15 DECORATIVE SURFACING CONSTRUCTION

- A. Decorative surfacing concrete walks, concrete median islands or other installations shall be formed and placed as a concrete slab conforming to the details shown or noted on the Plans.

**3.16 FIELD QUALITY CONTROL**

- A. Finish subgrade for concrete improvements shall be subject to approval prior to placement of forms.
- B. No concrete shall be placed prior to approval of forms.
- C. Concrete improvements constructed shall not contain "bird baths" or pond water and shall be smooth and ridge free.
- D. Conform the finish grade at top of curb, flow line of gutter, and the finish cross section of concrete improvements to the design grades and cross sections.
- E. Variation of concrete improvements from design grade and cross section as shown or called for on the plans shall not exceed the tolerances established the Caltrans Standard Specifications.

**3.17 RESTORATION OF EXISTING IMPROVEMENTS**

- A. Replace in kind all pavement or other improvements removed or damaged due to the installation of concrete improvements.
- B. Remove, landscaping or plantings damaged or disturbed due to the installation of concrete improvements. Replace in kind.

**END OF SECTION**

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**SECTION 32 11 00**

**BASE COURSES**

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**PART 1 - GENERAL**

**1.01 SECTION INCLUDES**

- A. Aggregate subbase.
- B. Aggregate base.
- C. Cement treated base.
- D. Lime stabilization.

**1.02 RELATED DOCUMENTS**

- A. ASTM:
  - 1. D 3740, Standard Practice for Minimum Requirement for Agencies Engaged in Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction.
  - 2. E 329, Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection.
  - 3. E 548, Standard Guide for General Criteria Used for Evaluating Laboratory Competence.
- B. Caltrans Standard Specifications:
  - 1. Lime Stabilized Soil.
  - 2. Aggregate Subbases.
  - 3. Aggregate Bases.
  - 4. Cement Treated Bases.

**1.03 DEFINITIONS**

- A. Geotechnical Testing Agency: An independent testing agency qualified according to ASTM E 329 to conduct soil materials and rock definition testing, as documented according to ASTM D 3740 and ASTM E 548.
- B. Rock: Rock material in beds, ledges, unstratified masses, and conglomerate deposits and boulders of rock material  $\frac{3}{4}$ -cubic yards or more in volume that when tested, according to ASTM D 1586, exceeds a standard penetration resistance of 100 blows/2-inches.
- C. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man made stationary features constructed above or below grade.
- D. Subgrade: Surface or elevation remaining after completing excavation, or top surface of a fill or backfill immediately below subbase, base or topsoil materials.

**1.04 SUBMITTALS**

- A. Follow submittal procedures outlined in Section 01 33 00 – Submittal Procedures.
- B. Submit material certificates signed by the material producer and the Contractor, certifying that that each material item complies with, or exceeds the specified requirements.

**1.05 QUALITY ASSURANCE**

- A. Percentage of compaction specified shall be the minimum acceptable. The percentage represents the ratio of the dry density of the compacted material to the maximum dry density of the material as determined by the procedure set forth in ASTM D 1557.
- B. Do not mix or place cement treated base when the temperature is below 36 degrees F or when the ground is frozen.

- C. Finish surface of material to be stabilized prior to lime treatment shall be as specified in the Caltrans Standard Specifications.
- D. Finish surface of the stabilized material after lime treatment shall be as specified in the Caltrans Standard Specifications.
- E. Finish surface of cement treated base shall be as specified in the Caltrans Standard Specifications.
- F. Do not project the finish surface of aggregate subbase above the design subgrade.
- G. Finish grade tolerance at completion of base installation: +0.05'

**1.06 PROJECT CONDITIONS**

- A. Protect open excavations, trenches, and the like with fences, covers and railings to maintain safe pedestrian and vehicular traffic passage.
- B. Temporarily stockpile material in an orderly and safe manner and in a location approved by the Owner.
- C. Provide dust and noise control in conformance with Division 1 General Requirements.

**PART 2 - PRODUCTS****2.01 AGGREGATE SUBBASE**

- A. Material: Caltrans Standard Specification.
  - 1. Class 1, 2, or 3: Section 25-1.02B.
  - 2. Class 4: Section 25-1.02C.
  - 3. Class 5: Section 25-1.02D.

**2.02 AGGREGATE BASE**

- A. Material: Caltrans Standard Specification.
  - 1. Class 2, 1-1/2-inch Maximum:.
  - 2. Class 2, 3/4-inch Maximum:.
  - 3. Class 3: .

**2.03 CEMENT TREATED BASE**

- A. Materials: Caltrans Standard Specification.

**2.04 LIME STABILIZATION**

- A. Lime Treatment Material: Conform to the Caltrans Standard Specifications.

**PART 3 - EXECUTION****3.01 GENERAL**

- A. Placement and compaction of material by flooding, ponding, or jetting will not be permitted.

**3.02 WET WEATHER CONDITIONS**

- A. Do not place or compact subgrade if above optimum moisture content.

**3.03 AGGREGATE SUBBASE**

- A. Spreading and Compacting: Conform to Caltrans Standard Specifications.

**3.04 AGGREGATE BASE**

- A. Spreading and Compacting: Conform to Caltrans Standard Specifications.

**3.05 CEMENT TREATED BASE**

- A. Cement treated base shall be as follows: Proportioning and Mixing Plant-Mixed: per Caltrans Standard Specifications.

**3.06 LIME STABILIZATION**

- A. Performing the stabilization shall conform to Caltrans Standard Specifications and the following:
  - 1. Add lime in the amount specified by a Geotechnical Consultant.
  - 2. Lime treat subgrade soils from back of curb to back of curb to a depth specified by a Geotechnical Consultant.

3. Mix in two mixing periods, both with the tines lowered to the same depth. Both mixing periods shall be monitored and verified by a Geotechnical Consultant. The second mixing shall occur at about 36 hours after the initial mixing.
4. Compact and grade the lime mixed subgrade immediately after the second mixing.
5. Compact the lime treated subgrade to 95 percent as determined by ASTM D1557.
6. After application of the curing seal, do not allow traffic on the lime treated material for a period of 7 days in lieu of the 3 days specified in the Caltrans Standard Specifications.
7. Proof-roll the stabilized subgrade after compacting to confirm that a non-yielding surface has been achieved. Yielding areas, if any, shall be mitigated. Mitigation could consist of over-excavation, utilization of stabilization fabric, or chemical treatment. Each case shall be addressed individually in the field by a Geotechnical Consultant.

**3.07 DISPOSAL**

- A. Lawfully dispose of all unsuitable and excess or surplus material off-site at no cost to the Owner.

**END OF SECTION**

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**SECTION 32 12 00**

**FLEXIBLE PAVING**

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**PART 1 - GENERAL**

**1.01 SECTION INCLUDES**

- A. Prime coat.
- B. Tack coat.
- C. Asphaltic concrete paving.
- D. Asphaltic concrete overlay and slurry seals.
- E. Speed bumps.
- F. Asphalt curbs.
- G. Pavement grinding.

**1.02 RELATED DOCUMENTS**

- A. ASTM:
  - 1. D 979: Standard Practice for Sampling Bituminous Paving Mixtures.
  - 2. D 1073: Standard Specification for Fine Aggregate for Asphalt Paving Mixtures.
  - 3. D 1188: Standard Test Method for Bulk Specific Gravity and Density of Compacted Bituminous Mixtures Using Coated Samples.
  - 4. D 2041: Standard Test Method for Theoretical Maximum Specific Gravity and Density of Bituminous Paving Mixtures.
  - 5. D 2726: Standard Test Method for Bulk Specific Gravity and Density of Non-Absorptive Compacted Asphalt Mixtures.
  - 6. D 2950: Standard Test Method for Density of Bituminous Concrete in Place by Nuclear Methods.
  - 7. D 3549: Standard Test Method for Thickness or Height of Compacted Bituminous Paving Mixture Specimens.
  - 8. D 3666: Standard Specification for Minimum Requirements for Agencies Testing and Inspecting Road and Paving Mixtures.
- B. Caltrans Standard Specifications.
  - 1. Bituminous Seals.
  - 2. Asphalt Concrete.
  - 3. Geosynthetics.
  - 4. Asphalt Binders.
  - 5. Asphaltic Emulsions.
- C. California Building Code:
  - 1. Accessibility to Public Buildings, Public Accommodations, Commercial Buildings, and Public Housing.
  - 2. Exterior Routes of Travel.

**1.03 DEFINITIONS**

- A. ASTM: American Society for Testing Materials.

#### **1.04 QUALITY ASSURANCE**

- A. Testing Agency: Owner will engage a qualified independent testing agency to perform field inspections and tests and to prepare test reports.
  - 1. Testing agency will conduct and interpret tests and state in each report whether tested work complies with or deviates from specified requirements.
- B. Additional testing, at Contractor's expense, will be performed to determine compliance of corrected Work with specified requirements.
- C. Thickness of Asphaltic Concrete: In-place compacted thickness of asphalt courses will be determined according to ASTM D 3549.
- D. Surface Smoothness: Finished surface of each asphalt course will be tested for compliance with smoothness tolerances.
- E. In-Place Density: Samples of uncompacted paving mixtures and compacted pavement will be secured by testing agency according to ASTM D 979.
  - 1. Reference maximum theoretical density will be determined by averaging results from 4 samples of hot-mix asphalt-paving mixture delivered daily to site, prepared according to ASTM D 2041, and compacted according to job-mix specifications.
  - 2. In-place density of compacted pavement may be determined by testing core samples according to ASTM D 1188 or ASTM D 2726.
    - (a) One core sample may be taken for every 1000 sq. yd. or less of installed pavement, but in no case will fewer than 3 cores be taken.
    - (b) Field density of in-place compacted pavement may also be determined by nuclear method according to ASTM D 2950 and correlated with ASTM D 1188 or ASTM D 2726.

#### **1.05 SUBMITTALS**

- A. Follow submittal procedures outlined in Section 01 33 00 – Submittal Procedures.
- B. Job-Mix Designs: Certificates signed by manufacturers certifying that each asphaltic concrete mix complies with requirements.
- C. Material Certificates: Certificates signed by manufacturers certifying that each material complies with requirements.

#### **1.06 PROJECT CONDITIONS**

- A. Environmental Limitations:
  - 1. Prime Coat: Minimum surface temperature of 60 deg F at application.
  - 2. Tack Coat: Minimum surface temperature of 60 deg F at application.
  - 3. Asphalt Base Course: Minimum surface temperature of 40 deg F and rising at application.
  - 4. Asphalt Surface Course: Minimum surface temperature of 60 deg F at application.
  - 5. Reinforcing Fabric: Air temperature is 50 deg F and rising and pavement temperature is 40 deg F and rising.



## **PART 2 - PRODUCTS**

### **2.01 ASPHALTIC CONCRETE**

- A. Caltrans Standard Specifications
- B. Asphalt Materials:
  - 1. Asphalt: Caltrans Standard Specification, steam refined paving asphalt.
    - (a) Asphalt Curbs: use grade PG 70-10
    - (b) All other asphalt products: use grade PG 64-10.
  - 2. Prime Coat: per Caltrans Standard Specification
  - 3. Tack Coat: per Caltrans Standard Specification.
  - 4. Asphaltic Emulsion: per Caltrans Standard Specification, for quick-setting type, Grade QS1h anionic or CQS1h cationic.
- C. Aggregates: Conform to Caltrans Standard Specification as applicable.
- D. Storing, Proportioning and Mixing Materials: per Caltrans Standard Specification
- E. Pavement Reinforcing Fabric: per Caltrans Standard Specification.
- F. Sand: ASTM D 1073, Grade No. 2 or 3.

## **PART 3 - EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that subgrade is dry and in suitable condition to support paving and imposed loads.
- B. Proof-roll subbase using heavy, pneumatic-tired rollers to locate areas that are unstable or that require further compaction.
- C. Notify Owner in writing of any unsatisfactory conditions. Do not begin paving until these conditions have been satisfactorily corrected.

### **3.02 PAVEMENT GRINDING**

- A. Clean existing paving surface of loose or deleterious material immediately before pavement grinding.
- B. Grind conforms as indicated.

### **3.03 SOIL STERILANT**

- A. Furnish and apply to areas indicated in accordance with Section 31 31 19 – Vegetation Control.

### **3.04 SURFACE PREPARATION FOR AGGREGATE BASE MATERIALS**

- A. General: Immediately before placing asphalt materials remove loose and deleterious material from substrate surfaces and ensure that prepared subgrade is ready to receive paving according to the Caltrans Standard Specification Section
- B. Prime Coat: Apply uniformly over surface of compacted-aggregate base according to the Caltrans Standard Specification Section. Apply enough material to penetrate and seal, but not flood, surface. Allow prime coat to cure for 24 hours minimum.

1. If prime coat is not entirely absorbed within 8 hours after application, spread excess prime coat with hand tools and broadcast sand over surface to blot excess asphalt. Use just enough sand to prevent pickup under traffic. Remove loose sand by sweeping before pavement is placed and after volatiles have evaporated.
  2. Protect primed substrate from damage until ready to receive paving.
- C. Tack Coat: Apply uniformly to all vertical surfaces against which asphaltic concrete is to be placed, including existing surfaces of previously constructed asphalt or portland cement concrete paving and to surfaces abutting or projecting into new asphalt pavement, according to the Caltrans Standard Specification.
1. Allow tack coat to cure undisturbed before paving.
  2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.

**3.05 SURFACE PREPARATION FOR PAVEMENT AT ASPHALTIC CONCRETE OVERLAYS AND SLURRY SEALS**

- A. Pavement Irregularities: Level with asphaltic concrete, Type B, No. 4 maximum.
- B. Pavement Cracks:
1. Less than 1/8-inch wide: Clean of all dirt by compressed air jet, spray and seal with RS-1 asphaltic emulsion.
  2. Wider than 1/8-inch: Clean of all dirt by compressed air jet, spray and seal with RS-1 asphaltic emulsion and skin patch.
- C. Clean surface of all material, such as leaves, dirt, sand, gravel, water and vegetation including roots prior to applying binder of paving asphalt to existing surface.
- D. Oil spots shall be removed with brush and detergents and covered with Oil Spot Sealer by OverKote or an equal product.
- E. Prior to first application in exceptionally hot weather, dampen surface with water. Remove excess water and leave surface slightly damp.

**3.06 APPLYING ASPHALT PAVEMENT OVERLAYS AND SLURRY SEALS**

- A. Use OverKote Asphalt Pavement Coating or equal product.
- B. Apply at a rate of 25 gallons per 1,000 sf of surface area.
- C. Follow all manufacturers' recommendations for preparation and applications procedure of the products used.
- D. Apply second coat as soon as first coat is dry.

**3.07 PAVEMENT REINFORCING FABRIC**

- A. Protect from exposure to ultraviolet rays until placed.
- B. Reject rolls with broken or damaged cores, or factory wrinkled fabric that prevents wrinkle free placement.
- C. Place with binder of paving asphalt in accordance with Caltrans Standard Specifications.

### **3.08 ASPHALTIC CONCRETE SPREADING AND COMPACTING EQUIPMENT**

- A. Spreading Equipment: per Caltrans Standard Specification.
- B. Compaction Equipment: per Caltrans Standard Specification

### **3.09 ASPHALTIC CONCRETE PLACEMENT**

- A. Place, spread and compact asphaltic concrete to required grade, cross section, and thickness according to the Caltrans Standard Specification Sections
- B. Promptly correct surface irregularities in paving course behind paver. Use suitable hand tools to remove excess material forming high spots. Fill depressions with hot asphalt to prevent segregation of mix; use suitable hand tools to smooth surface.

### **3.10 JOINTS**

- A. Construct joints to ensure continuous bond between adjoining paving sections according to the Caltrans Standard Specification.
  - 1. Construct joints free of depressions with same texture and smoothness as other sections of asphalt course.
  - 2. Clean contact surfaces and apply tack coat.
  - 3. Offset longitudinal joints in successive courses a minimum of 6 inches.
  - 4. Offset transverse joints in successive courses a minimum of 24 inches.
  - 5. Compact joints as soon as asphaltic concrete will bear roller weight without excessive displacement.

### **3.11 COMPACTION**

- A. General: Begin compaction as soon as placed hot-mix paving will bear roller weight without excessive displacement. Compact according to the Caltrans Standard Specification
- B. Compaction Requirements: Average Density to be 92 percent of reference maximum theoretical density according to ASTM D 2041, but not less than 90 percent nor greater than 96 percent.
- C. Finish Rolling: Finish roll paved surfaces to remove roller marks while asphalt is still warm.
- D. Edge Shaping: While surface is being compacted and finished, trim edges of pavement to proper alignment. Bevel edges while still hot, with back of rake or smooth iron. Compact thoroughly using tamper or other satisfactory method.
- E. Repairs: Remove paved areas that are defective or contaminated with foreign materials and replace with fresh asphalt. Compact by rolling to specified density and surface smoothness.
- F. Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened. Erect barricades to protect paving from traffic until mixture has cooled enough not to become marked.

### **3.12 ASPHALT CURBS**

- A. Construction: Place over compacted surfaces according to Caltrans Standard Specification Section 39-7.01 as specified for dikes. Apply a light tack coat prior to construction, unless pavement surface is still tacky and free of dust.
- B. Shape: Place asphaltic concrete to curb cross section indicated.

**3.13 SPEED BUMPS**

- A. Construct speed bumps over compacted pavement surfaces according to Caltrans Standard Specification. Apply a light tack coat prior to construction, unless pavement surface is still tacky and free of dust.
- B. Place asphaltic concrete by hand using a template/screed designed to result in speed bump cross-section indicated after compaction.
- C. Compact speed bumps with 8-ton static roller.

**3.14 INSTALLATION TOLERANCES**

- A. Asphalt Pavement:
  - 1. Course thickness and surface smoothness within the tolerances in the Caltrans Standard Specification
  - 2. Total Thickness: Not less than indicated.
- B. Trench Patch:
  - 1. Compacted surface: Within 0.01 foot of adjacent pavement.
  - 2. Do not create ponding.

**END OF SECTION**

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**SECTION 32 13 00**

**RIGID PAVING**

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**PART 1 - GENERAL**

**1.01 SECTION INCLUDES**

- A. Furnishing, placing, spreading, compacting and shaping portland cement concrete pavement with undoweled transverse weakened plane joints, for vehicular traffic.
- B. Form construction and use in placing portland cement concrete pavement.
- C. Joints for portland cement concrete pavement.
- D. Finishing portland cement concrete pavement.
- E. Curing and protecting portland cement concrete pavement.

**1.02 RELATED DOCUMENTS**

- A. AASHTO Standard Specifications
  - 1. T 53: Standard Method of Test for Softening Point of Bitumen (Ring-and-Ball Apparatus).
- B. ASTM Standards
  - 1. A 615: Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
  - 2. A 775: Standard Specification for Epoxy-Coated Steel Reinforcing Bars.
  - 3. A 934: Standard Specification for Epoxy-Coated Prefabricated Steel Reinforcing Bars.
  - 4. C 881: Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete.
  - 5. D 2628: Standard Specification for Preformed Polychloroprene Elastomeric Joint Seals for Concrete Pavements.
  - 6. D 2835: Standard Specification for Lubricant for Installation of Preformed Compression Seals in Concrete Pavements.
  - 7. D 6690: Standard Specification for Joint and Crack Sealants, Hot-Applied , for Concrete and Asphalt Pavements.
  - 8. D 3963: Standard Specification for Fabrication and Jobsite Handling of Epoxy-Coated Steel Reinforcing Bars.
- C. Caltrans Standard Specifications:

1. Concrete Pavement.
2. Reinforcement.
3. Concrete.
4. Epoxy.

D. Caltrans Standard Plans:

1. Portland Cement Concrete Pavement (Undoweled Transverse Joints).
2. Portland Cement Concrete Pavement Joint and End Anchor Details.

### 1.03 DEFINITIONS

- A. AASHTO: American Association of State Highway and Transportation Officials.
- B. ASTM: American Society for Testing and Materials.

### 1.04 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Manufacturer of ready-mixed concrete products complying with ASTM C 94 requirements for production facilities and equipment.
  1. Manufacturer must be certified according to the National Ready Mix Concrete Plant Certification Program.
- B. Installer Qualification: An experienced installer who has completed pavement work similar in material, design and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.
- C. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant and each aggregate from one source.

### 1.05 SUBMITTALS

- A. Follow submittal procedures outlined in Section 01 33 00 – Submittal Procedures.
- B. Design Mixes: For each concrete pavement mix. Include alternate mix designs when characteristics of materials, project conditions, weather, test results or other circumstances warrant adjustments.
- C. Material Certificates: Signed by manufacturers certifying that each of the following materials complies with requirements.
  1. Cementitious materials and aggregates.
  2. Steel reinforcement and reinforcement accessories.
  3. Admixtures.

4. Curing compound.
5. Applied finish material.
6. Bonding agent of adhesive.
7. Joint filler.
8. Joint Sealant.
9. Tie Bars.
10. Epoxy.
11. Backer Rods.

**PART 2 - PRODUCTS****2.01 PORTLAND CEMENT CONCRETE**

- A. General: Conform to Caltrans Standard Specifications. Use Class 2 Concrete.

**2.02 TIE BARS**

- A. Deformed reinforcing steel bars conforming to the requirements of ASTM Designation A 615/A (615M), Grade 40 or 60 (Grade 300 or 420).
- B. Epoxy-coat in conformance with the provisions in Caltrans Standard Specifications, except that references made to ASTM Designation D 3963/D 3963M shall be deemed to mean ASTM Designation A 934/A 934M or A 775/775M.
- C. Do not bend tie bars.

**2.03 EPOXY**

- A. Bond tie bars to existing concrete with epoxy resin conforming to "Epoxy Resin Adhesive for Bonding Freshly Mixed Concrete to Hardened Concrete," of the Caltrans Standard Specifications.

**2.04 SILICONE JOINT SEALANT**

- A. Furnish low modulus silicone joint sealant in a one-part silicone formulation. Do not use acid cure sealants. Compound to be compatible with the surface to which it is applied and conform to the following requirements:

Specification	Test Method	Requirement
Tensile stress, 150% elongation, 7-day cure at 25° ± 1°C and 45% to 55% R.H. <sup>e</sup>	ASTM D 412 (Die C)	310 kPa max.
Flow at 25° ± 1°C	ASTM C 639 <sup>a</sup>	Shall not flow from channel
Extrusion Rate at 25° ± 1°C	ASTM C 603 <sup>b</sup>	75-250 g/min.
Specific Gravity	ASTM D 792 Method A	1.01 to 1.51
Durometer Hardness, at -18°C, Shore A, cured 7 days at 25° ± 1°C	ASTM C 661	10 to 25
Ozone and Ultraviolet Resistance, after 5000 hours	ASTM C 793	No chalking, cracking or bond loss
Tack free at 25° ± 1°C and 45% to 55% R.H. <sup>e</sup>	ASTM C 679	Less than 75 minutes
Elongation, 7 day cure at 25° ± 1°C and 45% to 55% R.H. <sup>e</sup>	ASTM D 412 (Die C)	500 percent min.
Set to Touch, at 25° ± 1°C and 45% to 55% R.H. <sup>e</sup>	ASTM D 1640	Less than 75 minutes
Shelf Life, from date of shipment	—	6 months min.
Bond, to concrete mortar-concrete briquets, air cured 7 days at 25° ± 1°C	AASHTO T 132 <sup>c</sup>	345 kPa min.
Movement Capability and Adhesion, 100% extension at -18°C after, air cured 7 days at 25° ± 1°C, and followed by 7 days in water at 25° ± 1°C	ASTM C 719 <sup>d</sup>	No adhesive or cohesive failure after 5 cycles

Notes:

ASTM Designation: C 639 Modified (15 percent slope channel A).

ASTM Designation: C 603, through 3-mm opening at 345 kPa.

Mold briquets in conformance with the requirements in AASHTO Designation: T 132, sawed in half and bonded with a 1.5 mm maximum thickness of sealant and tested in conformance with the requirements in AASHTO Designation: T 132. Briquets shall be dried to constant mass at 100 ± 5° C.

Movement Capability and Adhesion: Prepare 305 mm x 25 mm x 75 mm concrete blocks in conformance with the requirements in ASTM Designation: C 719. A sawed face shall be used for bond surface. Seal 50 mm of block leaving 12.5 mm on each end of specimen unsealed. The depth of sealant shall be 9.5 mm and the width 12.5 mm.

- a. R.H. equals relative humidity.
- B. Formulate the silicon joint sealant to cure rapidly enough to prevent flow after application on grades of up to 15 percent.
- C. Furnish to the Owner a Certificate of Compliance. Accompany certificate with a certified test report of the results of the required tests performed on the sealant material within the



previous 12 months prior to proposed use. Provide the certificate and accompanying test report for each lot of silicone joint sealant prior to use on the project.

## 2.05 ASPHALT RUBBER JOINT SEALANT

- A. Conform to the requirements of ASTM Designation: D 6690 as modified herein or to the following:
  - 1. Provide a mixture of paving asphalt and ground rubber. Ground rubber to be vulcanized or a combination of vulcanized and de-vulcanized materials ground so that 100 percent will pass a 2.36-mm sieve and contain not less than 22 percent ground rubber, by mass. Modifiers may be used to facilitate blending.
  - 2. The Ring and Ball softening point shall be 57°C minimum, when tested in conformance with the requirements in AASHTO Designation: T 53.
  - 3. Provide asphalt rubber sealant material capable of being melted and applied to cracks and joints at temperatures below 204°C.
- B. The penetration requirement of Section 4.2 of ASTM Designation: D 6690 do not apply. The required penetration at 25°C, 150g, 5s, shall not exceed 120.
- C. The resilience requirement of Section 4.5 of ASTM Designation: D 6690 do not apply. The required resilience, when tested at 25°C, shall have a minimum of 50 percent recovery.
- D. Accompany each lot of asphalt rubber joint sealant shipped to the job site, whether as specified herein or conforming to the requirements of ASTM Designation D 6690, as modified herein, by a Certificate of Compliance, storage and heating instructions and precautionary instructions for use.
- E. Heat and place in conformance with the manufacturer's written instructions and the details shown on the plans. Provide manufacturer's instructions to the Owner. Do not place when the pavement surface temperature is below 10°C.

## 2.06 PREFORMED COMPRESSION JOINT SEALANT

- A. Material: ASTM Designation: D 2628.
  - 1. Number of cells: 5 or 6.
  - 2. Lubricant Adhesive: ASTM Designation D 2835.
  - 3. Install compression seals along with lubricant adhesive according to the manufacturer's recommendations. Submit manufacture's recommendations to the Owner's Representative`.
- B. Accompany each lot of compression seal and lubricant adhesive by a Certificate of Compliance, storage instructions and precautionary instructions for use. Also submit the manufacturer's data sheet with installation instructions and recommended model or type of preformed compression seal for the joint size and depth as shown on the plans. Show

evidence that the selected seal is being compressed at level between 20 and 50 percent at all times for the joint width and depth shown on the plans.

## **2.07 BACKER RODS**

- A. Provide backer rods that have a diameter prior to placement at least 25 percent greater than the width of the saw cut after sawing and are expanded, crosslinked, closed-cell polyethylene foam that is compatible with the joint sealant so that no bond, adverse reaction occurs between the rod and sealant. In no case use a hot pour sealant that will melt the backer rod. Submit a manufacturer's data sheet verifying that the backer rod is compatible with the sealant to be used.

## **PART 3 - EXECUTION**

### **3.01 WATER SUPPLY**

- A. Conform to Caltrans Standard Specifications.

### **3.02 SUBGRADE**

- A. Conform to Caltrans Standard Specifications.

### **3.03 SOIL STERILANT**

- A. Furnish and apply to areas indicated in accordance with Section 31 31 19 – Vegetation Control.

### **3.04 PLACING**

- A. Conform to Caltrans Standard Specifications.

### **3.05 SPREADING COMPACTING AND SHAPING**

- A. Conform to Caltrans Standard Specifications.
  - 1. Stationary Side Form Construction: per Caltrans Standard Specifications.
  - 2. Slip Form Construction: per Caltrans Standard Specifications.

### **3.06 INSTALLING TIE BARS**

- A. Install at longitudinal contact joints, longitudinal weakened plane joints, and transverse contact joints as shown on the plans. In no case, shall any consecutive width of new portland cement concrete pavement tied together with tie bars exceed 15 meters. In no case shall tie bars be used at a joint where portland cement concrete and asphalt concrete pavements abut.
- B. Tie bars shall be installed at longitudinal joints by one of the 3 following methods:

1. Drilling and bonding in conformance with the details shown on the plans. Provide a two-component, epoxy-resin, conforming to the requirements of ASTM Designation: C 881, Type V. Grade 3 (Non-Sagging), Class shall be as follows:

<u>Temperature of Concrete</u>	<u>Required Class of Epoxy Resin</u>
Lower than 40° F (4.5 °C)	A
40° F (4.5° C) through 60° F (15.5° C)	B
Above 60° F (15.5° C)	C

2. Provide, at least 7 days prior to start of work, a Certificate of compliance and a copy of the manufacturer's recommended installation procedure. The drilled holes shall be cleaned in accordance with the epoxy manufacturer's instructions and shall be dry at the time of placing the epoxy and tie bars. Immediately after inserting the tie bars into the epoxy, the tie bars shall be supported as necessary to prevent movement during the curing and shall remain undisturbed until the epoxy has cured a minimum time as specified by the manufacturer. Tie bars that are improperly bonded, as determined by the Owner, will be rejected. If rejected, adjacent new holes shall be drilled, as directed by the Owner, and new tie bars shall be placed and securely bonded to the concrete. All work necessary to correct improperly bonded tie bars shall be performed at the Contractor's expense.
3. Insert the tie bars into the plastic slip-formed concrete before finishing the concrete. Inserted tie bars shall have full contact between the bar and the concrete. When tie bars are inserted through the pavement surface, the concrete over the tie bars shall be reworked and refinished to such an extent that there is no evidence on the surface of the completed pavement that there has been any insertion performed. Any loose tie bars shall be replaced by drilling and grouting into place with epoxy as described in method 1 above at the Contractor's expense.
4. By using threaded dowel splice couplers fabricated from deformed bar reinforcement material, free of external welding or machining. Threaded dowel splice couplers shall be accompanied by a Certificate of Compliance and installation instructions. Installation of threaded dowel splice couplers shall conform to the requirements of the manufacturer's recommendations.

### 3.07 JOINTS

- A. Conform to Caltrans Standard Specifications, except that tie bars shall be as specified under Part 2, Products.
  1. Transverse Contact Joints: per Caltrans Standard Specifications.
    - (a) Construct a transverse contact (construction) joint at the end of each day's work, or where concrete placement is interrupted for more than 30 minutes, to coincide with the next weakened plane joint location.
    - (b) If sufficient concrete has not been mixed to form a slab to match the next weakened plane joint, when an interruption occurs, the excess concrete shall be removed and disposed of back to the last preceding joint. The cost of removing

and disposing of any excess concrete shall be at the Contractor's expense. Any excess material shall become the property of the Contractor and shall be properly disposed of.

(c) A metal or wooden bulkhead (header) shall be used to form the joint. The bulkhead shall be designed to accommodate the installation of tie bars.

2. Weakened Plane Joints: Conform to Caltrans Standard Specifications, except that the insert method of forming joints in pavement shall not be used.

### 3.08 FINISHING

- A. Conform to the Caltrans Standard Specifications.

### 3.09 CURING

- A. Conform to the Caltrans Standard Specifications.

### 3.10 SEALING JOINTS

- A. Liquid Joint Sealant Installation.

1. The joint sealant detail for transverse and longitudinal joints, as shown on the plans, shall apply only to weakened plane joints. Construct weakened plane joints by the sawing method. Should grinding or grooving be required over or adjacent to any joint after sealant has been placed, completely remove the joint material and disposed of, and replace at the Contractor's expense. Recess sealant below the final finished surface as shown on the plans.
2. At the Contractor's option, transverse weakened plane joints shall be either Type DSC or Type SSC as shown on the plans. Longitudinal weakened plane joints shall be Type SSC only as shown on the plans.
3. Seven days after the concrete pavement placement and not more than 4 hours before placing backer rods and joint sealant materials, clean the joint walls by the dry sand blast method and other means as necessary to completely remove from the joint all objectionable material such as soil, asphalt, curing compound, paint and rust. After cleaning the joint, remove all traces of sand, dust and loose material from and near the joint for a distance along the pavement surfaces of at least 50 mm on each side of the joint by the use of a vacuum device. Remove surface moisture at the joints by means of compressed air or moderate hot compressed air or other means approved means. Do not use drying procedures that leave a residue or film on the joint wall. Sandblasting equipment shall have a maximum nozzle diameter size of  $6 \pm 1$  mm and a minimum pressure of 0.62-MPa.
4. Install backer rod as shown on the plans. Provide an expanded, closed-cell polyethylene foam backer rod that is compatible with the joint sealant so that no bond or adverse reaction occurs between the rod and sealant. Install backer rod when the temperature of the portland cement concrete pavement is above the dew point of the air and when the air temperature is 4°C or above. Install backer rod when the joints to be sealed have been properly patched, cleaned and dried. Do not use a method of placing backer rod that leave a residue or film on the joint walls.

5. Immediately after placement of the backer rod, place the joint sealant in the clean, dry, prepared joints as shown on the plans. Apply the joint sealant by a mechanical device with a nozzle shaped to fit inside the joint to introduce the sealant from inside the joint. Apply adequate pressure to the sealant to ensure that the sealant material is extruded evenly and that full continuous contact is made with the joint walls. After application of the sealant recess the surface of the sealant as shown on the plans.
6. Any failure of the joint material in either adhesion or cohesion of the material will be cause for rejection of the joint. Conform the finished surface of joint sealant to the dimensions and allowable tolerances shown on the plans. Rejected joint materials or joint material whose finished surface does not conform to the dimensions shown on the plans shall be repaired or replaced, at the Contractor's expense, with joint material that conforms to the requirements.
7. After each joint is sealed, remove all surplus joint sealer on the pavement surface. Traffic shall not be permitted over the sealed joints until the sealant is tack free and set sufficiently to prevent embedment of roadway debris into the sealant.

**B. Preformed Compression Joint Seal Installation**

1. The compression seal alternative joint detail for transverse and longitudinal joints, as shown on the plans, shall apply only to weakened plane joints. Construct weakened plane joints by the sawing method. Should grinding or grooving be required over or adjacent to any joint after the compression seal has been placed, completely remove the joint materials and disposed of, and replace at the Contractor's expense. Compression seal shall be recessed below the final finished surface as shown on the plans.
2. At the Contractor's option, transverse weakened plane joints shall be either Type DSC or Type SSC as shown on the plans. Longitudinal weakened plane joints shall be Type SSC only as shown on the plans.
3. Seven days after the concrete pavement placement and not more than 4 hours before placing preformed compression joint seals, clean the joint walls by the dry sand blast method and other means as necessary to completely remove from the joint all objectionable material such as soil, asphalt, curing compound, paint and rust. After cleaning the joint, remove all traces of sand, dust and loose material from and near the joint for a distance along the pavement surfaces of at least 50 mm on each side of the joint by the use of a vacuum device. Remove surface moisture at the joints by means of compressed air or moderate hot compressed air or other means. Do not use drying procedures that leave a residue or film on the joint wall. Sandblasting equipment shall have a maximum nozzle diameter size of  $6 \pm 1$  mm and a minimum pressure of 0.62-MPa.

**3.11 PROTECTING CONCRETE PAVEMENT**

- A. Conform to Caltrans Standard Specifications.**

**END OF SECTION**

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**SECTION 32 31 00****CHAIN LINK FENCES AND GATES**

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**PART 1 - GENERAL****1.1 SUMMARY**

- A. Section Includes: Provide chain link fence and gates with framing and fabric, gate hardware, and accessories as required for complete installation.
  - 1. Provide plastic-coated chain-link fence, folding gate with heavy duty wheels on casters and pedestrian gates to match existing. See drawings for additional information.
  - 2. Excavate for post bases and provide concrete anchorage for posts.
  - 3. Provide privacy slats in chain link fabric.

- B. Related Work:

- 1. Not used.

**1.2 REFERENCES**

- A. Chain Link Fence Manufacturer's Institute (CLFMI): Chain Link Fence Installation Standard.
- B. ASTM F567: Installation of Chain Link Fence.
- C. ASTM F 2200 – Standard Specification for Automated Vehicular Gate Construction.
- D. ASTM F 1184 – Standard Specification for Industrial and Commercial Horizontal Slide Gates, Type II, Class 2.
- E. American Welding Society AWS D1.2 Structural Welding Code.

**1.3 SUBMITTALS**

- A. Product Data: Submit product literature, including standard details.
- B. Shop Drawings: Indicate plan layout, grid, spacing of components, accessories, and anchorage.

**PART 2 - PRODUCTS****2.1 SYSTEMS MANUFACTURERS**

- A. Anchor Fence, Inc.
- B. Master Halco, Inc.
- C. Iron World Manufacturing

- D. Substitutions: Refer to Section 01 25 00.

## 2.2 MATERIALS

- A. System Description: Provide chain link fence and gates with framing and fabric, gate hardware, and accessories.
1. Provide complete system from single manufacturer including framing, fabric, and accessories.
  2. Automatic Gate Operators: Provide operators including accessories. Automatic gate operators may be from different company.
- B. Framework: Design fence framework to comply with strength requirements conforming to ASTM F1043; ASTM A1083, Schedule 40, butt weld, standard weight, hot dip galvanized to 1.8 oz/sf coating; Type I weight.
1. Line Posts, Corner Posts, Terminal Posts, Caps, Brace Rails:
    - a. End, Corner and Pull Posts: Minimum 2.875" outside diameter, and 5.79 pounds per linear foot.
    - b. Rails and Braces: Minimum 1.66", 1.35 lbs/lin. ft.
    - c. Caps: Galvanized castings as approved by Architect and as appropriate for applications specified.
    - d. Gate Posts: Minimum 4" outside diameter; 9.1 lbs/lin. ft.
  2. Types and Sizes: As indicated, where not indicated, sizes as recommended by manufacturer.
    - a. Fence Height: 8'-0", unless otherwise indicated.
  3. Fittings: Provide sleeves, bands, clips, rail ends, tension bars, fasteners, fittings, tie wire, and accessories as required for complete installation.
- C. Fabric: 2" diamond mesh, interwoven, 9-gage top selvage twisted tight, bottom selvage knuckle end closed; one-piece fabric widths unless fence height exceeds maximum available width.
1. Mesh: ASTM A392 Class 2, zinc-coated steel or ASTM A428 aluminum coated steel, minimum 0.40 oz/sf coating.
  2. Plastic Coating: ASTM F668, minimum Class 2a extruded and adhered or Class 2b fusion bonded PVC coating on minimum 0.3 oz/sf zinc coated steel wire or comparable aluminum coated steel wire.
    - a. Colors: Black to match existing conditions. Verify in field..
- D. Tension Wire: Minimum 7-gage galvanized steel single strand or comparable aluminum coated steel.

- E. Plastic Coating: Manufacturer's standard virgin polyvinyl chloride (PVC) vinyl coating; Shore D hardness of 40 to 60; bond of coating to metal to be greater than or equal to cohesive strength of vinyl.
  - 1. Coat factory cut ends with same vinyl material.
  - 2. Colors: Where color is not indicated on Drawings or Finish Schedule, provide custom color as directed by Architect.
  - 3. Where plastic coating is indicated provide coating on fence components other than gate hardware; provide plastic coating on gate hardware where required hardware is available with plastic coating matching coating on gates.
- F. Privacy Slats: Polyethylene tubular slats, not less than 0.23" thick, manufactured from virgin polyethylene containing UV inhibitor, sized to fit mesh specified for direction indicated, and with bottom lock strips.
  - 1. Colors: Color to match existing slats in tennis courts.
- G. Concrete: ASTM C94, normal Portland cement, 2,500 psi at 28 days, 2" to 3" slump, 2 to 4 percent entrained air. See drawings for additional formation.

## 2.3 FABRICATION

- A. Gates: Assemble gate frames by welding with both horizontal and vertical members and with diagonal cross-bracing of minimum 3/8" diameter adjustable length truss rods to ensure rigidity.
  - 1. Swing Gates: Conform to ASTM F900; manufacturer's standard galvanized steel gates, 3'-0" wide unless otherwise indicated; complete with hardware including hasp for padlock.
    - a. Gate Frames: Minimum 1.9" outside diameter; 2.60 lbs/lin. ft.
    - b. Hinges: Non-lift-off type, offset to permit 180 degree opening, minimum 1-1/2 pair per gate leaf.
    - c. Locksets: Where gates are indicated to be locked provide mortise type locksets conforming to general requirements specified in Section 08 71 00 – Door Hardware.
      - 1) Panic Devices (Where Indicated): Provide panic devices conforming to general requirements specified in Section 08 71 00.
      - 2) Provide security casing for mortise locksets and panic devices and provide security screening for gates to prevent opening gates from secured side while allow egress from direction of travel for egress.
    - d. Accessories: Keepers, stops, and accessories as required for complete, secure fence gate installation.



2. Sliding Gates: Comply with ASTM F1184, Type II, Cantilever; manufacturer's standard top rail incorporating track for top roller and guideposts to keep gate on rollers.
3. Gate Operators: Heavy duty commercial quality gate operator sized as recommended by operator manufacturer for size of gate but not less than 1 H.P. motor with internal overload protection.
  - a. Operation: Wire operator to allow both remote control and key operation; gates to "auto close" after adjustable preset time.
    - 1) Key Operation: Minimum 6 pin cylinder key boxes mounted on posts at locations indicated; posts to be included in Work of this section.
    - 2) Remote Controls: Single channel digital radio transmitters with over 1000 Owner changeable codes, using 9-volt batteries
      - a) Provide 10 remote controls.
    - 3) Safety Devices: Provide as required by applicable codes, including photo electric non-contact reversing control and electric gate edge to reverse gate operator.
  - b. Accessories: Provide as required for complete, automatically operated secure fence gate installation in configuration indicated.

### **PART 3 - EXECUTION**

#### **3.1 INSTALLATION**

- A. Install line posts, corner posts, gates, rails, post caps, and fabric to provide rigid structure for fence of heights indicated and in accordance with CLFMI Installation Standard and ASTM F567.
  1. Use manufacturer's standard fittings, fasteners and hardware.
- B. Maximum Spacing of Posts: Comply with ASTM F567 and CLFMI Installation Standard.
- C. Install line, corner, and terminal posts plumb in accordance with recommendations of ASTM F567 and CLFMI Standard for locations indicated on Drawings.
  1. Coordinate embedded post sleeves with concrete work.
- D. Position bottom rail continuous between posts and centered nominal 4" above finished grade or surface with bottom of fabric nominal 2" above finished grade or surface.
- E. Position bottom of fabric 2" above finished grade or surface with tension wire stretched taut between posts.

- F. Pass top rail through line post tops to form continuous bracing; install 7" long couplings mid-span at pipe ends.
- G. Brace corner posts back to adjacent line post with horizontal center brace rail; install brace rail, one bay from end posts.
- H. Fasten fabric to rails, line posts, braces and tension wires with wire ties maximum 12" centers.
- I. Attach fabric to end, corner and gate posts with tension bars and tension bar clips.
- J. Stretch fabric between terminal posts or at intervals of 100 feet maximum, whichever is least dimension.
- K. Install gates for free, easy operation, ready for Owner supplied padlock.
  - 1. Install automatic gate operators in accordance with manufacturer recommendations and installation instructions for proper smooth operation; test gate operation and adjust as necessary for maximum lifespan of system.

**END OF SECTION**

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SECTION 33 05 16

UTILITY STRUCTURES

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**PART 1 - GENERAL**

1.01 SECTION INCLUDES

- A. Manhole structures for gravity storm drain and sanitary sewer utilities.

1.02 RELATED DOCUMENTS

A. AASHTO:

- 1. M 199: Standard Specification for Precast Reinforced Concrete Manhole Sections.

B. ASTM:

- 1. A 615/A615M: Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
- 2. C 478: Standard Specification for Circular Precast Reinforced Concrete Manhole Sections.
- 3. C 1244: Standard Test Method for Concrete Sewer Manholes by the Negative Air Pressure (Vacuum) Test Prior to Backfill.

C. Caltrans Standard Specifications.

- 1. Concrete Structures.
- 2. Miscellaneous Metal.

D. California Building Code.

- 1. Exterior Routes of Travel.

1.03 DEFINITIONS

- A. AASHTO: American Association of State Highway and Transportation Officials.

- B. ASTM: American Society for Testing Materials.

1.04 SUBMITTALS

- A. Follow submittal procedures outlined in Section 01 33 00 – Submittal Procedures.

- B. Product data for the following:

- 1. Cleanout plugs or caps.

- C. Shop drawings: Include plans, elevations, details and attachments for the following:

1. Precast concrete manholes, frames and covers.
2. Precast concrete clean out boxes and box covers.
- D. Design Mix Reports and Calculations: For each class of cast-in-place concrete.
- E. Field Test Reports: Indicate and interpret test results for compliance with performance.

#### 1.05 DELIVERY, STORAGE AND HANDLING

- A. Handle precast concrete manholes according to manufacturer's written instructions.
- B. Protect imported bedding and backfill material from contamination by other materials.

### **PART 2 - PRODUCTS**

#### 2.01 CLEANOUTS

- A. Piping: Same as sanitary sewer line if possible.
- B. Top Cap: Threaded and of same material as piping if possible.
- C. Box Size: As required to provide access and allow easy removal and reinstallation of cap.
- D. Box Types:
  1. Landscape Areas: Portland cement concrete box and box cover (bolt-down), light duty.
  2. Traffic Areas: Portland cement concrete box and box cover or steel or cast iron cover, heavy duty, both box and cover (bolt down) to be rated for AASHTO H20 loading.
- E. Box Cover Markings: "S.D." for storm drain cleanouts, "S.S." for sanitary sewer cleanouts, unless otherwise specified.
- F. Available Manufacturers: Subject to compliance with requirements, box manufacturers offering products that may be incorporated into the Project include, but are not limited to the following:
  1. Associated Concrete Products, Inc. (Santa Ana, California) (Tel. 714-557-7470).
  2. Brooks Products Inc. (El Monte, California) (Tel. 818-443-3017).
  3. Christy Concrete Products, Inc. (Fremont, California) (Tel. 800-486 7070).

#### 2.02 MANHOLES

- A. General: Size, shape, configuration, depth, etc. of manhole and frame and cover shall be

as indicated.

**B. Portland Cement Concrete and Reinforcing:**

1. Cast-In-Place Portion: Use Class A Concrete per Caltrans Standard Specification, and ASTM A615 Grade 60 reinforcing steel bars.
2. Precast Portion: ASTM C 478. Rate for AASHTO H20 loading in traffic areas.

**C. Frames and Covers: As indicated and in accordance with Caltrans Standard Specification.**

**D. Steps: ASTM C 478 or AASHTO M 199. Manufacture from deformed, ½-inch steel reinforcement rod complying with ASTM A 615 and encased in polypropylene complying with ASTM D4101. Include pattern designed to prevent lateral slippage off step.**

**E. Force Main Piping Access Openings:**

1. General: As indicated.

**2.03 JOINT SEALANT FOR STRUCTURES AND MANHOLES**

**A. Mortar: per Caltrans Standard Specification.**

1. Use to seal around pipes at connections to structures and manholes. Also use to seal joints between precast sections of structures and manholes.

**B. Gaskets: Preformed flexible rubber or plastic gasket.**

1. Rubber Gaskets: ASTM C443.
2. Plastic Gaskets: Federal Specification SS-S-00210 (GSA-FSS), Type I, Rope Form; or alternate standard which may exist.

**PART 3 - EXECUTION**

**3.01 CLEANOUT INSTALLATION**

**A. General: Install as indicated.**

**3.02 MANHOLE INSTALLATION**

**A. General: Install as indicated.**

**3.03 TESTING OF MANHOLES ON GRAVITY LINES**

**A. At the option of the Contractor, either the following hydrostatic or vacuum test shall be performed.**

**B. Hydrostatic Test:**

1. Insert inflatable plugs in all sewer inlets and outlets.

2. Fill the manhole with water to a point six inches below the base of the manhole frame.
3. Maintain the water at this point for one hour to allow time for absorption.
4. Begin one-hour test period. Measure the amount of water added in one-hour period to maintain the water level at six inches below the base of the manhole frame. Do not allow water level to drop more than 25% of the manhole depth.
5. Determine the allowable leakage by the following formula.
6.  $L = 0.0002 \times D \times H^{1/2}$
7. L = Allowable leakage, gallons per minute.
8. D = Depth of manhole from top to bottom, feet.
9. H = Head of water in feet as measured from the surface of the water in the manhole to the sewer line invert or to the prevailing ground water surface outside the manhole. The lesser height governs.
10. If the leakage exceeds the allowable, determine the cause, take remedial action and re-test the manhole. If the leakage is less than the allowable and leaks are observed, repair the leaks.

C. Vacuum Test:

1. General: Test in accordance with ASTM C 1244.
2. Test prior to backfilling around the manhole.
3. Test Preparation: Plug all lift holes and pipes entering or exiting the manhole.
4. Place test head inside the top section of the manhole's cone section and inflate in accordance with the manufacturers instructions.
5. Draw a vacuum of 10-inches of mercury and shut the pump off.
6. With the valve closed, the time for the vacuum to drop 9-inches shall be measured.
7. The manhole shall pass the test if the time is greater than 60 seconds for a 48-inch diameter manhole, 75 seconds for a 60-inch diameter manhole and 90 seconds for a 72-inch diameter manhole.
8. If the manhole fails the initial test, make necessary repairs with a non-shrink grout while the vacuum is still being drawn. Retest until a satisfactory test is obtained.

**END OF SECTION**

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**SECTION 33 10 00**

**WATER UTILITIES**

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**PART 1 - GENERAL**

**1.01 SECTION INCLUDES**

- A. Site water distribution system for domestic services up to 5 feet of any on-site building being served.
- B. Domestic water transmission or distribution system within a roadway or street right-of-way.

**1.02 RELATED SECTIONS**

- A. Section 31 23 33 – Trenching and Backfilling.
- B. Section 32 05 23 – Concrete for Exterior Improvements.

**1.03 RELATED DOCUMENTS**

**A. ASTM:**

- 1. A 536: Standard Specification for Ductile Iron Castings.
- 2. B 88: Standard Specifications for Seamless Copper Water Tube.
- 3. D 1785: Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.
- 4. D 2564: Standard Specifications for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems.

**B. AWWA:**

- 1. C104: Cement-Mortar Lining for Ductile-Iron Pipe and Fittings.
- 2. C105: Polyethylene Encasement for Ductile-Iron Pipe Systems.
- 3. C110: Ductile-Iron and Gray-Iron Fittings, 3 In. Through 48 In. (76 mm Through 1,219 mm) for Water.
- 4. C111: Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
- 5. C115: Flanged Ductile-Iron Pipe with Ductile-Iron or Gray-Iron Threaded Flanges.
- 6. C150: Thickness Design of Ductile Iron Pipe.
- 7. C151: Ductile-Iron Pipe, Centrifugally Cast.
- 8. C153: Ductile- Iron Compact Fittings.

9. C200: Steel Water Pipe-6 In. (150 mm) and larger.
10. C203: Coal-Tar Protective Coatings and Linings for Steel Water Pipelines-Enamel and Tape-Hot Applied.
11. C205: Cement-Mortar Protective Lining and Coating for Steel Water Pipe- 4 In. and Larger-Shop Applied.
12. C207: Steel Pipe Flanges for Waterworks Service-Sizes 4 In. Through 144 In. (100 mm Through 3,600 mm).
13. C208: Dimensions for Fabricated Steel Water Pipe Fittings.
14. C209: Cold-Applied Tape Coatings for Steel Water Pipe, Special Sections, Connections and Fittings.
15. C210: Liquid-Epoxy Coatings and Linings for Steel Water Pipe and Fittings.
16. C213: Fusion-Bonded Epoxy Coatings and Linings for Steel Water Pipe and Fittings.
17. C214: Tape Coatings for Steel Water Pipe.
18. C218: Liquid Coatings for Aboveground Steel Water Pipelines and Fittings.
19. C219: Bolted Sleeve-Type Couplings for Plain-End Pipe.
20. C500: Metal-Seated Gate Valves for Water Supply Service.
21. C504: Rubber-Seated Butterfly Valves, 3 In. (75 mm) through 72 In. (1,800 mm).
22. C507: Ball Valves 6 In. through 60 In. (150 mm Through 1,500 mm).
23. C508: Swing-Check Valves for Waterworks Service, 2-In. Through 48-In. (50-mm Through 1200-mm) NPS.
24. C509: Resilient-Seated Gate Valves for Water Supply Service.
25. C510: Double Check Valve Backflow Prevention Assembly.
26. C511: Reduced-Pressure Principle Backflow Prevention Assembly.
27. C512: Air Release, Air/Vacuum, and Combination Air Valves for Water and Wastewater Service.
28. C550: Protective Interior Coatings for Valves and Hydrants.
29. C600: Installation of Ductile-Iron Mains and Their Appurtenances.
30. C605: Underground Installation of Polyvinyl Chloride (PVC) and Molecularly Oriented Polyvinyl Chloride (PVCO) Pressure Pipe and Fittings.
31. C606: Grooved and Shouldered Joints.
32. C651: Disinfecting Water Mains.



- 33. C800: Underground Service Line Valves and Fittings.
- 34. C900: Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 In. Through 60 In. (100mm Through 1,500 mm).
- 35. C901: Polyethylene (PE) Pressure Pipe and Tubing, ½ In. (13mm) Through 3 In. (76mm) for Water Service.
- 36. C905: Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 14 In. Through 48 In. (350 mm Through 1,200 mm) for Water Transmission and Distribution.
- 37. C906: Polyethylene (PE) Pressure Pipe and Fittings, 4 In. Through 65 In. (100 mm Through 1,650 mm), for Waterworks.
- 38. C907: Injection-Molded Polyvinyl Chloride (PVC) Pressure Fittings, 4 In. Through 12 In. (100 mm Through 300 mm), for Water, Wastewater, and Reclaimed Water Service.
- 39. M11: Steel Pipe - A Guide for Design and Installation.
- 40. M23: PVC Pipe – Design and Installation.
- 41. M41: Ductile-Iron Pipe and Fittings.

#### 1.04 DEFINITIONS

- A. AASHTO: American Association of State Highway and Transportation Officials.
- B. ASTM: American Society for Testing Materials.
- C. AWWA: American Waterworks Association
- D. DI: Ductile iron.
- E. DIP: Ductile iron pipe.
- F. FM: Factory Mutual.
- G. NSF: National Sanitation Foundation.
- H. PCC: Portland cement concrete.
- I. PE: Polyethylene.
- J. PVC: Polyvinyl Chloride.
- K. UL: Underwriters Laboratory.

#### 1.05 SYSTEM PERFORMANCE REQUIREMENTS

- A. Minimum Internal Pressures: As indicated on plans.
- B. External Load: Earth load indicated by depth of cover plus AASHTO H20 live load unless

indicated otherwise.

#### 1.06 SUBMITTALS

- A. Follow submittal procedures outlined in Section 01 33 00 – Submittal Procedures.
- B. Product Data: For the following:
  - 1. Piping materials and fittings.
  - 2. Pipe couplings.
  - 3. Flexible pipe fittings.
  - 4. Restrained pipe fittings.
  - 5. High deflection fittings/ball joints.
  - 6. Expansion joints.
  - 7. Flexible expansion joints.
  - 8. Gate valves.
  - 9. Butterfly valves.
  - 10. Check valves.
  - 11. Air and vacuum relief valves.
  - 12. Blow-off valves.
  - 13. Pressure reducing valves.
  - 14. Pressure sustaining valves.
  - 15. Ball valves.
  - 16. Post indicator valves.
  - 17. Backflow preventers.
  - 18. Precast valve boxes and box covers.
- C. Shop drawings: Include plans, elevations, details and attachments.
  - 1. Precast and cast in-place vaults and covers.
  - 2. Wiring diagrams for alarm devices.
- D. Field test reports: Indicate and interpret test results for compliance with the Project requirements.

**1.07 QUALITY ASSURANCE**

- A. Comply with requirements of utility supplying water. Do not operate existing valves or tap existing piping without written permission and/or presence of utility company representative.
- B. Comply with the following requirements and standards:
  - 1. NSF 61: "Drinking Water System Components-Health Effects" for materials for potable water.
  - 2. NFPA 70: "National Electric Code" for electrical connections between wiring and electrically operated devices.
- C. Provide listing/approval stamp, label, or other marking on piping and specialties made to a specified standard.

**1.08 MATERIAL DELIVERY, STORAGE AND HANDLING**

- A. Preparation for Transport: Prepare valves, according to the following:
  - 1. Ensure that valves are dry and internally protected against rust and corrosion.
  - 2. Protect valves against damage to threaded ends and flange faces.
  - 3. Set Valves in best position for handling. Set valves closed to prevent rattling.
- B. Deliver piping with factory-applied end-caps. Maintain end-caps through shipping, storage and handling to prevent pipe end damage and to prevent entrance of dirt, debris and moisture.
- C. Handling: Use slings to handle valves whose size requires handling by crane or lift. Rig valves to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.
- D. During Storage: Use precautions for valves, according to the following.
  - 1. Do not remove end protectors, unless necessary for inspection, then reinstall for storage.
  - 2. Protection from Weather: Store indoors and maintain temperature higher than ambient dew-point temperature. Store indoors and maintain temperature higher than ambient dew point temperature. Support off the ground or pavement in watertight enclosures when outdoor storage is necessary.
- E. Do not store plastic pipe and fittings in direct sunlight.
- F. Protect pipe, fittings, flanges, seals and specialties from moisture, dirt and damage.
- G. Protect linings and coatings from damage.
- H. Handle precast boxes, vaults and other precast structures according to manufacturer's written instructions.

- I. Protect imported bedding and backfill material from contamination by other materials.

#### 1.09 COORDINATION

- A. Coordinate connection to existing water mains with water utility supplying water.
- B. Coordinate piping materials, sizes, entry locations, and pressure requirements with building domestic water distribution.

### **PART 2 - PRODUCTS**

#### 2.01 SMALL-SIZE SERVICE PIPES

- A. Copper Pipe: Sizes ¾-inch through 2-inch.
  1. Pipe and Fittings: ASTM B 88, Type K, seamless water tube, annealed.
  2. Joints: Restrain by couplings.
- B. PE Plastic Pipe: Sizes ½-inch through 3-inch.
  1. Pipe and Fittings: AWWA C901.
  2. Joints: Restrain with clamps or heat-fusion.
- C. PVC Pipe: Sizes 1/8-inch through 3 inch.
  1. Pipe and Fittings: ASTM D 1785, Schedule 40
  2. Joints: Restrain with solvent cement. Do not use threaded pipe.
  3. Solvent Cement: ASTM D2564.

#### 2.02 LARGE-SIZE SERVICE AND DISTRIBUTION PIPES

- A. DIP: Sizes 4-inch through 48-inch.
  1. Pipe: AWWA C150 and C151.
  2. Fittings
    - (a) Standard: AWWA C110, sizes 4-inch through 48-inch.
    - (b) Compact: AWWA C153, sizes 4-inch through 24-inch.
  3. Pipe and Fitting Lining: Cement Mortar, AWWA C104.
  4. Pipe and Fitting Coating: Asphaltic, AWWA C151 or C115.
  5. Exterior Soil Corrosion Protection for Pipe and Fittings: Polyethylene encasement, AWWA C105.

6. Unrestrained Joints:
  - (a) Push-On Bell and Spigot Joint: AWWA C111.
  - (b) Mechanical Joint: AWWA C111.
7. Restrained Joints:
  - (a) Flanged Joint: AWWA C115.
  - (b) Push-On Bell and Spigot Joint: AWWA C111 with "Field Lok Gasket," sizes 4-inch through 24-inch;"TR Flex," sizes 4-inch through 64-inch or approved equal.
  - (c) Mechanical Joint: AWWA C111 with "Mega Lug," sizes 3-inch through 48-inch. or approved equal.
  - (d) Grooved and Shouldered Joints: AWWA C150, AWWA C151 and AWWA C606. 24-inch maximum size.
8. Couplings:
  - (a) Plain End Pipe to Plain End Pipe: Ductile iron or steel bolted couplings, manufacturer's shop coating with low alloy steel bolts and nuts. Steel couplings to conform to AWWA C219. or approved equal.
  - (b) Plain End Pipe to Flanged Pipe: 1) Ductile iron or steel bolted flanged coupling adapters, manufacturer's shop coating with low alloy steel bolts and nuts. Steel flanged couplings to conform to AWWA C219
- B. PE Pipe: Sizes 4-inch through 64-inch.
  1. Pipe and Fittings: AWWA C906.
  2. Joints:
    - (a) Thermal Butt Fusion: AWWA C906 and pipe manufacturer's recommendations.
    - (b) Flanged joining: AWWA C906 and pipe manufacturer's recommendations.
    - (c) Other: Check with pipe manufacturer.
- C. PVC Pipe: Sizes 4-inch through 48-inch.
  1. Pipe:
    - (a) 4-inch through 12-inch: AWWA C900.
    - (b) 14-inch through 48-inch: AWWA C905.
  2. Fittings: DI conforming to 2.2A above.
  3. Unrestrained Joints:
    - (a) Push-On Bell and Spigot Joint: AWWA C900.

4. Restrained Joints:
  - (a) Push-On Bell and Spigot Joint: or approved equal.
  - (b) Plain End PVC to DI Mechanical Joint: or approved equal.
5. Steel or Ductile Iron Couplings:
  - (a) Plain End Pipe to Plain End Pipe: Ductile iron or steel bolted couplings, manufacturer's shop coating with low alloy steel bolts and nuts. Steel couplings to conform to AWWA C219. or approved equal.
  - (b) Plain End Pipe to DI or Steel Flanged Pipe: Ductile iron or steel bolted flanged coupling adapters, manufacturer's shop coating with low alloy steel bolts and nuts. Steel flanged couplings to conform to AWWA C219. or approved equal.
6. PVC Couplings
  - (a) Unrestrained Plain End to Plain End Pipe: AWWA C900, or approved equal.
  - (b) Restrained Plain End to Plain End Pipe: AWWA C900, or approved equal.
- D. Cement Mortar Lined and Coated Steel Pipe: 6-inch and larger.
  1. Pipe: AWWA C200 and AWWA M11.
  2. Special Sections and Fittings: AWWA C200, C207, C208 and AWWA M11 for all bends, tees, nozzles, closures, etc.
  3. Flanges: AWWA C207. Includes blind flanges.
  4. Linings and Coatings for Pipe, Special Sections and Fittings: Cement Mortar Lining and Coating: AWWA C205.
    - (a) Liquid Epoxy Lining and Coating: AWWA C210.
    - (b) Fusion Bonded Epoxy Lining and Coating: AWWA C213.
    - (c) Coal-Tar Lining and Coating: AWWA C203.
    - (d) Cold-Applied Tape Coatings, Piping: AWWA C214.
    - (e) Cold-Applied Tape Coatings, Specials, Connection and Fittings: AWWA C209.
    - (f) Cold Applied Petrolatum Tape and Petroleum Wax Tape Coatings for the Exterior of Special Sections, Connections, and Fittings for Buried or Submerged Steel Water Pipelines.
    - (g) Aboveground Pipe Coatings: AWWA C218.]
  5. Non-Restrained Joints: AWWA M11.
    - (a) Rubber Gasket: Carnegie-shape rubber gasket as indicated.

6. Restrained Joints: AWWA M11. Where a flanged joint, butt strap or coupling are not indicated, either restrained joint a, or b, as follows, is acceptable, but the selected joint shall be used throughout the project.
  - (a) Rubber Gasket: Carnegie-shape rubber gasket with field welded restraint bar as indicated.
  - (b) Field Lap Welded Slip Joint: As indicated.
  - (c) Field Welded Butt Strap: As indicated.
  - (d) Flanged Joint: AWWA C207 with Type 316L stainless steel bolts and nuts as indicated.
7. Joint Coating for Cement Mortar Lined and Coated Steel Pipe:
  - (a) Field Joint Encasement: Cement mortar contained in fabric lined with closed cell polyethylene foam as indicated. Attach fabric to pipe with Type 316L stainless steel straps as indicated.
8. Non-Restrained Flexible Couplings: Conforming to AWWA C219, with factory applied fusion-bond epoxy coating and Type 316L stainless steel bolts and nuts.
9. Restrained Flexible Couplings: Non-restrained flexible coupling supplemented with a restraining harness as indicated and as follows:
  - (a) Restraining harness design by Contractor's pipe manufacturer using criteria presented in Section 13.10 of AWWA M11.
  - (b) Space harness-lugs and tie bolts equally around the pipe.
  - (c) Type 316L stainless steel harness tie bolts and nuts.
  - (d) Design and dimensions of harness lugs to be modified from that shown in AWWA M11, as necessary, to provide additional height to clear the coupling.
10. Field Coating of Coupling Assemblies: Apply either of the following, flexible tape and mastic or putty coating systems to the all non-restrained or restrained flexible steel couplings.

## 2.03 HIGH DEFLECTION FITTINGS/BALL JOINTS

- A. Plain End Pipe: Xtra Flex Restrained Joint High Deflection Fittings, 4-inch through 24-inch, or approved equal.
- B. Mechanical or Flanged Joint: Flex 900, 4-inch through 12-inch, or approved equal.

## 2.04 EXPANSION JOINTS

- A. TR Flex Joints: TR Flex Telescoping Sleeve, 4-inch through 64 inch, or approved equal.
- B. Mechanical or Flanged Joint: Ex-Tend 200, 4-inch through 36-inch, or approved equal.

**2.05 FLEXIBLE EXPANSION JOINTS**

- A. Plain End to Plain End Pipe: "Xtra Flex," sizes 4-inch through 24-inch, or equal.
- B. Flanged or mechanical Joint: "Flex-Tend," sizes 3-inch through 48-inch, or equal.
- C. Flanged Joint: Starflex, Series 500 or equal.

**2.06 GATE VALVES**

- A. Provide on lines 10-inch and smaller.
- B. Valves, 3-Inch through 20-Inch: AWWA C509, resilient-seated, non-rising stem, gray or ductile-iron body and bonnet, with bronze or gray or ductile-iron gate, bronze stem and square stem operating nut unless noted otherwise. All bolts, nuts and washers, except operating nut, shall be stainless steel. Stem operating nut to be 2-inches square and open counter-clockwise. Stem extensions shall be installed to bring the stem operating nut to within 2-feet of finish grade where the depth from finish grade to the stem operating nut exceeds 4-feet. Equip valves in pump stations and other interior or vault installations with hand-wheels. Provide protective epoxy interior and exterior coating according to AWWA C550 and manufacturer's recommendations.
- C. Service Line Valves and Fittings, 2-Inch and Smaller: AWWA C800
- D. Valve Box and Cover: 9-inch minimum diameter PCC box with extensions of length required for depth of bury of valve, and cast iron or ductile iron cover with lettering "WATER". Both the box and the cover shall be rated for AASHTO H20 loading.

**2.07 BUTTERFLY VALVES**

- A. Provide on lines larger than 10-inch.
- B. Valves, 3-Inch through 72-Inch: AWWA C 504, rubber seated, Class 150B cast iron body, cast or ductile iron discs, stainless steel shafts, adjustable field replaceable rubber seats mating against stainless steel seat rings and field-replaceable seals. Flanged or mechanical joint end connections. No wafer type valves allowed. Traveling nut type valve actuators designed for buried service unless noted otherwise. All bolts, nuts and washers, except wrench nut, shall be stainless steel. Wrench nut to be 2-inches square and open counter-clockwise. Stem extensions shall be installed to bring the wrench nut to within 2-feet of finish grade where the depth from finish grade to the wrench nut exceeds 4-feet. Equip valves in pump stations and other interior or vault installations with hand-wheels. Provide protective epoxy interior and exterior coating according to AWWA C550 and manufacturer's recommendations.
- C. Valve Box and Cover: 9-inch minimum diameter PCC box with extensions of length required for depth of bury of valve, and cast iron or ductile iron cover with lettering "WATER". Both the box and the cover shall be rated for AASHTO H20 loading.

**2.08 AIR RELEASE, AIR/VACUUM AND COMBINATION AIR VALVES**

- A. AWWA C512, specific type of valve, size, details and valve box as indicated.



**2.09 BLOW-OFF VALVES**

- A. Blow-off valve assemblies, details and boxes as indicated.

**2.10 SWING CHECK VALVES**

- A. Valves 2-Inch through 24-Inch: AWWA C508, details as indicated.

**2.11 BALL VALVES**

- A. Valves 6-Inch through 48-Inch: AWWA C507, details as indicated.

**2.12 PRESSURE-REGULATING VALVES**

- A. Valve: Automatic, pilot-operated, cast-iron body with interior coating according to AWWA C550. 250-psi Working-pressure, bronze pressure-reducing pilot valve and tubing, and means for discharge pressure adjustment. Details as indicated.

**2.13 FLOW-REGULATING VALVES**

- A. Valve: Automatic, pilot-operated, cast-iron body with interior coating according to AWWA C550. 250-psi working-pressure, bronze pressure-reducing pilot valve and tubing, and means for flow adjustment. Details as indicated.

**2.14 SERVICE CONNECTIONS AND WATER METERS**

- A. Service connections and water meter details and boxes as indicated.

**2.15 REDUCED PRESSURE PRINCIPLE BACKFLOW PREVENTER**

- A. Provide as indicated and as required by State or local agency.
- B. General: AWWA C511, with OS gate valve on inlet and outlet, and strainer on inlet. Include test cocks and pressure-differential relief valve with ASME A112.1.2 air gap fitting located between 2 positive-seating check valves for continuous-pressure application.
- C. Body:
  - 1. 2-Inch and Smaller: Bronze with threaded ends.
  - 2. 2-1/2-Inch and Larger: Bronze, cast iron steel, or stainless steel with flanged ends.
- D. Interior Lining: AWWA C550, epoxy coating for cast iron or steel bodies.
- E. Interior Components: Corrosion-resistant materials.

**2.16 DOUBLE CHECK DETECTOR ASSEMBLY**

- A. FM approved or UL listed, with OS&Y gate valve on inlet and outlet, and strainer on inlet. Include two positive-seating check valves and test cocks, and bypass with displacement-type water meter, valves, and double-check backflow preventer, for continuous pressure application.

**2.17 UNDERGROUND VAULTS/PITS**

- A. General: Portland cement concrete, precast or cast-in-place as indicated.
- B. Portland Cement Concrete and Reinforcing Steel: Section 32 05 23 – Cement and Concrete for Exterior Improvements.
- C. Access Openings: As indicated.
- D. External Load: Earth load plus AASHTO H20 live load if located in paved areas.
- E. Lids: Bolt down type.

**2.18 TRACER WIRE**

- A. General: Minimum #12 AWG stranded copper wire with blue THW, THWN, or THHN rated insulation.

**2.19 WARNING TAPE**

- A. General: Non-detectable 3-inch warning tape made of solid blue film with continuously printed black-letter message reading "CAUTION—WATER LINE BURIED BELOW."

**2.20 PCC THRUST BLOCKS**

- A. Portland Cement Concrete and Reinforcing Steel: Section 32 05 23 – Cement and Concrete for Exterior Improvements.

**PART 3 - EXECUTION****3.01 PIPE INSTALLATION**

- A. General: Install pipe, fittings, and appurtenances utilizing best practices, manufacturer's instructions, and in accordance with the following:
  - 1. DIP: AWWA M41 and AWWA C600.
  - 2. PVC pipe: AWWA M23 and AWWA C605.
  - 3. Steel Pipe: AWWA M11.
- B. Pipe Depth and Trench Configuration: Conform to elevations, profiles and typical trench section(s) indicated.
- C. Excavation, Bedding, Backfill, and Compaction: Section 31 23 33 – Trenching and Backfilling.
- D. Handling: Carefully handle during loading, hauling, unloading and placing operations to avoid breakage or damage. Use strap type slings for lifting and placing; no chains or hooks will be permitted. Comply with manufacturer's recommendations.
- E. Laying: Before lowering pipe into the trench, remove all stakes, debris, loose rock and

other hard materials from the bottom of the trench. Lay accurately in conformance with lines and grades indicated. Lay pipe on a bed of bedding material specified and prepared by handwork, dug true to grade. Furnish firm bearing for pipe throughout its entire length with bell holes provided at the ends of each pipe length of sufficient size to permit making up the particular type of joint being used. Adjust pipe to line and grade by scraping away or filling and tamping material under the body of the pipe for the entire pipe length and not by blocking or wedging. After final positioning, hold pipe in place in trench with backfill material placed equally on both sides of the pipe at as many locations as required to hold the pipe section in place.

- F. Curved Alignment: When necessary to conform to the alignment specifically indicated, lay pipe on a curved alignment by means of asymmetrical closure of joints or bending of the pipe barrel. If necessary, use shorter than the standard lengths of pipe to achieve curvature specified. Do not exceed the recommendations of the pipe manufacture for deflections at the joints or pipe bending.
- G. Closure: Close open ends of pipes and appurtenance openings at the end of each days work or when work is not in progress.

### 3.02 CONNECTING TO EXISTING MAINS

- A. Pressure Tap Connections: Perform in accordance with the requirements of the owner of the system being tapped. Maintain a positive pressure flow from the main being tapped to the tapping device to flush plastic chips, metal ribbons, etc. into the tapping device and not into the pipe being tapped.
- B. Other Connections: As indicated and in accordance with the requirements of the owner of the line being connected to.

### 3.03 ANCHORAGE INSTALLATION

- A. Mechanically Restrained Joints: Install where indicated for lengths indicated in accordance with manufacturer's instructions.
- B. PCC Thrust Blocks: Install where required and as indicated. Bearing area indicated is to be against undisturbed earth. Allow a minimum of 24-hours curing time before introducing water into the pipeline and allow a minimum of 7-days curing time before pressure testing.

### 3.04 HIGH DEFLECTION FITTINGS/BALL JOINTS, EXPANSION JOINTS, AND FLEXIBLE EXPANSION JOINTS

- A. Install as indicated and in accordance with the manufacturers recommendations.

### 3.05 VALVE INSTALLATION

- A. Install all valves in accordance with the manufacturer's instructions and the following:
  - 1. General:
    - (a) Gate Valves: Appendix A of AWWA C509.

(b) Butterfly Valves: Appendix A of AWWA C504.

2. Joints:

(a) Valves on DI, PE and PVC Pipe: Mechanical joint valves for buried locations. Flanged-end valves for installation in vaults/pits.

(b) Valves on Steel Pipe: As indicated for buried locations. Flanged-end valves for installation in vaults/pits.

3.06 SERVICE CONNECTIONS INSTALLATION

A. Install as indicated and in accordance with the requirements of the owner of the system.

3.07 WATER METER INSTALLATION

A. Install as indicated and in accordance with the requirements of the owner of the system.

3.08 REDUCED PRESSURE PRINCIPLE BACKFLOW PREVENTER INSTALLATION

A. Install as indicated and in accordance with the requirements of the owner of the system and the local health department requirements.

3.09 DOUBLE CHECK DETECTOR ASSEMBLY INSTALLATION

A. Install as indicated and in accordance with the requirements of the owner of the system.

3.10 UNDERGROUND VAULT/PIT INSTALLATION

A. Install as indicated.

B. Excavation and Backfill: Section 31 23 33 – Trenching and Backfilling.

3.11 TRACER WIRE INSTALLATION

A. Install on trench bottom under the vertical projection of the pipe to protect it in all installations.

B. Form a mechanically and electrically continuous line throughout the pipeline, extending to the nearest valve or other pipeline appurtenance designated by the owner of the system or the Owner. Extend the wire up the outside of the valve box/riser and cut a hole that is 8-inches from the top, extend a 12-inch wire lead to the inside of the box. At other pipeline appurtenances, designated by the owner of the system or the Owner, terminate the 12-inch wire lead inside the enclosure.

C. Splice wire with a splicing device consisting of and electro-tin plated seamless copper sleeve conductor. Install as recommended by the manufacturer. Wrap splices and damaged insulation with electrician's tape.

3.12 WARNING TAPE INSTALLATION

A. Install tape approximately 1-foot above and along the centerline of the pipe.

B. Where tape is not continuous, lap tape ends a minimum of 2-feet.

**3.13 HYDROSTATIC PRESSURE AND LEAKAGE TEST**

**A. General:**

1. Provide all necessary materials and equipment, including water.
2. Backfill all trenches sufficient to hold pipe firmly in position.
3. Allow time for thrust blocks to cure prior to testing.
4. Flush all pipes prior to testing to remove all foreign material.
5. Perform pressure and leakage test concurrently.
6. Test pressure: See Subsection titled "System Performance Requirements."
7. Apply test pressure by means of a pump connected to the pipe.
8. Base test pressure on the elevation of the lowest point in the line.
9. Fill each closed valve section or bulk-headed section slowly. Expel air from section being tested by means of permanent air vents installed at high points or by means of temporary corporation cocks installed at such points. Remove and plug the temporary corporation cocks at the conclusion of the test.
10. Allow water to stand in the pipe for 24 hours before test pressure is applied.
11. Allow the system to stabilize at the test pressure before conducting the leakage test.
12. Do not operate valves in either the opening or closing direction at differential pressures above the valves rated pressure.
13. Maintain test pressure as specified for type of pipe being tested.
14. Pressure Test: Examine any exposed pipe, fittings, valves, hydrants and joints during the test, if no leaks are observed the section of line has passed the pressure test. If leaks are observed, repair any damaged or defective pipe, fittings, valves, or hydrants, and repeat the pressure test.
15. Leakage Test: Perform as specified hereafter for the type of pipe being installed.

**B. DIP Leakage Test: Perform in accordance with AWWA C600. Selected requirements of AWWA C600 are repeated as follows:**

1. Maintain the test pressure, +/- 5 psi, for a minimum of two hours.
2. No piping will be accepted if the leakage is greater than that determined by the following formula:

$$L = (S \times D \times P^{1/2}) / 133,200$$

L = Allowable leakage, gallons per hour.  
S = Length of pipe tested, feet.  
D = Nominal diameter of pipe, inches.

P = Average test pressure during the leakage test, pounds per square inch (gauge).

C. PE Pipe Leakage Test:

1. Apply the test pressure and allow the pipe to stand, without makeup pressure, for sufficient time to allow for diametric expansion or pipe stretching to stabilize, approximately two to three hours.
2. After the above stabilization has occurred, return the section being tested to the test pressure. Hold the test pressure for one to three hours. If the pressure in the test section drops, and it is determined the drop may be the result of expansion resulting from increasing temperature, a limited amount of additional water may be added to bring the pressure back to the test pressure. Allowable amounts of make-up water, to compensate for expansion due to increasing temperature, are as shown in the following table. Make-up water is only allowed during this final test period and not during the initial stabilization described in the previous paragraph. If the additional water added is less than the allowable shown in the table and there are no visual leaks or significant pressure drops, the tested section passes the test.
3. Nominal Allowance for Expansion

Pipe Size (in.) Test	(U.S. Gals./100 Feet of Pipe)		
	1-Hour Test	2-Hour Test	3-Hour Test
3	0.10	0.15	0.25
4	0.13	0.25	0.40
6	0.30	0.60	0.90
8	0.50	1.0	1.50
10	0.75	1.3	2.1
<u>11</u>	<u>1.0</u>	<u>2.0</u>	<u>3.0</u>
12	1.1	2.3	3.4
14	1.4	2.8	4.2
16	1.7	3.3	5.0
18	2.2	4.3	6.5
20	2.8	5.5	8.0
<u>22</u>	<u>3.5</u>	<u>7.0</u>	<u>10.5</u>
24	4.5	8.9	13.3
28	5.5	11.1	16.8
32	7.0	14.3	21.5
36	9.0	18.0	27.0
40	11.0	22.0	33.0
<u>48</u>	<u>15.0</u>	<u>27.0</u>	<u>43.0</u>

- D. PVC Pipe Leakage Test: Perform in accordance with AWWA M23. Selected requirements of AWWA M23 are repeated as follows:

1. Maintain the test pressure, +/- 5 psi, for a minimum of two hours.
2. No piping will be accepted if the leakage is greater than that determined by the following formula:

$$L = (N \times D \times P^{1/2}) / 7,400$$

L = Allowable leakage, gallons per hour.

N = Number of joints in the length of the pipeline tested.

D = Nominal diameter of pipe, inches.

P = Average test pressure during the leakage test, pounds per square inch (gauge).

- E. Cement Mortar Lined and Coated Steel Pipe Leakage Test: Perform in accordance with AWWA M11. Selected requirements of AWWA M11 are repeated as follows:

1. Maintain the test pressure, +/- 5 psi, for a minimum of two hours.
2. There shall be no significant leakage for pipe with welded joints or mechanical couplings.
3. For pipe joined with O-ring rubber gaskets, a leakage of 25 gallons per inch of diameter per mile per 24-hours is allowed.

### 3.14 DISINFECTION

- A. All New Pipelines shall be disinfected in accordance with one of the three methods specified in AWWA C651 and the following:

1. Disinfect after pressure and leakage test have been performed and accepted.
2. The method used shall be at the Contractor's option, unless specified by the owner of the water system.
3. Engage the services of a commercial testing laboratory, approved by the owner of the water system, to perform the bacteriological tests specified in Section 5.1 of AWWA C651. Direct the testing laboratory to send the original report of the bacteriological testing to the owner of the water system. Should the laboratory report show that any sample taken was not acceptable, repeat the sterilization process shall until a satisfactory sterilization is accomplished.
4. Lawfully dispose of the chlorinated water.

### END OF SECTION

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**SECTION 33 30 00**

**SANITARY SEWERAGE UTILITIES**

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**PART 1 - GENERAL**

**1.01 SECTION INCLUDES**

- A. Roadway and/or site sanitary gravity sewers and force mains up to 5 feet of any on-site building.

**1.02 RELATED SECTIONS**

- A. Section 31 23 33 – Trenching and Backfilling.
- B. Section 32 05 23 – Cement and Concrete for Exterior Improvements.
- C. Section 33 05 16 – Utility Structures.

**1.03 RELATED DOCUMENTS**

**A. AASHTO:**

- 1. M 252: Standard Specification for Corrugated Polyethylene Drainage Pipe.
- 2. M 294: Standard Specification for Corrugated Polyethylene Pipe, 300- to 1500-mm (12- to 60-inch.) Diameter.

**B. ASTM:**

- 1. A 615/A615M: Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
- 2. A 674: Standard Practice for Polyethylene Encasement for Ductile Iron Pipe for Water and Other Liquids.
- 3. C 443: Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets.
- 4. C 1173: Standard Specification for Flexible Transition Couplings for Underground Piping Systems.
- 5. D 1785: Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.
- 6. D 2235: Standard Specification for Solvent Cement for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe and Fittings.
- 7. D 2321: Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications.
- 8. D 2564: Standard Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC)



## Plastic Piping Systems.

9. D 2751: Acrylonitrile-Butadiene-Styrene (ABS) Sewer Pipe and Fittings.
10. D 3034: Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
11. D 4101: Standard Specification for Propylene Injection and Extrusion Materials.
12. F 477: Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.
13. F 656: Standard Specification for Primers for Use in Solvent Cement Joints of Poly(Vinyl Chloride) (PVC) Plastic Pipe and Fittings.
14. F 679: Standard Specification for Poly(Vinyl Chloride) (PVC) Large Diameter Plastic Gravity Sewer Pipe and Fittings.
15. F-1336: Standard Specification for Poly(Vinyl Chloride) (PVC) Gasketed Sewer Fittings.

## C. AWWA:

1. C104: Cement-Mortar Lining for Ductile-Iron Pipe and Fittings.
2. C105: Polyethylene Encasement for Ductile-Iron Pipe Systems.
3. C110: Ductile-Iron and Gray-Iron Fittings.
4. C111: Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
5. C150: Thickness design of Ductile-Iron Pipe.
6. C151: Ductile-Iron Pipe, Centrifugally Cast.
7. C153: Ductile-Iron Compact Fittings.
8. M41: Ductile Iron Pipe and Fittings.

## D. Caltrans Standard Specifications.

1. Section 65, Concrete Pipe.

## E. California Building Code.

## F. Section 1806A.11 – Pipes and Trenches.

## G. California Plumbing Code.

## 1.04 DEFINITIONS

- A. AASHTO: American Association of State Highway and Transportation Officials.
- B. ABS: Acrylonitrile-butadiene-styrene.

- C. ASTM: American Society for Testing Materials.
- D. AWWA: American Water Works Association.
- E. HDPE: High-density polyethylene.
- F. PE: Polyethylene.
- G. DIP: Ductile iron pipe.
- H. PVC: Polyvinyl Chloride.
- I. RCP: Reinforced concrete pipe.
- J. NPS: Nominal pipe size.

**1.05 SUBMITTALS**

- A. Follow submittal procedures outlined in Section 01 33 00 – Submittal Procedures.
- B. Product data for the following:
  - 1. Piping materials and fittings.
  - 2. Special pipe couplings.
  - 3. Joint sealants.
  - 4. Sewage air relief valves.
- C. Shop drawings: Include plans, elevations, details and attachments for the following:
  - 1. Force main piping access openings.
- D. Design Mix Reports and Calculations: For each class of cast-in-place concrete.
- E. Field Test Reports: Indicate and interpret test results for compliance with performance.

**1.06 DELIVERY, STORAGE AND HANDLING**

- A. Do not store plastic pipe and fittings in direct sunlight.
- B. Protect pipe, fittings, and seals from dirt and damage.
- C. Handle precast concrete pipe and other precast structures according to manufacturer's written instructions.
- D. Protect imported bedding and backfill material from contamination by other materials.

**PART 2 - PRODUCTS****2.01 PIPING MATERIALS FOR GRAVITY FLOW**

- A. ABS Pipe and Fittings: 4-inch through 12 inch, ASTM D 2751, SDR 26. Bell and spigot joints.
  - 1. Bell and Spigot Joint Gasket: Elastomeric seal, ASTM F 477.
- B. DIP: Sizes 4-inch through 48-inch.
  - 1. Pipe: AWWA C150 and C151.
  - 2. Pressure Class: Minimum pressure class for size indicated.
  - 3. Fittings
    - (a) Standard: AWWA C110, sizes 4-inch through 48-inch.
    - (b) Compact: AWWA C153, sizes 4-inch through 24-inch.
  - 4. Pipe and Fitting Lining: Cement Mortar, AWWA C104.
  - 5. Pipe and Fitting Coating: Asphaltic, AWWA C151 or C115.
  - 6. Exterior Soil Corrosion Protection for Pipe and Fittings: Polyethylene encasement, AWWA C105.
  - 7. Joints:
    - (a) Push-On Bell and Spigot Joint: AWWA C111.
    - (b) Mechanical Joint: AWWA C111.
    - (c) Flanged joint. AWWA C115.
- C. PE Pipe and Fittings (HDPE): 4-inch through 10-inch, AASHTO M252 Type S, smooth interior and corrugated exterior. Bell and spigot joints.
  - 1. Bell and Spigot Joint Gasket: Elastomeric seal, ASTM F 477.
  - 2. Couplings: AASHTO M 252, corrugated band type, engage a minimum of 4 corrugations, 2 on each side of pipe joint.
- D. PE Pipe and Fittings (HDPE): 12-inch through 48-inch, AASHTO M 294. Type S, smooth interior and corrugated exterior. Bell and spigot joints.
  - 1. Bell and Spigot Joint Gasket: Elastomeric seal, ASTM F 477.
  - 2. Couplings: AASHTO M 252, corrugated band type, engage a minimum of 4 corrugations, 2 on each side of pipe joint.
- E. PVC Pipe:
  - 1. Pipe:
    - (a) 4-inch through 15-inch: ASTM D 3034, SDR 26. Bell and spigot joints.

- (b) 18 inch through 36-inch: ASTM F 679, T-1 wall. Bell and spigot joints.
- 2. Fittings:
  - (a) 4-inch through 27-inch: ASTM F 1336.
  - (b) 30-inch through 36-inch: ASTM D 3034, SDR 26
- 3. Joint Gasket: Elastomeric seal, ASTM F 477.
- F. Reinforced Concrete Pipe: Designated by Class, rubber gasketed joints, Type II or V cement.
  - 1. Circular Reinforced Concrete Pipe, Described or Chosen by Class: Caltrans Standard Specification.
  - 2. Oval shaped (Elliptical) Reinforced Concrete Pipe: Caltrans Standard Specification.
  - 3. Rubber Gasketed Joints: Caltrans Standard Specification Section 65-2.02F.
- 2.02 PIPING MATERIALS FOR FORCE MAINS
  - A. DIP: See Section 33 10 00 – Water Utilities.
  - B. PE Pipe: See Section 33 10 00 – Water Utilities.
  - C. PVC Pipe: See Section 33 10 00 – Water Utilities.
- 2.03 SPECIAL PIPE COUPLINGS
  - A. Gravity Piping: ASTM C 1173. Rubber or elastomeric sleeve and band assembly fabricated to match outside diameters of pipes to be joined.
  - B. Force Main piping: See Section 33 10 00 – Water Utilities.
- 2.04 MANHOLES AND CLEANOUTS
  - A. See Section 33 05 16 – Utility Structures.
- 2.05 SEWAGE AIR RELIEF VALVE ASSEMBLY FOR FORCE MAINS
  - A. General: As indicated.
- 2.06 THRUST BLOCKS FOR FORCE MAINS
  - A. General: Location, configuration bearing area, etc. as indicated.
  - B. Portland Cement Concrete: Section 32 05 23 – Concrete for Exterior Improvements.

**PART 3 - EXECUTION****3.01 GRAVITY PIPE INSTALLATION**

- A. General: Install pipe, fittings, and appurtenances utilizing best practices, manufacturer's instructions, and in accordance with Section 6 and 7 of ASTM D 2321 for plastic pipe, Caltrans Standard Specification Section 65-2.03C for reinforced concrete pipe and chapter 11.3.3 of AWWA M41 for ductile iron pipe.
- B. Pipe Depth and Trench Configuration: Conform to typical trench section(s) indicated.
- C. Excavation, Bedding, Backfill, and Compaction: Section 31 23 33 – Trenching and Backfilling.
- D. Handling: Carefully handle during loading, hauling, unloading and placing operations to avoid breakage or damage. Use strap type slings for lifting and placing; no chains or hooks will be permitted. Comply with the manufacturer's recommendations.
- E. Laying: Before lowering pipe into the trench, remove all stakes, debris, loose rock and other hard materials from the bottom of the trench. Lay accurately in conformance with lines and grades indicated. Start laying the pipeline at the low end and proceed upstream. Lay bell and spigot pipe with the bell end facing upstream. Lay pipe on a bed prepared by handwork, dug true to grade. Furnish firm bearing for pipe throughout its entire length with bell holes provided at the ends of each pipe length of sufficient size to permit making up the particular type of joint being used. Adjust pipe to line and grade by scraping away or filling and tamping material under the body of the pipe for the entire pipe length and not by blocking or wedging. After final positioning, hold pipe in place in trench with backfill material placed equally on both sides of the pipe at as many locations as required to hold the pipe section in place.
- F. Curved Alignment: When necessary to conform to the alignment specifically indicated, lay pipe on a curved alignment by means of asymmetrical closure of joints or bending of the pipe barrel. Use shorter lengths of pipe than the standard length if necessary to achieve curvature specified. Do not exceed the recommendations of the pipe manufacture for deflections at the joints or pipe bending.
- G. Closure: Close open ends of pipes and appurtenance at the end of each days work or when work is not in progress.

### 3.02 FORCE MAIN PIPE INSTALLATION

- A. General: See Section 33 10 00 – Water Utilities.

### 3.03 SPECIAL PIPE COUPLINGS

- A. General: Use where required to join piping and no other appropriate method is specified. Do not use instead of specified joining methods.
- B. Installation: Per manufacturer's instructions.

### 3.04 AIR RELIEF VALVE ASSEMBLY INSTALLATION

- A. General: Install as indicated.

### 3.05 TESTING OF GRAVITY PIPING MAINS

- A. Obstructions: After backfilling and compacting, but before paving or other surface improvements, test sewer for obstructions either by rodding or by the sewer ball method. Provide for intercepting all grit, rocks and other flushed debris to keep debris from entering the existing system.
- B. At the option of the Contractor, either the following hydrostatic or air test shall be performed.
- C. Hydrostatic Test:
  - 1. Test after backfilling to finish grade or pavement structural section subgrade in paved areas.
  - 2. Test sewer mains between successive manholes by closing the lower end of the sewer main to be tested and the inlet sewer main of the upper manhole with stoppers.
  - 3. Fill pipe and manholes with water to a point four feet below the ground surface of the upper manhole, but in no case less than four feet above the pipe invert. If ground water is present, the water surface at the upper manhole shall be at least four feet above the level of the ground water.
  - 4. Fill piping at least one hour prior to testing.
  - 5. Test piping at least two hours by maintaining the head specified above with measured additions of water. The sum of these additions of water, in the two-hour test period, shall be the leakage amount.
  - 6. The maximum allowable head of water above any portion of sewer being tested shall be 15-feet. Where the difference in elevation between successive manholes exceeds 15-feet, a test tee shall be installed between manholes, and the testing shall be carried on between the tee and the manhole.
  - 7. The allowable leakage shall not exceed 0.1-gallons per minute per inch diameter, per 1000-feet of sewer main being tested.
  - 8. If the leakage exceeds the above amount, determine the cause and remedy it prior to retesting.
  - 9. If the leakage is less than the allowable, but leaks are observed, repair the observed leaks.
- D. Air Test:
  - 1. Test after backfilling to finish grade or pavement structural section subgrade in paved areas.
  - 2. Apply to each length between adjacent manholes.
  - 3. Supply pressure gauge with minimum divisions of 0.10-psi and with an accuracy of +/- 0.04-psi. When requested by the Owner, provide certification that the gauge has been tested for accuracy within the last six months by a reliable testing firm.

4. Pressurize the test section to 3.5-psi, and then hold the pressure above 3.0-psi during a saturation period of at least 5 minutes. At the end of the saturation period, note the pressure, which must be a minimum of 3.0-psi, and begin the timed period. If the pressure drops 0.5-psi in less than the time given in the following table the section of pipe has not passed the test.

<u>PipeSize</u>	<u>Minimum Time Allowed</u> <u>for Pressure to Drop 0.5-PSI</u>
4"	125 seconds
6"	185 seconds
8"	245 seconds
10"	310 seconds
12"	370 seconds
15"	460 seconds
18"	555 seconds
21"	10 minutes
24"	12 minutes
27"	14 minutes
30"	16 minutes
36"	18 minutes
42"	20 minutes
48"	23 minutes
54"	26 minutes

6. If the time for the pressure to drop 0.5-psi is 125% or less of the time indicated, the line shall immediately be re-pressurized to 3.0-psi and the test repeated. If, during the 5-minute saturation period, the pressure drops less than 0.5-psi after the initial pressurization and air is not added, the section undergoing the test shall have passed.
7. If the test did not pass, find and repair the leak to the satisfaction of the Owner.
8. When the prevailing ground water is above the line being tested the air pressure shall be increased 0.43-psi for each foot the water table is above the invert of the pipe at the highest manhole.

### 3.06 TESTING OF LATERALS

- A. At the option of the Contractor, either the following hydrostatic or air test shall be performed.
- B. Hydrostatic Test:
  - 1. Test laterals before backfilling.
  - 2. Plug lateral at its ends and fill with water through the cleanouts.
  - 3. Maintain the water level in the cleanouts as high as possible throughout the test period.
  - 4. One hour after filling with water, examine the lateral for leakage.
  - 5. Repair all leaks to the satisfaction of the Owner.
  - 6. Do not backfill the trench until testing and repairs of the lateral are complete, and approved by the Owner.
  - 7. Following approval of the Owner, remove all plugs, dispose of the water and complete the connection to the main.
- C. Air Test
  - 1. Test after backfilling to finish grade or pavement structural section subgrade in paved areas.
  - 2. Test in accordance with subsection above titled "Testing of Gravity Piping Mains," paragraph titled "Air Test."

**3.07 HYDROSTATIC AND LEAKAGE TESTING OF FORCE MAINS**

- A. General: Perform hydrostatic and leakage test in accordance with Section 33 10 00 – Water Utilities.

**END OF SECTION**



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SECTION 33 40 00

STORM DRAINAGE UTILITIES

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**PART 1 - GENERAL**

1.01 SECTION INCLUDES

- A. Roadway and/or site storm drainage up to 5-feet of any on-site building.

1.02 RELATED DOCUMENTS

A. AASHTO:

- 1. M 252: Standard Specification for Corrugated Polyethylene Drainage Pipe.
- 2. M 294: Standard Specification for Corrugated Polyethylene Pipe, 300- to 1500-mm (12- to 60-in.) Diameter.

B. ASTM:

- 1. A 74: Standard Specification for Cast Iron Soil Pipe and Fittings.
- 2. A 615/A615M: Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
- 3. C 443: Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets.
- 4. C 564: Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings.
- 5. C 1173: Standard Specification for Flexible Transition Couplings for Underground Piping Systems.
- 6. D 1785: Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.
- 7. D 2235: Standard Specification for Solvent Cement for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe and Fittings.
- 8. D 2321: Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity Flow Applications.
- 9. D 2564: Standard Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems.
- 10. D 2751: Acrylonitrile-Butadiene-Styrene (ABS) Sewer Pipe and Fittings.
- 11. D 3034: Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
- 12. D 4101: Standard Specification for Polypropylene Injection and Extrusion Materials.
- 13. F 477: Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.

14. F 656: Standard Specification for Primers for Use in Solvent Cement Joints of Poly(Vinyl Chloride) (PVC) Plastic Pipe and Fittings.
15. F 679: Standard Specification for Poly(Vinyl Chloride) (PVC) Large Diameter Plastic Gravity Sewer Pipe and Fittings.
16. F-1336: Standard Specification for Poly(Vinyl Chloride) (PVC) Gasket Sewer Fittings.

C. AWWA:

1. C104: Cement-Mortar Lining for Ductile Iron Pipe and Fittings.
2. C105: Polyethylene Encasement for Ductile-Iron Pipe Systems.
3. C110: Ductile-Iron and Gray-Iron Fittings.
4. C111: Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
5. C150: Thickness design of Ductile-Iron Pipe.
6. C151: Ductile-Iron Pipe, Centrifugally Cast.
7. C153: Ductile-Iron Compact Fittings.
8. M41: Ductile Iron Pipe and Fittings.

D. Caltrans Standard Specifications:

1. Concrete Pipe.
2. Corrugated Metal Pipe.
3. Miscellaneous Drainage Facilities.
4. Slope Protection.

E. Caltrans Standard Plans:

1. Metal and Plastic Flared End Sections.
2. Concrete Flared End Sections.
3. Corrugated Metal Pipe Coupling Details No.1, Annular Coupling Band Bar and Strap and Angle Connections.
4. Corrugated Metal Pipe Coupling Details No. 2, Hat Band Coupler and Flange Details.
5. Corrugated Metal Pipe Coupling Details No. 3, Helical and Universal Couplers.
6. Corrugated Metal Pipe Coupling Details No. 4, Hugger Coupling Bands.
7. Corrugated Metal Pipe Coupling Details No. 5, Standard Joint.
8. Corrugated Metal Pipe Coupling Details No. 6, Positive Joint.
9. Corrugated Metal Pipe Coupling Details No. 7, Downdrain.
10. Slotted Corrugated Steel Pipe Drain Details.

11. Slotted Corrugated Steel Pipe Drain Details.

- F. California Building Code:
- G. Section for Pipes and Trenches.
- H. Section for Gratings.
- I. California Plumbing Code.

#### 1.03 DEFINITIONS

- A. AASHTO: American Association of State Highway and Transportation Officials.
- B. ABS: Acrylonitrile-butadiene-styrene.
- C. ASTM: American Society for Testing Materials.
- D. AWWA: American Water Works Association.
- E. CMP: Corrugated metal pipe.
- F. DIP: Ductile iron pipe.
- G. HDPE: High-density polyethylene.
- H. NPS: Nominal pipe size.
- I. PE: Polyethylene.
- J. PVC: Polyvinyl chloride.
- K. RCP: Reinforced concrete pipe.

#### 1.04 SUBMITTALS

- A. Follow submittal procedures outlined in Section 01 33 00 – Submittal Procedures.
- B. Product Data Shop Drawings, Etc.: For the following:
  - 1. Piping materials and fittings.
  - 2. Special pipe couplings.
  - 3. Polymer-concrete, channel drainage systems (trench drains).
  - 4. Joint sealants.
  - 5. Plastic area drains.
  - 6. Precast concrete catch basins, inlets, curb inlets, and area drains, including frames and grates.
  - 7. Concrete, metal and plastic flared end sections.
- C. Design Mix Reports and Calculations: For each class of cast in place concrete.
- D. Field Test Reports: Indicate and interpret test results for compliance with performance.

**1.05 DELIVERY, STORAGE AND HANDLING**

- A. Do not store plastic structures, pipe and fittings in direct sunlight.
- B. Protect pipe, fittings, and seals from dirt and damage.
- C. Handle precast concrete pipe and other precast structures according to manufacturer's written instructions.
- D. Protect imported bedding.
- E. Guard and backfill material from contamination by other materials.

**PART 2 - PRODUCTS****2.01 PIPING MATERIALS**

- A. ABS Pipe and Fittings: Smaller than 4-inch, ASTM D 2751, SDR 35. Solvent cement joints.
  - 1. Solvent Cement: ASTM D 2235.
- B. ABS Pipe and Fittings: 4-inch through 12 inch, ASTM D 2751, SDR 35. Bell and spigot joints.
  - 1. Bell and Spigot Joint Gasket: Elastomeric seal, ASTM F 477.
- C. Cast Iron Pipe and Fittings: Hub and spigot, 2-inch through 15-inch, ASTM A74, service class.
  - 1. Gaskets: ASTM 564, rubber, compression type, thickness to match class of pipe.
- D. Corrugated Metal Pipe: per Caltrans Standard Specification
  - 1. Bituminous Coating: per Caltrans Standard Specification.
  - 2. Bituminous Lining: per Caltrans Standard Specification.
  - 3. Bituminous Pavings: per Caltrans Standard Specification.
  - 4. Corrugated Aluminum Pipe: per Caltrans Standard Specification.
  - 5. Corrugated Steel Pipe: per Caltrans Standard Specification.
  - 6. Slotted Corrugated Steel Pipe: per Caltrans Standard Specification.
  - 7. Details: per Caltrans Standard Plans
- E. DIP: Sizes 4-inch through 48-inch.
  - 1. Pipe: AWWA C150 and C151.
  - 2. Pressure Class: Minimum pressure class for size indicated.
  - 3. Fittings:
    - (a) Standard: AWWA C110, sizes 4-inch through 48-inch.
    - (b) Compact: AWWA C153, sizes 4-inch through 24-inch.

4. Pipe and Fitting Lining: Cement Mortar, AWWA C104.
5. Pipe and Fitting Coating: Asphaltic, AWWA C151 or C115.
6. Exterior Soil Corrosion Protection for Pipe and Fittings: Polyethylene encasement, AWWA C105.
7. Joints:
  - (a) Push-On Bell and Spigot Joint: AWWA C111.
  - (b) Mechanical Joint: AWWA C111.
  - (c) Flanged joint. AWWA C115.
- F. Reinforced Concrete Pipe: Designated by Class, rubber gasketed joints.
  1. Circular Reinforced Concrete Pipe: per Caltrans Standard Specification.
  2. Oval shaped (Elliptical) Reinforced Concrete Pipe: per Caltrans Standard Specification.
  3. Reinforced Concrete Pipe Arch: per Caltrans Standard Specification.
  4. Rubber Gasketed Joints: per Caltrans Standard Specification.
- G. PE Pipe and Fittings: 4-inch through 10-inch, AASHTO M 252 Type S, smooth interior and corrugated exterior. Bell and spigot joints.
  1. Bell and Spigot Joint Gasket: Elastomeric seal, ASTM F 477.
  2. Couplings: AASHTO M 252, corrugated band type. Engage a minimum of 4 corrugations, 2 on each side of pipe joint.
- H. PE Pipe and Fittings: 12-inch through 48-inch, AASHTO M 294.Type S, smooth interior and corrugated exterior. Bell and spigot joints.
  1. Bell and Spigot Joint Gasket: Elastomeric seal, ASTM F 477.
  2. Couplings: AASHTO M 252, corrugated band type. Engage a minimum of 4 corrugations, 2 on each side of pipe joint.
- I. PVC Pipe and Fittings-Smaller than 4-Inch: ASTM D1785, Schedule 40.
  1. Joints: Solvent Cement, ASTM D 2564. Include primer according to ASTM F656.
- J. PVC Pipe and Fittings,4-Inch and Larger
  1. Pipe:
    - (a) 4-inch through 15-inch: ASTM D 3034, SDR 35. Bell and spigot joints.
    - (b) 18 inch through 36-inch: ASTM F 679, T-1 wall. Bell and spigot joints.
  2. Fittings:
    - (a) 4-inch through 27-inch: ASTM F 1336.

(b) 30-inch through 36-inch: ASTM D 3034, SDR 35

3. Joint Gasket: Elastomeric seal, ASTM F 477.

## 2.02 PIPE ANCHORS

A. Section 32 05 23 – Cement and Concrete for Exterior Improvements.

## 2.03 SPECIAL PIPE COUPLINGS

A. Plastic, Cast Iron and Ductile Iron Pipe: ASTM C 1173, rubber or elastomeric sleeve and band assembly fabricated to match outside diameters of pipes to be joined.

B. Reinforced Concrete Pipe: Portland cement concrete collar as indicated.

C. Section 32 05 23 – Cement and Concrete for Exterior Improvements.

## 2.04 CURB INLETS, CATCH BASINS, DROP INLETS, AREA DRAINS, ETC.

A. General: Size, shape, configuration, depth, etc. of structure and frame, grate, or cover shall be as indicated.

B. Section 32 05 23 – Cement and Concrete for Exterior Improvements.

C. Precast Structure: Rate for AASHTO H20 loading in paved areas.

D. Steps: ASTM C 478 or AASHTO M 199. Manufacture from deformed, ½-inch steel reinforcement rod complying with ASTM A 615 and encased in polypropylene complying with ASTM D4101. Include pattern designed to prevent lateral slippage off step.

E. Frames, Grates and Covers: per Caltrans Standard Specification.

1. Galvanize steel frames, grates and covers.

2. Grates and covers shall be non-rocking, bolt-down type.

3. Rate for AASHTO H20 loading in paved areas.

## 2.05 MANHOLES AND CLEANOUTS

A. See Section 33 05 16 – Utility Structures.

## 2.06 POLYMER-CONCRETE TRENCH DRAINS

A. General: Modular system of precast, polymer-concrete channel sections, grates, and appurtenances; designed so grates fit into channel recesses without rocking or rattling. Include number of units required to form total length required.

B. Include the following components:

1. Channel Sections: Interlocking-joint, precast modular units with end caps. Inside width as indicated with deep, rounded bottom, with built in slope or flat invert as indicated and outlets in number, sizes, and locations indicated. Include extension sections necessary for required depth.

2. Frame and Grate: Gray iron, ductile iron or galvanized steel as indicated. Where drain is located in traffic areas, rate for AASHTO H20 loading.

- C. Locking Mechanism: Manufacturer's standard device for securing grates to channel sections.

## 2.07 METAL, CONCRETE OR PLASTIC FLARED END SECTIONS

- A. General: Caltrans Standard Specification and Caltrans Standard Plans.

## 2.08 SLOPE PROTECTION

- A. Rock Slope Protection: Caltrans Standard Specification.
  - 1. Class: *[Select Class applicable to the Project.]*
  - 2. Fabric: Caltrans Standard Specification.
- B. Concrete/Shotcrete Slope Protection: Caltrans Standard Specification.
  - 1. Bar Reinforcement: Caltrans Standard Specification, minimum Grade 40.
  - 2. Welded Wire Fabric: Caltrans Standard Specification. Use 6 x 6-W1.4 xW1.4 unless otherwise indicated.
- C. Concreted-Rock Slope Protection: Caltrans Standard Specification.
  - 1. Class: *[Select Class applicable to the Project.]*
- D. Sacked Concrete Slope Protection.
  - 1. Concrete: Caltrans Standard Specification.
  - 2. Sacks: 10 ounce burlap measuring approximately 19.5-inches by 36 inches when empty and laid flat.

## 2.09 CONCRETE/SHOTCRETE DITCH LINING

- A. General: Caltrans Standard Specification.
  - 1. Bar Reinforcement: Caltrans Standard Specification, minimum Grade 40.
  - 2. Welded Wire Fabric: Caltrans Standard Specification. Use 6 x 6-W1.4 xW1.4 unless otherwise indicated.

## PART 3 - EXECUTION

### 3.01 PIPE INSTALLATION

- A. General: Install pipe, fittings, and appurtenances utilizing best practices, manufacturer's instructions, and in accordance with Section 6 and 7 of ASTM D 2321 for plastic pipe, Caltrans Standard Specification Section 65-2.03C for reinforced concrete pipe, per Caltrans Standard Specification and chapter 11.3.3 of AWWA M41 for cast iron and ductile iron pipe.
- B. Pipe Depth and Trench Configuration: Conform to typical trench section(s) indicated.
- C. Excavation, Bedding, Backfill, and Compaction: Section 31 23 33 – Trenching and Backfilling.
- D. Handling: Carefully handle during loading, hauling, unloading and placing operations to avoid breakage or damage. Use strap type slings for lifting and placing; no chains or hooks will be permitted. Comply with manufacturer's recommendations.

- E. Laying: Before lowering pipe into the trench, remove all stakes, debris, loose rock and other hard materials from the bottom of the trench. Lay accurately in conformance with lines and grades indicated. Start laying the pipeline at the low end and proceed upstream. Lay bell and spigot pipe with the bell end facing upstream. Lay pipe on a bed prepared by handwork, dug true to grade. Furnish firm bearing for pipe throughout its entire length with bell holes provided at the ends of each pipe length of sufficient size to permit making up the particular type of joint being used. Adjust pipe to line and grade by scraping away or filling and tamping material under the body of the pipe for the entire pipe length and not by blocking or wedging. After final positioning, hold pipe in place in trench with backfill material placed equally on both sides of the pipe at as many locations as required to hold the pipe section in place.
- F. Curved Alignment: When necessary to conform to the alignment specifically indicated, lay pipe on a curved alignment by means of asymmetrical closure of joints or bending of the pipe barrel. Use shorter lengths of pipe than the standard length if necessary to achieve curvature specified. Do not exceed the recommendations of the pipe manufacture for deflections at the joints or pipe bending.
- G. Closure: Close open ends of pipes and appurtenance openings at the end of each days work or when work is not in progress.

### 3.02 INSTALLATION OF PIPE ANCHORS

- A. Install at location, configuration and details shown on the Plans.

### 3.03 SPECIAL PIPE COUPLINGS

- A. General: Use where required to join piping and no other appropriate method is specified. Do not use instead of specified joining methods.
- B. Installation: Per manufacturer's instructions.

### 3.04 INSTALLATION OF CURB INLETS, CATCH BASINS, DROP INLETS, AREA DRAINS, ETC.

- A. Excavation, Bedding, Backfill, and Compaction: Section 31 23 33 – Trenching and Backfilling.
- B. Poured in Place Structures: Install as indicated and Caltrans Standard Specification Section 51.
  - 1. Shape bottoms to convey flows as indicated.
- C. Precast Structures: Install as indicated.
  - 1. Seal all joints and pipe entrances and exits.
  - 2. Place concrete in bottom and shape to convey flows as indicated.

### 3.05 POLYMER-CONCRETE TRENCH DRAIN INSTALLATION

- A. Excavation, Bedding, Backfill, and Compaction: Section 31 23 33 – Trenching and Backfilling.
- B. Install: As indicated and in accordance with the manufacturer's instructions.

### 3.06 CONCRETE OR PLASTIC FLARED END SECTION INSTALLATION

- A. Install: As indicated.

### 3.07 SLOPE PROTECTION PLACEMENT



- A. Rock Slope Protection: Caltrans Standard Specification and as indicated.
  - 1. Use Method B Placement unless otherwise indicated. If Method A is used, then refer to Caltrans Standard Specification
- B. Concrete/Shotcrete Slope Protection: Caltrans Standard Specification.
- C. Concreted-Rock Slope Protection: Caltrans Standard Specification.
  - 1. Use Method B Placement unless otherwise indicated. If Method A is used, then refer to Caltrans Standard Specification.
- D. Sacked Concrete Slope Protection.
  - 1. Detailed configuration: As indicated.
  - 2. Use one cubic foot of concrete per sack.
  - 3. Locate headers and stretchers as indicated.
  - 4. Headers: Folded end to bank.
  - 5. Stretchers: Folded ends are not to be adjacent.
  - 6. Place no more than four vertical courses until initial set has taken place in first course.

**3.08 CONCRETE/SHOTCRETE DITCH LINING PLACEMENT**

- A. Concrete/Shotcrete Slope Protection: Caltrans Standard Specification.

**END OF SECTION**