TECHNICAL SPECIFICATIONS MANUAL

For

HUMBOLDT COUNTY GARBERVILLE MINI-COMPLEX Modular Building Addition

At

715 Cedar Street

Garberville, California 95542

COUNTY PROJECT NUMBER: 2018-502

Prepared by:

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For:

The County of Humboldt

100% Design Documents
August 6, 2019

PROJECT # 2018-502

TECHNICAL SPECIFICATIONS

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SELECTIVE DEMOLITION

PART 1 - GENERAL

SUMMARY

A. Section Includes: Requirements for demolishing, cutting, removing and salvaging existing improvements as designated or required for construction of new work under this contract.

B. Related Sections.

1. Section 01 04 50 Cutting and Patching.

1.02 REFERENCES

A. ANSI - American National Standards Institute, Inc.

1. A10.6 - American National Standard Safety Requirements for Demolition

1.03 DEFINITIONS

A. Remove: Remove and legally dispose of items except those indicated to be reinstalled, salvaged, or to remain.

B. Salvage: Items indicated to be salvaged remain the County's property. Remove, clean, and pack or crate items to protect against damage. Identify contents of containers and deliver to County's designated storage area.

C. Relocate: Remove items indicated, clean, service, and otherwise prepare them for reuse; store and protect against damage. Reinstall items in locations indicated.

D. Existing to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by the County's Representative, items may be removed to a suitable, protected storage location during selective demolition and then cleaned and reinstalled in their original locations.

1.04 SUBMITTALS

A. Permits and Certificates: Submit all permits and certificates required for the Project for record purposes.

B. Work Schedule: Submit proposed schedule of work items to be performed, and description of how work is to be accomplished.

C. Report of inspections conducted with the County's Representative both before and after performing work.

1.05 QUALITY ASSURANCE

A. Requirements of Regulatory Agencies:

1. All work shall comply with rules and regulations of State of California, California Code of Regulations, Title 8, Industrial Relations, Chapter 4, Subchapter 4, "Construction Safety Orders" and other applicable local and state agencies having jurisdiction.

2. Secure all required Permits or Certificates for demolition or discontinuance of utilities prior to beginning work.

1.06 PROJECT CONDITIONS

A. Prepare photographs or videotape, sufficiently detailed, to document existing conditions in adjoining construction and site improvements in event of damage, or allegations of damage, resulting from demolition or other construction operations.

B. Disposition of Existing Improvements:

1. All materials indicated to be removed shall become property of the Contractor and shall be disposed of by him outside of project site. Do not dispose of removed materials by sale, gift or in any other manner to general public at site. Sale or disposal of such materials at site to other duly licensed contractors or material men will be permitted provided materials are removed from construction site by the Contractor.

2. All removal of debris from site, including removal of inventory to site of storage, is part of this contract and shall be done by Contractor's employees and no others.

C. Protection:

1. Erect and maintain temporary bracing, lights, barricades, construction barricades for subsequent new construction, warning signs, and guards necessary to protect public, County’s employees, finishes, improvements to remain, trees, and adjoining structures from damage, all in accordance with applicable regulations.

2. Wet down areas affected by this work as required to prevent dust and dirt from rising.

D. Scheduling:

1. Coordinate with County’s Representative in scheduling noisy or dirty work.

2. Schedule work to cause minimal interference with normal county operations.

E. Traffic Circulation:

1. Ensure minimum interference with roads, streets, driveways, sidewalks, and adjacent facilities.

2. Do not close or obstruct public thoroughfares without first obtaining required permit or permission of the County's Representative.

PART 2 - PRODUCTS

NOT USED

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine areas affected by work of this Section and verify following:

1. Disconnection of utilities as required.

2. Utilities serving occupied portions of campus will not be disturbed.

B. Where existing conditions conflict with representations of the Contract Documents, notify the County's Representative and obtain clarification. Do not perform work affecting conflicting conditions until clarification of conflict is received.

3.02 PREPARATION

A. Verify that area to be demolished or removed is not in use and that adequate space is available to perform work.

B. Arrange for, and verify termination of utility services and capping of lines.

C. Lay out cutting work at job site and coordinate with related work for which cutting is required.

3.03 DEMOLITION

A. Provide noise and dust abatement as required to prevent contamination of adjacent areas. Remove all materials not designated as salvage in their entirety.

B. Concrete:

1. Concrete shall be removed by saw cutting, drilling, chipping, breaking or combination thereof, as indicated or required to satisfactorily accomplish work without damage to existing improvements to remain. Control dust by wetting and frequent cleanup.

2. Cut concrete by wet method only. No dry cutting is allowed.

C. Hazardous Materials:

1. If hazardous materials are uncovered or encountered, stop all work in area of hazardous materials and notify the County's Representative in writing.

2. Continue work only after the County's Representative has, in writing, notified the Contractor that hazardous materials have been abated.

3.04 CUTTING

A. Cutting of concrete shall be made neat and clean.

B. Do not cut or alter structural members unless indicated to do so in the Contract Documents, or written approval is received from the County's Representative.

C. Take care not to damage structural elements (steel reinforcing, or structural steel or wood, or concrete) shown to remain in place and not explicitly noted to be removed.

3.05 CLEANING AND ADJUSTING

A. Promptly patch and repair holes and damaged surfaces caused to adjacent construction by demolition operations.

B. Where repairs to existing surfaces are required, patch to produce surfaces to match existing.

3.06 FIELD QUALITY CONTROL

A. The County's Representative will accompany the Contractor before and after performance of work to confirm physical condition of structures or improvements involved.

END OF SECTION

SECTION 10 1400
SIGNAGE

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Interior and exterior accessibility, identification, directional and informational signs.

2. Parking signs.

3. School Name and Address Sign.

B. Related Requirements:

1. Division 01: General Requirements.

1.02 REFERENCES

A. ASTM International:

1. ASTM A500 - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.

2. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.

3. ASTM D4802 - Standard Specification for Poly (Methyl Methacrylate) Acrylic Plastic Sheet.

1.03 SUBMITTALS

A. Product Data: Submit material descriptions, finishes and color charts for each type of sign.

B. Shop Drawings: Submit Shop Drawings indicating sign style, lettering, overall dimensions and quantities. Submit floor plans showing locations for each sign.

C. Material Samples: Submit three samples illustrating full size sample sign, of type, style and color specified.

D. Manufacturer’s installation instructions.

1.04 QUALITY ASSURANCE

A. Pre-Installation Conference: Notify OAR when signs are ready for installation. Arrange for conference at site. Do not proceed with installation until ARCHITECT'S approval of specific locations and methods of attachment has been obtained.

B. Provide signs from one manufacturer.

1.05 DELIVERY, STORAGE AND HANDLING

A. Deliver products to site and protect from damage. Store until immediately prior to installation.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Products of following manufacturers are acceptable and are the basis for intended design and quality.

1. H. Toji and Company.
2. Karman Ltd., Architectural Signs.
3. Vomar Products Inc.
4. ASI-Modulex, Inc.
5. Mohawk Sign Systems, Inc.
6. Accent Signage Systems.
7. The Gruenke Company.
8. Ada Sign Products.
9. AccuBraille.
10. Equal.

2.02 MATERIALS AND FABRICATION

A. Interior Sign Materials:

1. Substrate Panel: 1/8 inch minimum thick, integrally colored or clear acrylic plastic, or laminated acrylic. Conforming to ASTM D4802; non-glare (matte), UV stable, suitable for interior and exterior use.

a. Corners shall be [square], [radius].

b. Edges shall be square and eased.

c. Colors as selected by ARCHITECT from manufacturer's custom color range.

2. Fasteners:

a. Stainless steel tamper-proof screws and plastic anchors.

b. Signs mounted on fire-rated doors shall be secured with adhesive.

c. Adhesives and sealants shall comply with the limits for VOC content and shall be approved by OWNER's Office of Environmental Health Services (OEHS).

B. Exterior Sign Materials:

1. Sign: ASTM B209 aluminum sheet, 0.080 inch thick with rounded corners of at least 1/8 inch radius and eased edges. White figure on a blue background; non-glare, high contrast signs. The blue shall be equal to color number 15090 in Federal Standard 595B.

2. Post: 2 by 2 inch galvanized steel tubing, weighing minimum of 4.31 pounds per foot and conforming to ASTM A500, Grade B, 3/16 inch thick wall thickness.

3. Concrete Post Footings: Refer to Section 32 1313, Site Concrete Work.

4. Fasteners: Stainless steel carriage bolts with tamper resistant nuts.

C. Characters and Symbols: Shall be fabricated by one of the processes described below:

1. Computer cut raised characters and graphics shall be cut from 1/16 inch integrally colored acrylic. Raised characters and graphics shall be inlaid 1/32 inch minimum into first surface of sign background, secured with adhesive so it cannot be removed without the use of tools. Raised characters and graphics shall have beveled, eased or rounded edges. Non-tactile text and graphics shall be applied to the second surface, and background color shall be applied to the second surface and protected with film or an additional backplate. Pictograms and other symbols including the International Symbol of Accessibility, which are included on signs with raised characters and Braille, are not required to be raised.

2. Raised characters and graphics including braille shall be integral to sign face and shall be formed into sign face by high pressure thermoforming using a negative mold. No applied, glued, welded tactile elements are acceptable. Raised characters and graphics shall have beveled, eased or rounded edges. No sharp, square edges are acceptable. Non-tactile text and graphics shall be applied to the second surface, and background color shall be applied to the second surface and protected with vinyl film. Pictograms and other symbols including the International Symbol of Accessibility, which are included on signs with raised characters and Braille, or other signs are not required to be raised.

2.03 COMMUNICATION ELEMENTS AND FEATURES

A. Raised Characters Raised characters shall comply with CBC 11B-703.2.

1. Character Type: Characters on signs shall be raised 1/32 inch minimum above their background and shall be sans serif uppercase characters duplicated in Braille. Characters and Braille shall be in a horizontal format.

2. Character Height: Character height measured vertically from the baseline of the character shall be 5/8 inch minimum and 2 inch maximum based on the height of the uppercase letter "I".

3. Character Proportions: Characters shall be selected from fonts where the width of the uppercase letter "O" is 60 percent minimum and 110 percent maximum of the height of the letter "I".

4. Stroke Thickness: Stroke thickness of the uppercase letter "I" shall be 15 percent maximum of the height of the character.

5. Character and Line Spacing shall be in conformance to CBC 11B-703.2.7 and 11B-703.2.8.

6. Character Placement: Shall be placed in accordance to Paragraph 2.03, C below.

B. Visual Characters: Visual characters shall comply with CBC Section 11B-703.5. Characters shall be conventional in form, and shall be uppercase or lowercase or a combination of both, as indicated on the drawings. Characters shall not be italic, oblique, highly decorative, or of other unusual forms.

1. Finish and Contrast: Characters and their backgrounds shall have a non-glare finish. Characters shall contrast with their background with either light characters on a dark background or a dark characters on a light background.

2. Character Proportions: Characters shall be selected from fonts where the width of the uppercase letter "O" is 60 percent minimum and 110 percent maximum of the height of the uppercase of the letter "I".

3. Character Height: Minimum character height shall comply with CBC Table 11B-703.5.5.

4. Height from Finish Floor or Ground: Visual characters shall be a 40 inches minimum above the finish floor or ground

5. Stroke Thickness: Uppercase letter "I" shall be 10 percent minimum and 20 percent maximum of the height of the character.

6. Character and Line Spacing: Shall be in accordance to CBC 11B-703.5.8 and 11B-703.5.9.

C. Braille: Contracted Grade 2 Braille, conforming to CBC 11B-703.3. Braille characters shall be inlaid optically correct acrylic Raster beads into computer drilled holes in the panel surface.

1. Dimensions and Capitalization: Braille dots shall have a domed or rounded shape and shall comply with CBC Table 11B-703.3.1.The indication of an

uppercase letter or letters shall only be used before the first word of sentences, proper nouns and names, individual letters of the alphabet, initials, and acronyms.

2. Position: Braille shall be positioned below the corresponding text in a horizontal format, flush left or centered. If text is multi-lined, Braille shall be placed below the entire line of text. Braille shall be separated 3/8 inch minimum and 1/2 maximum from any other tactile characters and 3/8 inch minimum from raised borders and decorative elements.

D. Pictograms: In conformance to CBC 11B-703.6. Pictograms shall have a field height of 6 inches minimum. Characters and Braille shall not be located in the pictogram field.

1. Finish and Contrast: Pictograms and their field shall have a non-glare finish. Pictograms shall contrast with their field with either a light pictogram on a dark field or a dark pictogram on a light field.

2. Text Descriptors: Pictograms shall have text descriptors located directly below the pictogram field, and shall comply with CBC 11B-703.2, 11B-703.3 and 11B-703.4.

E. International Symbol of Accessibility (ISA): Shall comply with CBC 11B-703.7 and CBC Figure 11B-703.7.2.1. The ISA shall consist of a white figure on a blue background. The blue color shall be approximate to FS. 15090 in Federal Standard 595C.

F. Mounting Locations and Height: Signs with tactile characters shall be as indicated on the drawings and in conformance to CBC 11B-703.4.

1. Mounting Locations:

a. Identification signs for rooms and spaces shall be located on the wall adjacent to the latch side of the door, as one enters the room or space.

b. Signs that identify exits shall be located at the exit door when approached in the direction of egress travel.

c. Signs containing tactile characters shall be located so that a clear floor space 18 inches minimum by 18 inches minimum, centered on the tactile characters, is provided beyond the arc of any door swing between the closed position and 45 degree open position.

d. Where a tactile sign is provided at a door, the sign shall be located alongside the door at the latch side.

e. Where a tactile sign is provided at double doors with one active leaf, the sign shall be located at the inactive leaf.

f. Where a tactile sign is provided at double doors with two active leafs, the sign shall be located to the right of the right hand door.

g. Where there is no wall space at the latch side of a single door or at the right side of double doors, signs shall be located on the nearest adjacent wall.

2. Mounting height above finish floor or ground: Tactile characters on signs shall be located 48 inches minimum above the finish floor or ground surface, measured from the baseline of the lowest Braille cells and 60 inches maximum above the finish floor or ground surface, measured from the baseline of the highest line of raised characters.

2.04 ROOM IDENTIFICATION SIGNS

A. Room Identification Sign Types:

1. Room Identification Sign with Changeable Insert: 7 inches high by 9 inches wide, minimum, with 4 inches high by 9 inches wide window for name and title removable insert. Locate room name immediately below window, and centered above room number. Room name shall be raised characters 3/4 inches high minimum, and room number 1 inch minimum; and shall be accompanied with Braille indicators.

2. Room Identification Sign with Room Name and Room Number: 7 inches high by 9 inches wide, minimum. Room name shall be raised characters 3/4 inches high minimum, and room number 1 inch minimum; and shall be accompanied with Braille indicators.

3. Room Number Sign: 7 inches wide by 4 inches high; room number, 1 inch high minimum, raised character, accompanied by Braille indicator immediately bellow.

B. Room Identification Sign Requirements:

1. Finish and Contrast: Refer to paragraph 2.03.B.

2. Raised Characters and Proportions: Refer to paragraph 2.03.A.

3. Braille: Refer to paragraph 2.03.C.

4. Mounting Location and Height: Refer to paragraph 2.03.F.

2.05 RESTROOM SIGNAGE

A. Multiple-Occupancy restrooms shall be provided with geometric symbols and wall mounted pictograms with text descriptors.

B. Geometric Symbols:

1. Doorways leading to toilet rooms shall be identified by a geometric symbol complying with CBC Section 11B-703.7.2.6.

2. Male Restroom Door Symbol: 1/4 inch thick equilateral triangle with edges 12 inches long, with vertex pointing upward, the triangle symbol shall contrast with the door, either light on a dark background or dark on a light background. A male silhouette shall appear within the equilateral triangle in contrasting color to it.

3. Female Restroom Door Sign: 1/4 inch thick circle 12-inch diameter, the circle symbol shall contrast with the door, either light on a dark background or dark on a light background. A female silhouette shall appear within the circle in contrasting color to it.

4. "All Gender" Restroom Door Sign (Single occupancy restrooms): 1/4 inch thick circle, 12-inch diameter with a 1/4 inch thick equilateral triangle with the vertex pointing upward superimposed on the circle and within the 12-inch diameter. Triangle and circle shall be of contrasting colors; the circle symbol shall contrast with the door. A female and male silhouettes shall appear within the equilateral triangle in contrasting color to it, and the word "restroom" shall appear on the bottom part of the circle in contrasting color to it.

5. Edges and Vertices on Geometric Symbols: Shall be eased or rounded at 1/16 inch minimum, or chamfered at 1/8 inch maximum. Vertices shall be radiused between 1/8 minimum and ¼ inch maximum.

6. Location and Mounting Height: Symbols shall be mounted at 58 inches minimum and 60 inches maximum above the finish floor or ground surface measured from the centerline of the symbol. Where a door is provided the symbol shall be mounted within one inch of the vertical centerline of the door.

    a. At locations with no restroom doors, locate sign adjacent to the opening. Tactile room name accompanied by Braille shall be located on symbol sign.

C. Room Identification for Multiple-Occupancy Restrooms: Provide a 16 inch long by 6 inch tall room identification sign, including a pictogram of the International Symbol of Accessibility on a side. Restroom names shall be "Girls" or "Boys", for students, and "Women" and "Men" for staff. Characters, Braille, pictograms and mounting locations and height shall be in conformance to Article 2.03.

D. Room Identification for Single-Occupancy Restrooms: Provide a 16 inch long by 6 inch tall room identification sign, including a pictogram of the International Symbol of Accessibility on a side. Text descriptor shall be "All Gender Restroom". Characters, Braille, pictograms and mounting locations and height shall be in conformance to Article 2.03.

E. Room Identification for Non-Accessible Single-Occupancy Restrooms: Provide an 8 inch long by 3 inch tall room identification sign. Text descriptor shall be "All Gender Restroom". Characters, Braille, and mounting locations and height shall be in conformance to Article 2.03.

2.06 RAISED CHARACTER AND BRAILLE EXIT SIGNS

A. Tactile Exit Sign Types:

1. "EXIT".
2. "EXIT STAIR DOWN".
3. "EXIT RAMP DOWN".
4. "EXIT STAIR UP".
5. "EXIT RAMP UP".
6. "EXIT ROUTE".
7. "TO EXIT".
8. "EXIT WITH ALARM", on exit doors with an alarm.
9. "EXIT ONLY" or "EXIT STAIR ONLY", on exit doors and stair exit doors which lock from outside and does not allow a return.

B. Sign Requirements:

1. Finish and Contrast: Refer to paragraph 2.03.B.
2. Raised Characters and Proportions: Refer to paragraph 2.03.A.
3. Braille: Refer to paragraph 2.03.C.
4. Mounting Location and Height: Refer to paragraph 2.03.F.

2.07 STAIRWAY IDENTIFICATION SIGNS

A. Provide floor identification signs at the landing of each floor level in interior exit stairway connecting more than three stories, designating the floor level, the terminus of the top and bottom of the interior exit stairway and the identification of the stair.

1. Mount signs 5 feet above each floor landing in a position that is readily visible when doors are in the open and closed positions.
2. Sign size shall be a minimum of 18 by 12-inch.
3. The letters designating the identification of the stair, such as "STAIR No. 1", shall be placed at the top of the sign in 1 ½-inches minimum in height block lettering with 1/4 inch strokes.
4. Upper terminus, such as "ROOF ACCESS" or "NO ROOF ACCESS", shall be placed under the stairway identification in 1 inch high block lettering with 1/4 inch strokes.

5. The number designating the floor level shall be a minimum of 5 inches in height with 3/4 inch strokes and located in the center of the sign.

   a. Mezzanine levels shall be identified by letter "M" preceding the floor number.

   b. Basement levels shall be identified by letter "B" preceding the floor number.

6. All other lettering and numbers shall be a minimum of one inch in height.

7. Lower and upper terminus of the stairway shall be placed at the bottom of the sign in 1 inch high block lettering with 1/4 inch strokes.

8. Characters and their background shall have a non-glare finish. Characters shall contrast with their background, with either light characters on a dark background or dark characters on a light background.

B. Tactile Floor Designation Sign in Stairways: Shall be located at the landing of each floor level, placed adjacent to the door on the latch side, to identify the floor level. At the exit discharge level, the sign shall include a raised five-pointed star located to the left of the identifying floor level. The outside diameter of the star shall be the same as the height of the raised characters.

1. Finish and Contrast: Refer to paragraph 2.03.B.

2. Raised Characters and Proportions: Refer to paragraph 2.03.A.

3. Braille: Refer to paragraph 2.03.C.

2.08 SIGNS FOR AREAS OF REFUGE AND EXTERIOR AREA FOR ASSISTED RESCUE

A. Doors providing access to an area of refuge shall be identified by a sign stating "AREA OF REFUGE". Sign shall have visual characters per paragraph 2.03.B, Braille per 2.03.C and the International Symbol of Accessibility per 2.03.E.

B. Doors providing access to an exterior area for assisted rescue shall be identified by a sign stating "EXTERIOR AREA FOR ASSISTED RESCUE". Sign shall have visual characters per paragraph 2.03.B, Braille per 2.03.C and the International Symbol of Accessibility per 2.03.E.

C. Sign Instructions: In Areas of Refuge and Exterior Areas for Assisted Rescue provide instructions on the use of the area under emergency conditions. The sign shall include the following, and shall comply with 2.03.B:

1. Persons able to use the exit stairway do so as soon as possible, unless they are assisting others.

2. Information on planned availability of assistance in the use of stairs or supervised operation of elevators and how to summon such assistance.

3. Directions for use of the two-way communications system where provided.

2.09 DIRECTIONAL EXIT SIGNAGE

A. At exits serving a required accessible space but not providing an approved accessible means of egress, at elevator landings and within areas of refuge, provide signage indicating the location of accessible means of egress.

1. Finish and Contrast: Refer to paragraph 2.03.B.

2. Character Height and Proportions: Refer to paragraph 2.03.B.

3. Symbol of Accessibility: Refer to paragraph 2.03.E.

2.10 ASSISTIVE LISTENING DEVICE SIGN

A. Include International Symbol of Access for Hearing Loss, CBC Figure 11B-703.7.2.4, with text “Assistive-Listening System Available”. Use upper and lower case characters. Sign shall comply with the following requirements:

1. Finish and Contrast: Refer to paragraph 2.03.B.

2. Character Height and Proportions: Refer to paragraph 2.03.B.

3. Symbol of Accessibility: Refer to paragraph 2.03.E.

2.11 DESIGNATED AISLE SEAT

A. Designated Aisle Seat: Each designated aisle seat shall be identified by a sign with the International Symbol of Accessibility per paragraph 2.03.E. Additionally, post visual signage at the ticket office, or where indicated on drawings, indicating availability of seats for disabled persons. Visual sign shall be per paragraph 2.03.B.

2.12 PUBLIC TELEPHONE WITH VOLUME CONTROL SIGN

A. Sign shall contain a depiction of a telephone handset with radiating sound waves. Symbol shall be white on a blue background. The blue shall be equal to Color No. 15090 in Federal Standard 595B. Symbol shall comply with CBC Figure 11B-703.7.2.3.

2.13 ACCESSIBILITY ENTRANCE SIGNS AND PATH OF TRAVEL DIRECTIONAL SIGNS

A. Entrance Sign: Provide at each building entrance an International Symbol of Accessibility sign. Signs shall be visible to persons along approaching pedestrian ways.

B. Directional Signs: Provide where indicated on the drawings with arrow indicators and International Symbol of Accessibility.

C. Signs shall be mounted on wall with lower edge between 48 inches and 60 inches above ground surface or finish floor. Pole mounted, overhead and projecting signs shall have the lower edge at least 80 inches from the ground surface or finish floor.

D. Sign shall comply with the following requirements.

1. Directional Signs: Refer to paragraph 2.03.B.

2. Symbol of Accessibility: Refer to paragraph 2.03.E.

E. No Smoking Sign: Provide at each building entrance. Reverse cut white vinyl sign with 4 1/2-inch high no smoking symbol, mounted on glass entry doors. Under No Smoking symbol, place words “No Smoking”, ½ inch high minimum, San Serif upper and lower case characters.

2.14 PARKING SIGNS

A. Tow-Away Sign: 18 inches by 24 inches with rounded corners. Black graphics on white background, with lettering not less than 1 inch high. Sign to read: “UNAUTHORIZED VEHICLES PARKED IN DESIGNATED ACCESSIBLE SPACES NOT DISPLAYING DISTINGUISHING PLACARDS OR SPECIAL LICENSE PLATES ISSUED FOR PERSONS WITH DISABILITIES WILL BE TOWED AWAY AT THE OWNER’S EXPENSE. TOWED VEHICLES MAY BE RECLAIMED AT [Insert location] OR BY TELEPHONING (213) 625-6631“.

B. Parking Space Identification Sign: 12-inch by 18-inch with rounded corners. White reflectorized graphic on dark blue background, and shall display an 8-inch high International Symbol of Accessibility per paragraph 2.03.E.

1. Additional language or an additional sign below the International Symbol of Accessibility shall state I “Minimum Fine $250”.

2. Signs identifying van accessible parking spaces shall contain additional language or an additional sign with the designation “Van Accessible”.

C. Signs shall be mounted on posts at head of each accessible parking with lower edge 80 inches minimum above ground surface, or mounted on walls at a minimum height of 60 inches from ground surface.

D. Headroom Signs: On parking structures provide signs indicating headroom clearance height at entries and at any point of a vehicular path where entry clearance height is reduced. Minimum character height shall be 3 inches.

2.15 OCCUPANT LOAD SIGNS

A. Provide maximum occupancy load signs. Post in a conspicuous place near the main exit or exit access doorway from the room or space of rooms and areas indicated in the drawings.

B. Minimum size: 4 inches high by 8 inches wide, 7/8 inch high letters, 1 inch high numerals.

C. Sign to read: “MAXIMUM OCCUPANCY LOAD XXX”. Indicate occupant load shown on drawings.

2.16 EMERGENCY GAS SHUT OFF SIGN

A. Exterior Signs: Painted aluminum, suitable for outdoor use, with pre-drilled mounting holes.

1. Sign Size: Minimum 4 inches high by 8 inches wide.

2. Color: Subsurface white text, red background.

3. Character Height: One inch high.

4. Text:

a. Site main gas shut off valve(s): “MAIN SITE EMERGENCY GAS SHUT-OFF VALVE”.

b. Building gas shut-off valve(s): “BUILDING EMERGENCY GAS SHUT-OFF VALVE.”

2.19 EMERGENCY EGRESS WINDOW SIGN

A. Provide upper and lower emergency egress windows as follows:

1. Lower Sign: Signs shall be mounted on the wall centered with the emergency egress window and with the bottom edge located between 6 and 8 inches from the floor.

2. Upper Signs: Signs shall be mounted on the wall within 4 inches of the window frame with the lower edge between 60 inches and 72 inches above ground surface or finish floor.

B. Text: Text shall state “EMERGENCY EGRESS WINDOW”.

C. Sign shall comply with the following requirements:

1. Sign Size: Four inches by six inches.

2. Color: Subsurface white text, red background.

3. Character Height: one inch.

2.21 OWNER FURNISHED / CONTRACTOR INSTALLED SIGNS

A. Locate at the main entry and at pedestrian and vehicular entrances to the school site.

1. Welcome to Our School Sign: Sign size is 24 inches by 36 inches.

2. Safe School Zone Sign: Sign size is 18 inches by 24 inches.

2.22 2.24 FACILITY NAME AND ADDRESS SIGN

A. Sign, indicating school name and address, shall be furnished with cast aluminum letters as manufactured by Andco Industries Corp., or equal.

B. Style: Helvetica Medium, Futura 444, Ribbon 555, 556 or 557 as selected.

C. Material: 0.064 inch aluminum construction, unless indicated otherwise.

D. Letter Size: Facility name shall be 10 inches high and address shall be 4 inches high, unless indicated otherwise.

E. Letter Copy and Design: As indicated on Drawings.

F. Finish: Finish shall be type H anodic clear or black, as selected by ARCHITECT.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that surfaces are ready to receive work.

B. Beginning of installation means installer accepts condition of existing surfaces.

3.02 METHODS OF INSTALLATION

A. Interior Identification Signs and Interior Directional Signs:

1. Fasten to wall with four tamper-proof round-head screws, one at each corner of sign. Furnish plastic anchors.

2. When concealed installation is specified, install backplate to wall as above. Fasten sign to backplate with very high-bond double-faced tape.

3. For installation on glass, fasten sign to glass with very high bond double faced tape. On opposite side of glass, anchor matching backplate to glass with very high-bond double-faced tape.

B. Geometric Signs: Geometric toilet room signs shall be fastened to doors with three tamper-proof oval-head counter-sunk screws.

C. Exterior Post Mounted Directional Signs: Size of required footing shall be as indicated on the drawings. Fasten sign with tamperproof stainless steel bolts.

D. Exterior Wall Mounted Identification Signs and Directional Signs:

1. Aluminum signs: Fasten to wall with 4 tamper-proof round-head screws, one at each corner of sign. Furnish plastic anchors.

a. Cement Plaster, Brick, or Masonry: Provide plastic anchors. For signs greater than 640 square inches use Leadwood Screw Anchors, concrete fasteners 1WSA 10112, or equal.

b. Chain Link Fence: Fasten with 9 gage hog rings, King Hughes Fasteners 5150DG50, or equal, with 11/16 inch opening at each corner of sign.

c. Wrought Iron Fence: Install at each corner with 3/16 inch stainless steel rivets.

2. Acrylic signs: Install backplate to wall as indicated above. Fasten sign to backplate with high-bond double-faced tape and silicone.

E. Exterior Building Sign:

1. Each letter shall be furnished with a minimum of three cast mounting lugs on backside, drilled and tapped to receive installation bolts.

2. Letters shall be installed according to manufacturer's method PMC-1. Letters shall be installed ¾ inch away from wall surface, by an aluminum sleeve spacer.

3.03 CLEANUP

A. Remove rubbish, debris, and waste materials and legally dispose of off Project site.

3.04 PROTECTION

A. Protect Work of this section until Substantial Completion.

END OF SECTION

SECTION 26 05 19
LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes building wire and cable; service entrance cable; metal clad cable; and wiring connectors and connections.

1.2 REFERENCES

A. International Electrical Testing Association:

1. NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.

B. National Fire Protection Association:

1. NFPA 70 - National Electrical Code with California Amendments.
2. NFPA 262 - Standard Method of Test for Flame Travel and Smoke of Wires and Cables for Use in Air-Handling Spaces.

C. Underwriters Laboratories, Inc.:

1. UL 1277 - Standard for Safety for Electrical Power and Control Tray Cables with Optional Optical-Fiber Members.

1.3 SYSTEM DESCRIPTION

A. Product Requirements: Provide products as follows:

1. Solid conductor for feeders and branch circuits 10 AWG and smaller.
2. Stranded conductors for control circuits.
3. Conductor not smaller than 12 AWG for power and lighting circuits.
4. Conductor not smaller than 14 AWG for control circuits.
5. Increase wire size in branch circuits to limit voltage drop to a maximum of 3 percent.
6. 10 AWG conductors for 20 ampere or larger as designated on plans for 120 volt branch circuit home runs longer than 75 feet.

B. Wiring Methods: Provide the following wiring methods:

1. Concealed Dry Interior Locations: Use only building wire, Type THHN/THWN-2 insulation, in raceway.
2. Exposed Dry Interior Locations: Use only building wire, Type THHN/THWN-2 insulation, in raceway.
3. Above Accessible Ceilings: Use only building wire, Type THHN/THWN-2 insulation, in raceway.

4. Wet or Damp Interior Locations: Use only building wire, Type THHN/THWN-2 insulation, in raceway.
5. Exterior Locations: Use only building wire, Type XHHW-2 insulation, in raceway.
6. Underground Locations: Use only building wire, Type XHHW-2 insulation, in raceway.
7. Metal clad cable can be utilized at concealed dry interior locations and above accessible ceilings.

1.4 DESIGN REQUIREMENTS

A. Conductor sizes are based on copper unless indicated as aluminum or "AL".

B. When aluminum conductor is substituted for copper conductor, size to match circuit requirements, terminations, conductor ampacity and voltage drop. Contractor shall be responsible for verifying maximum number of aluminum conductors for substituted copper conductors in specified conduit.

1.5 SUBMITTALS

A. Product Data: Submit for building wire and each cable assembly type.

B. Design Data: Indicate voltage drop and ampacity calculations for aluminum conductors substituted for copper conductors.

C. Test Reports: Indicate procedures and values obtained.

1.6 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations of components and circuits.

1.7 QUALITY ASSURANCE

A. Provide wiring materials located in plenums with peak optical density not greater than 0.5, average optical density not greater than 0.15, and flame spread not greater than 5 feet when tested in accordance with NFPA 262.

B. Perform Work in accordance with State, Municipality, Highways, and Public Work's standard.

C. Maintain one copy of each document on site.

1.8 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

1.9 FIELD MEASUREMENTS

A. Verify field measurements are as indicated on Drawings.

1.10 COORDINATION

A. Where wire and cable destination is indicated and routing is not shown, determine routing and lengths required.

B. Wire and cable routing indicated is approximate unless dimensioned.

C. Determine required separation between wire, cable and other work. Determine cable routing to avoid interference with other work.

PART 2 - PRODUCTS

2.1 BUILDING WIRE

A. Product Description: Single conductor insulated wire.

B. Conductor: Copper.

C. Insulation Voltage Rating: 600 volts.

D. Insulation Temperature Rating: 75 or 90 degrees C.

E. Insulation Material: Thermoplastic.

2.2 SERVICE ENTRANCE CABLE

A. Conductor: Copper.

B. Insulation Voltage Rating: 600 volts.

C. Insulation: Type SE.

2.3 METAL CLAD CABLE

A. Conductor: Copper.

B. Health Care Facility (HCF) rated.

C. Insulation Voltage Rating: 600 volts.

D. Insulation Temperature Rating: 90 degrees C.

E. Insulation Material: Thermoplastic.

F. Full-sized equipment grounding/bonding conductor.

G. Interlocked Armor: The interlocking metal tape armor shall be aluminum and shall be green.

H. Aluminum interlocking metal tape shall be formed and helically wrapped around the cable assembly such that the interlocked armor and aluminum grounding/bonding conductor are in intimate contact throughout the entire cable.

I. Interlocked armor shall be listed as being suitable for grounding.

2.4 PLASTIC TAPE:

A. Black 7 mil thick general purpose electrical tape, Scotch 33 plus or equal.

2.5 INSULATING RESIN:

A. Use two part liquid epoxy resin with resin and catalyst in premeasured, sealed mixing pouch. Scotchcast 4 or equivalent.

2.6 REDUCING ADAPTERS:

A. Burndy, Thomas and Betts or approved equal.

2.7 TERMINATIONS

A. Terminal Lugs for Wires 6 AWG and Smaller: Solderless, compression type copper.

B. Lugs for Wires 4 AWG and Larger: Color keyed, compression type copper, with insulating sealing collars.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify interior of building has been protected from weather.

B. Verify mechanical work likely to damage wire and cable has been completed.

C. Verify raceway installation is complete and supported.

3.2 PREPARATION

A. Completely and thoroughly swab raceway before installing wire.

3.3 EXISTING WORK

A. Remove exposed abandoned wire and cable, including abandoned wire and cable above accessible ceiling finishes. Patch surfaces where removed cables pass through building finishes.

B. Disconnect abandoned circuits and remove circuit wire and cable. Remove abandoned boxes when wire and cable servicing boxes is abandoned and removed. Install blank cover for abandoned boxes not removed.

C. Provide access to existing wiring connections remaining active and requiring access. Modify installation or install access panel.

D. Extend existing circuits using materials and methods as specified.

E. Clean and repair existing wire and cable remaining or wire and cable to be reinstalled.

3.4 INSTALLATION

A. Route wire and cable to meet Project conditions.

1. Wire and cable routing indicated is approximate unless dimensioned.
2. Where wire and cable destination is indicated and routing is not shown, determine exact routing and lengths required.
3. Include wire and cable of lengths required to install connected devices within 10 ft. of location shown.

B. Neatly train and lace wiring inside boxes, equipment, and panelboards.

C. Identify and color code wire and cable. Identify each conductor with its circuit number or other designation indicated.

D. Special Techniques--Building Wire in Raceway:

1. Pull conductors into raceway at same time.
2. Install building wire 4 AWG and larger with pulling equipment.

E. Special Techniques - Cable:

1. Protect exposed cable from damage.
2. Support cables above accessible ceiling, using spring metal clips to support cables from structure. Do not rest cable on ceiling panels.
3. Use suitable cable fittings and connectors.

F. Special Techniques - Wiring Connections:

1. Clean conductor surfaces before installing lugs and connectors.
2. Make splices, taps, and terminations to carry full ampacity of conductors with no perceptible temperature rise.
3. Tape uninsulated conductors and connectors with electrical tape to 150 percent of insulation rating of conductor.
4. Install split bolt connectors for copper conductor splices and taps, 6 AWG and larger.
5. Install solderless pressure connectors with insulating covers for copper conductor splices and taps, 8 AWG and smaller.

6. Install insulated spring wire connectors with plastic caps for copper conductor splices and taps, 10 AWG and smaller.
7. Terminate aluminum conductors with tin-plated, aluminum-bodied compression connectors only. Fill with anti-oxidant compound before installing conductor.
8. Install suitable reducing connectors or mechanical connector adaptors for connecting aluminum conductors to copper conductors.
9. Encapsulate below grade splices at outlet, pull and junction boxes with specified insulating resin kits. Make all splices watertight.
10. Install waterproof wire connectors with plastic caps for copper conductor splices and taps, 10 AWG and smaller in outdoor or wet locations.
11. Where oversized cables are used to accommodate voltage drop, whether a single or parallel feeder, provide appropriate reducing adapter and conductors for termination.

G. Install stranded conductors for branch circuits 10 AWG and smaller. Install crimp on fork terminals for device terminations. Do not place bare stranded conductors directly under screws.

H. Install terminal lugs on ends of 600 volt wires unless lugs are furnished on connected device, such as circuit breakers.

I. Size lugs in accordance with manufacturer's recommendations terminating wire sizes. Install 2-hole type lugs to connect wires 4 AWG and larger to copper bus bars.

J. For terminal lugs fastened together such as on motors, transformers, and other apparatus, or when space between studs is small enough that lugs can turn and touch each other, insulate for dielectric strength of 2-1/2 times normal potential of circuit.

3.5 WIRE COLOR

A. General:

1. For wire sizes 10 AWG and smaller, install wire colors in accordance with the following:
   a. Black and red for single phase circuits at 120/240 volts.
   b. Black, red, and blue for circuits at 120/208 volts single or three phase.
   c. Orange, brown, and yellow for circuits at 277/480 volts single or three phase.

2. For wire sizes 8 AWG and larger, identify wire with colored tape at terminals, splices and boxes. Colors are as follows:
   a. Black and red for single phase circuits at 120/240 volts.
   b. Black, red, and blue for circuits at 120/208 volts single or three phase.
   c. Orange, brown, and yellow for circuits at 277/480 volts single or three phase.

B. Neutral Conductors: White. When two or more neutrals are located in one conduit, individually identify each with proper circuit number.

C. Branch Circuit Conductors: Install three or four wire home runs with each phase uniquely color coded.

D. Feeder Circuit Conductors: Uniquely color code each phase.

E. Ground Conductors:

1. For 6 AWG and smaller: Green.
2. For 4 AWG and larger: Identify with green tape at both ends and visible points including junction boxes.

3.6 FIELD QUALITY CONTROL

A. Inspect and test in accordance with NETA ATS, except Section 4.

B. Perform inspections and tests listed in NETA ATS, Section 7.3.1.

C.

END OF SECTION

SECTION 26 05 26
GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Rod electrodes.
2. Wire.
3. Grounding well components.
4. Mechanical connectors.
5. Exothermic connections.

1.2 REFERENCES

A. Institute of Electrical and Electronics Engineers:

1. IEEE 142 - Recommended Practice for Grounding of Industrial and Commercial Power Systems.
2. IEEE 1100 - Recommended Practice for Powering and Grounding Electronic Equipment.

B. International Electrical Testing Association:

1. NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.

C. National Fire Protection Association:

1. NFPA 70 - National Electrical Code, with California Amendments.
2. NFPA 99 - Standard for Health Care Facilities.

1.3 SYSTEM DESCRIPTION

A. Grounding systems use the following elements as grounding electrodes:

1. Metal underground water pipe.
2. Metal building frame.
3. Concrete-encased electrode.
4. Ground ring.
5. Rod electrode.
6. Plate electrode.

1.4 PERFORMANCE REQUIREMENTS

A. Grounding System Resistance: 25 ohms maximum.

1.5 SUBMITTALS

A. Product Data: Submit data on grounding electrodes and connections.

B. Test Reports: Indicate overall resistance to ground and resistance of each electrode.

1.6 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations of components and grounding electrodes.

1.7 QUALITY ASSURANCE

A. Provide grounding materials conforming to requirements of NEC, IEEE 142, and UL labeled.

B. Perform Work in accordance with State, Municipality, Highways, and Public Work's standard.

C. Maintain one copy of each document on site.

1.8 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three years documented experience.

B. Installer: Company specializing in performing work of this section with minimum 3 years documented experience.

1.9 PRE-INSTALLATION MEETINGS

A. Convene minimum one week prior to commencing work of this section.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site in original factory packaging, labeled with manufacturer's identification.

B. Protect from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original packaging.

C. Do not deliver items to project before time of installation. Limit shipment of bulk and multiple-use materials to quantities needed for immediate installation.

1.11 COORDINATION

A. Complete grounding and bonding of building reinforcing steel prior concrete placement.

PART 2 - PRODUCTS

2.1 ROD ELECTRODES

A. Product Description:

1. Material: Copper.
2. Diameter: 0.75 inch.
3. Length: 10 feet.

B. Connector: Connector for exothermic welded connection.

2.2 WIRE

A. Material: Stranded copper.

B. Foundation Electrodes: 4/0 AWG or as indicated on drawings.

C. Grounding Electrode Conductor: Copper conductor insulated.

D. Bonding Conductor: Copper conductor insulated.

2.3 GROUNDING WELL COMPONENTS

A. Well Pipe: 8 inches by 24 inches long concrete pipe with belled end.

B. Well Cover: Cast iron with legend "GROUND" embossed on cover.

2.4 MECHANICAL CONNECTORS

A. Description: Bronze connectors, suitable for grounding and bonding applications, in configurations required for particular installation.

2.5 EXOTHERMIC CONNECTIONS

A. Product Description: Exothermic materials, accessories, and tools for preparing and making permanent field connections between grounding system components.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify final backfill and compaction has been completed before driving rod electrodes.

3.2 PREPARATION

A. Remove paint, rust, mill oils, surface contaminants at connection points.

3.3 EXISTING WORK

A. Modify existing grounding system to maintain continuity to accommodate renovations.

B. Extend existing grounding system using materials and methods as specified.

3.4 INSTALLATION

A. Install in accordance with IEEE 142 and 1100.

B. Install rod electrodes at locations as indicated on Drawings. Install additional rod electrodes to achieve specified resistance to ground.

C. Install grounding and bonding conductors concealed from view.

D. Install grounding well pipe with cover at each rod location. Install well pipe top flush with finished grade.

E. Install 4/0 AWG bare copper wire in foundation footing or as indicated on Drawings.

F. Bond together metal siding not attached to grounded structure; bond to ground.

G. Bond together reinforcing steel and metal accessories in pool and fountain structures.

H. Install ground grid under access floors. Construct grid of 4 AWG bare copper wire installed on 24 inch centers both ways. Bond each access floor pedestal to grid.

I. Bond together each metallic raceway, pipe, duct and other metal object entering space under access floors. Bond to underfloor ground grid. Install 2 AWG bare copper bonding conductor.

J. Install grounding and bonding in patient care areas to meet requirements of NFPA 99.

K. Equipment Grounding Conductor: Install separate, insulated conductor within each feeder and branch circuit raceway. Terminate each end on suitable lug, bus, or bushing.

L. Connect to site grounding system.

M. Bond to lightning protection system.

N. Install continuous grounding using underground cold water system and building steel as grounding electrode. Where water piping is not available, install artificial station ground by means of driven rods or buried electrodes.

O. Permanently ground entire light and power system in accordance with NEC, including service equipment, distribution panels, lighting panelboards, switch and starter enclosures, motor frames, grounding type receptacles, and other exposed non-current carrying metal parts of electrical equipment.

P. Install branch circuits feeding isolated ground receptacles with separate insulated grounding conductor, connected only at isolated ground receptacle, ground terminals, and at ground bus of serving panel.

Q. Accomplish grounding of electrical system by using insulated grounding conductor installed with feeders and branch circuit conductors in conduits. Size grounding conductors in accordance with NEC. Install from grounding bus of serving panel to ground bus of served panel, grounding screw of receptacles, lighting fixture housing, light switch outlet boxes or metal enclosures of service equipment. Ground conduits by means of grounding bushings on terminations at panelboards with installed number 12 conductor to grounding bus.

R. Grounding electrical system using continuous metal raceway system enclosing circuit conductors in accordance with NEC.

S. Permanently attach equipment and grounding conductors prior to energizing equipment.

3.5 FIELD QUALITY CONTROL

A. Inspect and test in accordance with NETA ATS, except Section 4.

B. Grounding and Bonding: Perform inspections and tests listed in NETA ATS, Section 7.13.

C. Perform ground resistance testing in accordance with IEEE 142.

D. Perform leakage current tests in accordance with NFPA 99.

E. Perform continuity testing in accordance with IEEE 142.

F. When improper grounding is found on receptacles, check receptacles in entire project and correct. Perform retest.

3.6 INDEPENDENT TESTING ORGANIZATION AND PERSONNEL

A. Obtain the services of an independent third-party testing organization to perform electrical tests.

B. Independent testing organization and personnel shall meet the requirements of NETA ATS 3.1 and 3.2.

C. Provide written test results and a final report of electrical tests per NETA ATS 5.4 to Engineer.

END OF SECTION

SECTION 26 05 29
HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Conduit supports.
2. Formed steel channel.
3. Spring steel clips.
4. Sleeves.
5. Mechanical sleeve seals.
6. Firestopping relating to electrical work.
7. Firestopping accessories.
8. Equipment bases and supports.

1.2 REFERENCES

A. ASTM International:

1. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
2. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials.
3. ASTM E814 - Standard Test Method for Fire Tests of Through-Penetration Fire Stops.
4. ASTM E1966 - Standard Test Method for Fire-Resistive Joint Systems.

B. FM Global:

1. FM - Approval Guide, A Guide to Equipment, Materials & Services Approved by Factory Mutual Research for Property Conservation.

C. National Fire Protection Association:

1. NFPA 70 - National Electrical Code with California Amendments.

D. Underwriters Laboratories Inc.:

1. UL 263 - Fire Tests of Building Construction and Materials.
2. UL 723 - Tests for Surface Burning Characteristics of Building Materials.
3. UL 1479 - Fire Tests of Through-Penetration Firestops.
4. UL 2079 - Tests for Fire Resistance of Building Joint Systems.
5. UL - Fire Resistance Directory.

1.3 DEFINITIONS

A. Firestopping (Through-Penetration Protection System): Sealing or stuffing material or assembly placed in spaces between and penetrations through building materials to arrest movement of fire, smoke, heat, and hot gases through fire rated construction.

1.4 SYSTEM DESCRIPTION

A. Firestopping Materials: ASTM E119, ASTM E814, UL 263, UL 1479, to achieve fire ratings of adjacent construction in accordance with FM and UL Design Numbers noted on Drawings.

B. Firestop interruptions to fire rated assemblies, materials, and components.

1.5 PERFORMANCE REQUIREMENTS

A. Firestopping: Conform to applicable code, FM, and UL for fire resistance ratings and surface burning characteristics.

B. Firestopping: Provide certificate of compliance from authority having jurisdiction indicating approval of materials used.

1.6 SUBMITTALS

A. Shop Drawings: Indicate system layout with location and detail of trapeze hangers.

B. Product Data:

1. Hangers and Supports: Submit manufacturers catalog data including load capacity.
2. Firestopping: Submit data on product characteristics, performance and limitation criteria.

C. Firestopping Schedule: Submit schedule of opening locations and sizes, penetrating items, and required listed design numbers to seal openings to maintain fire resistance rating of adjacent assembly.

D. Design Data: Indicate load carrying capacity of trapeze hangers and hangers and supports.

E. Submit details and calculations for support and anchors that are not specifically detailed on the Drawings where required by California Building Standards Code, California Code of Regulations, Title 24. Pre-approved systems may be used as noted below only if the pre-approval is current and accepted by the local agency having jurisdiction.

F. Where pre-approved bracing systems will be employed, submit:

1. System component brochure describing components used and detailed installation instructions.
2. Loads to be transmitted to the structure at anchor points.

G. Where pre-approved bracing systems are not used, submit details and calculations of proposed systems. Include:

1. Detailed drawings and calculations showing system to be installed, stamped by a Structural Engineer registered in the state of California.

2. Loads to be transmitted to the structure at anchor points.
3. Submit detailed routing and installation drawings of all raceway systems requiring seismic supports for review. Include attachment points, raceway sizes and methods proposed for securing and attaching.

H. Manufacturer's Installation Instructions:

1. Hangers and Supports: Submit special procedures and assembly of components.
2. Firestopping: Submit preparation and installation instructions.

I. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

J. Firestopping Engineering Judgments: For conditions not covered by UL listed designs, submit judgments by licensed professional engineer suitable for presentation to authority having jurisdiction for acceptance as meeting code fire protection requirements.

1.7 QUALITY ASSURANCE

A. Through Penetration Firestopping of Fire Rated Assemblies: UL 1479 or ASTM E814 with 0.10-inch water gage minimum positive pressure differential to achieve fire F-Ratings and temperature T-Ratings as indicated on Drawings, but not less than 1-hour.

1. Wall Penetrations: Fire F-Ratings as indicated on Drawings, but not less than 1-hour.
2. Floor and Roof Penetrations: Fire F-Ratings and temperature T-Ratings as indicated on Drawings, but not less than 1-hour.
   a. Floor Penetrations Within Wall Cavities: T-Rating is not required.

B. Through Penetration Firestopping of Non-Fire Rated Floor and Roof Assemblies: Materials to resist free passage of flame and products of combustion.

1. Noncombustible Penetrating Items: Noncombustible materials for penetrating items connecting maximum of three stories.
2. Penetrating Items: Materials approved by authorities having jurisdiction for penetrating items connecting maximum of two stories.

C. Fire Resistant Joints in Fire Rated Floor, Roof, and Wall Assemblies: ASTM E1966 or UL 2079 to achieve fire resistant rating as indicated on Drawings for assembly in which joint is installed.

D. Fire Resistant Joints Between Floor Slabs and Exterior Walls: ASTM E119 with 0.10-inch water gage minimum positive pressure differential to achieve fire resistant rating as indicated on Drawings for floor assembly.

E. Surface Burning Characteristics: Maximum 25/450 flame spread/smoke developed index when tested in accordance with ASTM E84.

F. Perform Work in accordance with State, Municipality, Highways, and Public Work's standard.

G. Maintain one copy of each document on site.

1.8 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three years documented experience.

B. Installer: Company specializing in performing work of this section with minimum 3 years documented experience.

1.9 PRE-INSTALLATION MEETINGS

A. Convene minimum one week prior to commencing work of this section.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site in original factory packaging, labeled with manufacturer's identification.

B. Protect from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original packaging.

1.11 ENVIRONMENTAL REQUIREMENTS

A. Do not apply firestopping materials when temperature of substrate material and ambient air is below 60 degrees F.

B. Maintain this minimum temperature before, during, and for minimum 3 days after installation of firestopping materials.

C. Provide ventilation in areas to receive solvent cured materials.

PART 2 - PRODUCTS

2.1 CONDUIT SUPPORTS

A. Hanger Rods: Threaded high tensile strength galvanized carbon steel with free running threads.

B. Beam Clamps: Malleable Iron, with tapered hole in base and back to accept either bolt or hanger rod. Set screw: hardened steel.

C. Conduit clamps for trapeze hangers: Galvanized steel, notched to fit trapeze with single bolt to tighten.

D. Conduit clamps - general purpose: One-hole malleable iron for surface mounted conduits.

E. Cable Ties: High strength nylon temperature rated to 185 degrees F. Self-locking.

2.2 FORMED STEEL CHANNEL

A. Product Description: Galvanized 12 gage thick steel.

2.3 SPRING STEEL CLIPS

A. Product Description: Mounting hole and screw closure.

2.4 SLEEVES

A. Sleeves for Through Non-fire Rated Floors: 18 gage thick galvanized steel.

B. Sleeves for Through Non-fire Rated Beams, Walls, Footings, and Potentially Wet Floors: Steel pipe or 18 gage thick galvanized steel.

C. Sleeves for Through Fire Rated and Fire Resistive Floors and Walls, and Fire Proofing: Prefabricated fire rated sleeves including seals, UL listed.

D. Fire-stopping Insulation: Glass fiber type, non-combustible.

2.5 MECHANICAL SLEEVE SEALS

A. Product Description: Modular mechanical type, consisting of interlocking synthetic rubber links shaped to continuously fill annular space between object and sleeve, connected with bolts and pressure plates causing rubber sealing elements to expand when tightened, providing watertight seal and electrical insulation.

2.6 FIRESTOPPING

A. Product Description: Different types of products by multiple manufacturers are acceptable as required to meet specified system description and performance requirements; provide only one type for each similar application.

1. Silicone Firestopping Elastomeric Firestopping: Single component silicone elastomeric compound and compatible silicone sealant.
2. Foam Firestopping Compounds: Single component foam compound.
3. Formulated Firestopping Compound of Incombustible Fibers: Formulated compound mixed with incombustible non-asbestos fibers.
4. Fiber Stuffing and Sealant Firestopping: Composite of mineral fiber stuffing insulation with silicone elastomer for smoke stopping.
5. Mechanical Firestopping Device with Fillers: Mechanical device with incombustible fillers and silicone elastomer, covered with sheet stainless steel jacket, joined with collars, penetration sealed with flanged stops.
6. Intumescent Firestopping: Intumescent putty compound which expands on exposure to surface heat gain.
7. Firestop Pillows: Formed mineral fiber pillows.

B. Color: Dark gray.

2.7 FIRESTOPPING ACCESSORIES

A. Primer: Type recommended by firestopping manufacturer for specific substrate surfaces and suitable for required fire ratings.

B. Dam Material: Permanent:

1. Mineral fiberboard.
2. Mineral fiber matting.
3. Sheet metal.
4. Plywood or particle board.
5. Alumina silicate fire board.

C. Installation Accessories: Provide clips, collars, fasteners, temporary stops or dams, and other devices required to position and retain materials in place.

D. General:

1. Furnish UL listed products.
2. Select products with rating not less than rating of wall or floor being penetrated.

E. Non-Rated Surfaces:

1. Stamped steel, chrome plated, hinged, split ring escutcheons or floor plates or ceiling plates for covering openings in occupied areas where conduit is exposed.
2. For exterior wall openings below grade, furnish modular mechanical type seal consisting of interlocking synthetic rubber links shaped to continuously fill annular space between conduit and cored opening or water-stop type wall sleeve.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify openings are ready to receive sleeves.

B. Verify openings are ready to receive firestopping.

3.2 PREPARATION

A. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other matter affecting bond of firestopping material.

B. Remove incompatible materials affecting bond.

C. Install backing materials to arrest liquid material leakage.

D. Obtain permission from Architect/Engineer before using powder-actuated anchors.

E. Obtain permission from Architect/Engineer before drilling or cutting structural members.

3.3 INSTALLATION - HANGERS AND SUPPORTS

A. Anchors and Fasteners:

1. Concrete Structural Elements: Provide precast inserts and expansion anchors.
2. Steel Structural Elements: Provide beam clamps, spring steel clips, steel ramset fasteners, and welded fasteners.
3. Concrete Surfaces: Provide self-drilling anchors and expansion anchors.
4. Hollow Masonry, Plaster, and Gypsum Board Partitions: Provide toggle bolts.
5. Solid Masonry Walls: Provide expansion anchors and preset inserts.
6. Sheet Metal: Provide sheet metal screws.
7. Wood Elements: Provide wood screws.

B. Inserts:

1. Install inserts for placement in concrete forms.
2. Install inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
3. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches.
4. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.
5. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut flush with top of slab.

C. Install conduit and raceway support and spacing in accordance with NEC.

D. Do not fasten supports to pipes, ducts, mechanical equipment, or conduit.

E. Install multiple conduit runs on common hangers.

F. Supports:

1. Fabricate supports from structural steel or formed steel channel. Install hexagon head bolts to present neat appearance with adequate strength and rigidity. Install spring lock washers under nuts.
2. Install surface mounted cabinets and panelboards with minimum of four anchors.
3. In wet and damp locations install steel channel supports to stand cabinets and panelboards 1 inch off wall.
4. Support vertical conduit at every floor.

3.4 INSTALLATION - FIRESTOPPING

A. Install material at fire rated construction perimeters and openings containing penetrating sleeves, piping, ductwork, conduit and other items, requiring firestopping.

B. Apply primer where recommended by manufacturer for type of firestopping material and substrate involved, and as required for compliance with required fire ratings.

C. Apply firestopping material in sufficient thickness to achieve required fire and smoke rating.

D. Place intumescent coating in sufficient coats to achieve rating required.

E. Remove dam material after firestopping material has cured.

F. Fire Rated Surface:

1. Seal opening at floor, wall, partition, ceiling, and roof as follows:
   a. Install sleeve through opening and extending beyond minimum of 1 inch on both sides of building element.
   b. Size sleeve allowing minimum of 1-inch void between sleeve and building element.
   c. Pack void with backing material.
   d. Seal ends of sleeve with UL listed fire resistive silicone compound to meet fire rating of structure penetrated.

2. Where cable tray, bus, cable bus, conduit, wireway, and trough penetrates fire rated surface, install firestopping product in accordance with manufacturer's instructions.

G. Non-Rated Surfaces:

1. Seal opening through non-fire rated wall, partition, floor, ceiling, and roof opening as follows:
   a. Install sleeve through opening and extending beyond minimum of 1 inch on both sides of building element.
   b. Size sleeve allowing minimum of 1-inch void between sleeve and building element.
   c. Install type of firestopping material recommended by manufacturer.

2. Install floor plates or ceiling plates where conduit, penetrates non-fire rated surfaces in occupied spaces. Occupied spaces include rooms with finished ceilings and where penetration occurs below finished ceiling.
3. Exterior wall openings below grade: Assemble rubber links of mechanical seal to size of conduit and tighten in place, in accordance with manufacturer's instructions.
4. Interior partitions: Seal pipe penetrations at clean rooms, laboratories, hospital spaces, computer rooms, telecommunication rooms, and data rooms. Apply sealant to both sides of penetration to completely fill annular space between sleeve and conduit.

3.5 INSTALLATION - EQUIPMENT BASES AND SUPPORTS

A. Provide housekeeping pads of concrete, minimum 3-1/2 inches thick and extending 6 inches beyond supported equipment.

B. Using templates furnished with equipment, install anchor bolts, and accessories for mounting and anchoring equipment.

C. Construct supports of formed steel channel. Brace and fasten with flanges bolted to structure.

3.6 INSTALLATION - SLEEVES

A. Exterior watertight entries: Seal with adjustable interlocking rubber links.

B. Conduit penetrations not required to be watertight: Sleeve and fill with silicon foam.

C. Set sleeves in position in forms. Provide reinforcing around sleeves.

D. Size sleeves large enough to allow for movement due to expansion and contraction. Provide for continuous insulation wrapping.

E. Extend sleeves through floors 1 inch above finished floor level. Caulk sleeves.

F. Where conduit or raceway penetrates floor, ceiling, or wall, close off space between conduit or raceway and adjacent work with fire stopping insulation and caulk airtight. Provide close fitting metal collar or escutcheon covers at both sides of penetration.

G. Install chrome plated steel escutcheons at finished surfaces.

3.7 FIELD QUALITY CONTROL

A. Inspect installed firestopping for compliance with specifications and submitted schedule.

3.8 CLEANING

A. Clean adjacent surfaces of firestopping materials.

3.9 PROTECTION OF FINISHED WORK

A. Protect adjacent surfaces from damage by material installation.

END OF SECTION

SECTION 260533
RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes conduit, surface raceways, wireways, outlet boxes, pull and junction boxes, and handholes.

1.2 REFERENCES

A. American National Standards Institute:

1. ANSI C80.1 - Rigid Steel Conduit, Zinc Coated.
2. ANSI C80.3 - Specification for Electrical Metallic Tubing, Zinc Coated.
3. ANSI C80.5 - Aluminum Rigid Conduit - (ARC).

B. National Electrical Manufacturers Association:

1. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).
2. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit and Cable Assemblies.
3. NEMA OS 1 - Sheet Steel Outlet Boxes, Device Boxes, Covers, and Box Supports.
4. NEMA OS 2 - Nonmetallic Outlet Boxes, Device Boxes, Covers, and Box Supports.
5. NEMA RN 1 - Polyvinyl Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit.
6. NEMA TC 2 - Electrical Polyvinyl Chloride (PVC) Tubing and Conduit.
7. NEMA TC 3 - PVC Fittings for Use with Rigid PVC Conduit and Tubing.

1.3 SYSTEM DESCRIPTION

A. Raceway and boxes located as indicated on Drawings, and at other locations required for splices, taps, wire pulling, equipment connections, and compliance with regulatory requirements. Raceway and boxes are shown in approximate locations unless dimensioned. Provide raceway to complete wiring system.

B. Underground More than 5 feet outside Foundation Wall: Provide thickwall nonmetallic conduit. Provide cast metal boxes or nonmetallic handhole.

C. Underground Within 5 feet from Foundation Wall: Provide thickwall nonmetallic conduit. Provide cast metal or nonmetallic boxes.

D. In Slab Above Grade: Not permitted.

E. Below Slab on Grade: Use thickwall nonmetallic conduit. Terminate with coated rigid steel elbows and short length of coated rigid steel conduit out of concrete.

F. Outdoor Locations, Above Grade: Provide galvanized rigid steel conduit. Provide cast metal outlet, pull, and junction boxes.

G. Wet and Damp Locations: galvanized rigid steel conduit. Provide cast metal outlet, junction, and pull boxes. Provide flush mounting outlet box in finished areas.

H. Concealed Dry Locations: Provide electrical metallic tubing. Provide sheet-metal boxes. Provide flush mounting outlet box in finished areas. Provide hinged enclosure for large pull boxes where shown on drawings.

I. Exposed Interior Dry Locations: Use rigid steel conduit or intermediate metal conduit below eight feet or where subject to damage. Use rigid steel conduit, intermediate metal conduit, or electrical metallic tubing above eight feet or in electrical, mechanical or telecommunication rooms. Use sheet-metal or cast metal boxes. Use flush mounting outlet box in finished areas. Provide hinged enclosure for large pull boxes.

1.4 DESIGN REQUIREMENTS

A. Minimum Raceway Size:

1. 0.75 inch unless otherwise specified.
2. 1 inch for Homeruns unless otherwise specified.
3. 1 inch for outside foundation line unless otherwise specified.

1.5 SUBMITTALS

A. Product Data: Submit for the following:

1. Flexible metal conduit.
2. Liquidtight flexible metal conduit.
3. Nonmetallic conduit.
4. Flexible nonmetallic conduit.
5. Raceway fittings.
6. Conduit bodies.
7. Surface raceway.
8. Wireway.
9. Pull and junction boxes.
10. Handholes.

B. Manufacturer's Installation Instructions: Submit application conditions and limitations of use stipulated by Product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, and installation of Product.

1.6 CLOSEOUT SUBMITTALS

A. Project Record Documents:

1. Record actual routing of conduits larger than 2 inches.
2. Record actual locations and mounting heights of outlet, pull, and junction boxes.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Protect conduit from corrosion and entrance of debris by storing above grade. Provide appropriate covering.

B. Protect PVC conduit from sunlight.

1.8 COORDINATION

A. Coordinate mounting heights, orientation and locations of outlets mounted above counters, benches, and backsplashes.

B. Coordinate Work of this Division and Work of other Divisions in advance of installation. Provide additional Work to overcome tight conditions at no increase in Contract Sum.

C. Coordinate installation of outlet boxes for equipment specified in other divisions.

PART 2 - PRODUCTS

2.1 METAL CONDUIT

A. Rigid Steel Conduit: ANSI C80.1.

B. Rigid Aluminum Conduit: ANSI C80.5.

C. Intermediate Metal Conduit (IMC): Rigid steel.

D. Fittings and Conduit Bodies: NEMA FB 1. Fittings shall be steel/malleable iron with threaded fittings. Use insulated metallic bushings with lug where ground connections are required. Use plastic bushing for non-bonding applications.

2.2 PVC COATED METAL CONDUIT

A. Product Description: NEMA RN 1; rigid steel conduit with external PVC coating, 40 mil thick.

B. Fittings and Conduit Bodies: NEMA FB 1; steel fittings with external PVC coating to match conduit.

2.3 FLEXIBLE METAL CONDUIT

A. Product Description: Interlocked steel construction.

B. Fittings: NEMA FB 1.

2.4 LIQUIDTIGHT FLEXIBLE METAL CONDUIT

A. Product Description: Interlocked steel construction with PVC jacket.

B. Fittings: NEMA FB 1.

2.5 ELECTRICAL METALLIC TUBING (EMT)

A. Product Description: ANSI C80.3; galvanized tubing.

B. Fittings and Conduit Bodies: NEMA FB 1; steel couplings and connectors. Box connectors shall have with insulated throat. Set screw type couplings.

2.6 NONMETALLIC CONDUIT

A. Product Description: NEMA TC 2; Schedule 40 PVC for normal power and 80 PVC for emergency power.

B. Fittings and Conduit Bodies: NEMA TC 3.

2.7 WIREWAY

A. Product Description: General purpose for indoor applications and raintight type for outdoor locations wire way.

B. Knockouts: Manufacturer's standard.

C. Cover: Hinged cover with full gaskets.

D. Connector: Flanged.

E. Fittings: Lay-in type with removable top, bottom, and side; captive screws and drip shield for outdoor.

F. Finish: Rust inhibiting primer coating with gray enamel finish.

2.8 OUTLET BOXES

A. Sheet Metal Outlet Boxes: NEMA OS 1, galvanized steel.

1. Luminaire and Equipment Supporting Boxes: Rated for weight of equipment supported; furnish 0.5-inch male fixture studs where required.
2. Boxes for shall be 1.5-inch-deep by 4-inch square minimum.
3. Boxes for telecommunications outlets shall be 2-1/8-inch-deep by 4-11/16-inch square minimum. Provide 1-gang device ring.
4. Concrete Ceiling Boxes: Concrete type.

B. Nonmetallic Outlet Boxes: NEMA OS 2.

C. Cast Boxes: NEMA FB 1, Type FD, aluminum. Furnish gasketed cover by box manufacturer. Furnish threaded hubs.

2.9 PULL AND JUNCTION BOXES

A. Sheet Metal Boxes: NEMA OS 1, galvanized steel.

B. Hinged Enclosures: As specified in Section 262716.

C. Surface Mounted Cast Metal Box: NEMA 250, Type 4X; flat-flanged, surface mounted junction box:

1. Material: Galvanized cast iron.
2. Cover: Furnish with ground flange, neoprene gasket, and stainless-steel cover screws.

D. In-Ground Cast Metal Box: NEMA 250, Type 6, outside flanged, recessed cover box for flush mounting:

1. Material: Galvanized cast iron.
2. Cover: Nonskid cover with neoprene gasket and stainless-steel cover screws.
3. Cover Legend: "ELECTRIC".

E. Concrete composite Handholes: Die-molded, concrete composite hand holes:

1. Cable Entrance: Pre-cut 6-inch x 6-inch cable entrance at center bottom of each side.
2. Extension: 12” reinforced concrete below box.
3. Cover: Concrete composite cover with nonskid finish. Covers shall be marked “ELECTRIC”, “SIGNAL”, “GROUND’ or as indicated on drawings.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify outlet locations and routing and termination locations of raceway prior to rough-in.

3.2 EXISTING WORK

A. Remove exposed abandoned raceway, including abandoned raceway above accessible ceiling finishes. Cut raceway flush with walls and floors, and patch surfaces.

B. Remove concealed abandoned raceway to its source.

C. Disconnect abandoned outlets and remove devices. Remove abandoned outlets when raceway is abandoned and removed. Install blank cover for abandoned outlets not removed.

D. Maintain access to existing boxes and other installations remaining active and requiring access. Modify installation or provide access panel.

E. Extend existing raceway and box installations using materials and methods [compatible with existing electrical installations, or] as specified.

F. Clean and repair existing raceway and boxes to remain or to be reinstalled.

3.3 INSTALLATION

A. Ground and bond raceway and boxes.

B. Fasten raceway and box supports to structure and finishes.

C. Identify raceway and boxes.

D. Arrange raceway and boxes to maintain headroom and present neat appearance.

3.4 INSTALLATION - RACEWAY

A. Raceway routing is shown in approximate locations unless dimensioned. Route to complete wiring system.

B. Arrange raceway supports to prevent misalignment during wiring installation.

C. Support raceway using coated steel or malleable iron straps, lay-in adjustable hangers, clevis hangers, and split hangers.

D. Group related raceway; support using conduit rack. Construct rack using steel channel and provide space on each for 25 percent additional raceways.

E. Do not support raceway with wire or perforated pipe straps. Remove wire used for temporary supports

F. Do not attach raceway to ceiling support wires or other piping systems.

G. Construct wire way supports from steel channel.

H. Route exposed raceway parallel and perpendicular to walls.

I. Route raceway installed above accessible ceilings parallel and perpendicular to walls.

J. Route conduit in and under slab from point-to-point.

K. Maintain clearance between raceway and piping for maintenance purposes.

L. Maintain 12-inch clearance between raceway and surfaces with temperatures exceeding 104 degrees F.

M. Cut conduit square using saw or pipe cutter; de-burr cut ends.

N. Bring conduit to shoulder of fittings; fasten securely.

O. Join nonmetallic conduit using cement as recommended by manufacturer. Wipe nonmetallic conduit dry and clean before joining. Apply full even coat of cement to entire area inserted in fitting. Allow joint to cure for minimum 20 minutes.

P. Install conduit hubs to fasten conduit to sheet metal boxes in damp and wet locations and to cast boxes.

Q. Install no more than equivalent of three 90-degree bends between boxes. Install conduit bodies to make sharp changes in direction, as around beams. Install factory elbows for bends in metal conduit larger than 2-inch size.

R. Avoid moisture traps; install junction box with drain fitting at low points in conduit system.

S. Install fittings to accommodate expansion and deflection where raceway crosses seismic and expansion joints.

T. Install suitable pull string or cord in each empty raceway except sleeves and nipples.

U. Install suitable caps to protect installed conduit against entrance of dirt and moisture.

V. Surface Raceway: Install flat-head screws, clips, and straps to fasten raceway channel to surfaces; mount plumb and level. Install insulating bushings and inserts at connections to outlets and corner fittings.

W. Close ends and unused openings in wire way.

3.5 INSTALLATION - BOXES

A. Adjust box location up to 10 feet prior to rough-in to accommodate intended purpose.

B. Orient boxes to accommodate wiring devices.

C. Install pull boxes and junction boxes above accessible ceilings and in unfinished areas only.

D. In Accessible Ceiling Areas: Install outlet and junction boxes no more than 6 inches from ceiling access panel or from removable recessed luminaire.

E. Locate flush mounting box in masonry wall to require cutting of masonry unit corner only. Coordinate masonry cutting to achieve neat opening.

F. Do not install flush mounting box back-to-back in walls; install with minimum 6 inches separation. Install with minimum 24 inches separation in acoustic rated walls.

G. Secure flush mounting box to interior wall and partition studs. Accurately position to allow for surface finish thickness.

H. Install stamped steel bridges to fasten flush mounting outlet box between studs.

I. Install flush mounting box without damaging wall insulation or reducing its effectiveness.

J. Install adjustable steel channel fasteners for hung ceiling outlet box.

K. Do not fasten boxes to ceiling support wires or other piping systems.

L. Support boxes independently of conduit.

M. Install gang box where more than one device is mounted together. Do not use sectional box.

N. Install gang box with plaster ring for single device outlets.

3.6 INSTALLATION CONCRETE COMPOSITE HANDHOLES

A. Install boxes flush with finished grade or surface material.

B. Provide hold down bolts for all covers.

C. Provide minimum 12” depth of crushed rock or pea gravel below boxes for drainage. Ground bond steel cover plate with insulated green grounding conductor.

3.7 INTERFACE WITH OTHER PRODUCTS

A. Install conduit to preserve fire resistance rating of partitions and other elements.

B. Route conduit through roof openings for piping and ductwork or through suitable roof jack with pitch pocket. Coordinate location with roofing installation.

C. Locate outlet boxes to allow luminaires positioned as indicated on reflected ceiling plan.

D. Align adjacent wall mounted outlet boxes for switches, thermostats, and similar devices.

3.8 ADJUSTING

A. Adjust flush-mounting outlets to make front flush with finished wall material.

B. Install knockout closures in unused openings in boxes.

3.9 CLEANING

A. Clean interior of boxes to remove dust, debris, and other material.

B. Clean exposed surfaces and restore finish.

END OF SECTION 280533

SECTION 26 05 53
IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Nameplates.
2. Labels.
3. Wire markers.
4. Conduit markers.
5. Stencils.
6. Underground Warning Tape.
7. Lockout Devices.

1.2 SUBMITTALS

A. Product Data:

1. Submit manufacturer's catalog literature for each product required.
2. Submit electrical identification schedule including list of wording, symbols, letter size, color coding, tag number, location, and function.

B. Manufacturer's Installation Instructions: Indicate installation instructions, special procedures, and installation.

1.3 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations of tagged devices; include tag numbers.

1.4 QUALITY ASSURANCE

A. Perform Work in accordance with State, Municipality, Highways, Public Work's standard.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three years documented experience.

B. Installer: Company specializing in performing Work of this section with minimum three years documented experience.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Accept identification products on site in original containers. Inspect for damage.

B. Accept materials on site in original factory packaging, labeled with manufacturer's identification, including product density and thickness.

C. Protect insulation from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original wrapping.

1.7 ENVIRONMENTAL REQUIREMENTS

A. Install labels and nameplates only when ambient temperature and humidity conditions for adhesive are within range recommended by manufacturer.

PART 2 - PRODUCTS

2.1 NAMEPLATES

A. Product Description: Laminated three-layer plastic with engraved black letters on white contrasting background color.

B. Letter Size:

1. 0.125 inch high letters for identifying individual equipment and loads.
2. 0.25 inch high letters for identifying grouped equipment and loads.

2.2 LABELS

A. Labels: Embossed adhesive tape, with 0.125 inch white letters on black background.

2.3 WIRE MARKERS

A. Description: Self-adhering, pre-printed, machine printable or write-on, self-laminating vinyl wrap around strips. Blank markers shall be inscribed using the printer or pen recommended by manufacturer for this purpose.

B. Legend:

1. Power and Lighting Circuits: Branch circuit or feeder number as indicated on Drawing
2. Control Circuits: Control wire number as indicated on shop drawings.

2.4 CONDUIT AND RACEWAY MARKERS

A. Description: Nameplate fastened with straps.

B. Color:

1. 208 Volt System: Blue lettering on white background.
2. Fire Alarm System: Red lettering on white background.

C. Legend:

1. 208 Volt System: 208 VOLTS.
2. Fire Alarm System: FIRE ALARM.

PART 3 - STENCILS

A. Stencils: With clean cut symbols and letters of following size:

1. Up to 2 inches Outside Diameter of Raceway: 0.5 inch high letters.
2. 2.5 to 6 inches Outside Diameter of Raceway: 1 inch high letters.

B. Stencil Paint: Semi-gloss enamel, colors conforming to the following:

1. Black lettering on white background.
2. White lettering on gray background.
3. Red lettering on white background.
4. Blue lettering on white background.

3.2 UNDERGROUND WARNING TAPE

A. Description: 4 inch wide plastic tape, detectable type, color yellow with suitable warning legend describing buried electrical lines.

3.3 LOCKOUT DEVICES

A. Lockout Hasps:

1. Anodized aluminum hasp with erasable label surface; size minimum 7.25 x 3 inches.

PART 4 - EXECUTION

4.1 PREPARATION

A. Degrease and clean surfaces to receive adhesive for identification materials.

4.2 EXISTING WORK

A. Install identification on existing equipment to remain in accordance with this section.

B. Install identification on unmarked existing equipment.

C. Replace lost nameplates, labels, and markers.

D. Re-stencil existing equipment.

4.3 INSTALLATION

A. Install identifying devices after completion of painting.

B. Nameplate Installation:

1. Install nameplate parallel to equipment lines.
2. Install nameplate for each electrical distribution and control equipment enclosure with corrosive-resistant mechanical fasteners, or adhesive.
3. Install nameplates for each control panel and major control components located outside panel with corrosive-resistant mechanical fasteners, or adhesive.
4. Secure nameplate to equipment front using screws.
5. Secure nameplate to inside surface of door on recessed panelboard in finished locations.
6. Install nameplates for the following:
    a. Switchboards.
    b. Switchgear.
    c. Motor Control Centers.
    d. Distribution Panelboards
    e. Panelboards.
    f. Transformers.
    g. Service Disconnects.
    h. Fused and Non-Fused Disconnects.
    i. Automatic Transfer Switches.

C. Provide color coded nameplates that present, as applicable, the following information:

1. Equipment or device designation.
2. Amperage, kVA, or horsepower rating where applicable.
3. Voltage or signal system name.
4. Source or power or control.
5. Examples:
    a. Boards: CH2A; 1000A; 277/480V, 3-Phase, 4-Wire.
    b. Feeder Power Supply for Panel “XXX” Originates at Panel “XXX”.
    c. Disconnects and Individual Motor Starters: AHU-1; 25HP; 480V, 3-Phase, 3-Wires; Served from EHD5.
    d. Available Fault Current: XX,XXX Amperes. Date Calculated: XX/XX/XX.

D. Color coding for nameplates for power systems:

1. 120/208V Normal – Blue with white letters.
2. 120/208V Emergency/Battery – Red with white letters.
3. UPS Power – Orange with black letters.

E. Color coding for nameplates for signal systems:

1. Fire alarm and life safety - Red with black letters.
2. Security - Green with white letters.
3. Clock/Intercom/Sound/MATV/CATV - Magenta with white letters.
4. Energy Management System – White with black letters.

F. Label Installation:

1. Install label parallel to equipment lines.
2. Install label for identification of individual control device stations, receptacles, and switches.
3. Install labels for permanent adhesion and seal with clear lacquer.

G. Wire Marker Installation:

1. Install wire marker for each conductor at panelboard gutters, pull boxes, outlet and junction boxes, and each load connection.
2. Mark data cabling at each end. Install additional marking at accessible locations along the cable run.
3. Install labels at data outlets identifying patch panel and port designation as indicated on Drawings.

H. Conduit Marker Installation:

1. Install conduit marker for each conduit longer than 6 feet.
2. Conduit Marker Spacing: 20 feet on center.

I. Junction Box Identification

1. Color code and identify all junction boxes located above suspended ceilings and below ceilings in non-public areas.
2. Use finish paint suitable for use on metal surfaces.
3. Boxes shall be identified with permanent felt tip marker on cover indicating panel and circuit numbers. Paint junction box covers using the color coding listed below.
   a. 208/120 Volt System: Blue.
   b. Fire Alarm System: Red.
   c. Security System: Green.
   d. Nurse Call System: Yellow

J. Underground Warning Tape Installation:

1. Install underground warning tape along length of each underground conduit, raceway, or cable 8 inches below finished grade, directly above buried conduit, raceway, or cable.

K. BRASS TAGS:

1. Provide brass tags for all feeder cables in underground vaults and pull boxes.
2. Provide brass tags for empty conduits in underground vaults, pull boxes and stubs.

L. WARNING, CAUTION AND INSTRUCTION SIGNS

1. Provide warning, caution or instruction signs where required by OSHA, where indicated, or where reasonably required to assure safe operation and maintenance of electrical systems.
   a. Install engraved plastic-laminated instruction signs with approved legend where instructions or explanations are needed for system of equipment operation
   b. Provide polyester film self-adhesive signs for indoor/outdoor equipment and door warning. Use rigid polyethylene non-adhesive signs where adhesives will not work; for example, installing on a metal fence. Provide sign color and marking that meets

OSHA regulations. For example, DANGER (red background with white letters), HIGH VOLTAGE (white with black letters.

1) Use 2 by 4 inch signs for small equipment or enclosure doors.
2) Use 7 by 10 inch or 10 by 14 inch signs for large equipment or enclosure doors.

2. Emergency Operating Signs: Install engraved laminate signs with white letters on red background with minimum 3/8 inch high lettering for emergency instructions on power transfer, load shedding, or other emergency operations.

END OF SECTION 260553

SECTION 26 05 83
WIRING CONNECTIONS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes electrical connections to equipment.

1.2 REFERENCES

A. National Electrical Manufacturers Association:

1. NEMA WD 1 - General Requirements for Wiring Devices.
2. NEMA WD 6 - Wiring Devices-Dimensional Requirements.

1.3 SUBMITTALS

A. Product Data: Submit wiring device manufacturer's catalog information showing dimensions, configurations, and construction.

B. Manufacturer's installation instructions.

1.4 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations, sizes, and configurations of equipment connections.

1.5 COORDINATION

A. Obtain and review shop drawings, product data, manufacturer's wiring diagrams, and manufacturer's instructions for equipment furnished under other sections.

B. Determine connection locations and requirements.

C. Sequence rough-in of electrical connections to coordinate with installation of equipment.

D. Sequence electrical connections to coordinate with start-up of equipment.

PART 2 - PRODUCTS

2.1 CORD AND PLUGS

A. Attachment Plug Construction: Conform to NEMA WD 1.

B. Configuration: NEMA WD 6; match receptacle configuration at outlet furnished for equipment.

C. Cord Construction: Type SO multiconductor flexible cord with identified equipment grounding conductor, suitable for use in damp locations.

D. Size: Suitable for connected load of equipment, length of cord, and rating of branch circuit over-current protection.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify equipment is ready for electrical connection, for wiring, and to be energized.

3.2 INSTALLATION

A. Make electrical connections.

B. Make conduit connections to equipment using flexible conduit. Use liquid tight flexible conduit with watertight connectors in damp or wet locations.

C. Connect heat producing equipment using wire and cable with insulation suitable for temperatures encountered.

D. Install receptacle outlet to accommodate connection with attachment plug.

E. Install cord and cap for field-supplied attachment plug.

F. Install suitable strain-relief clamps and fittings for cord connections at outlet boxes and equipment connection boxes.

G. Install disconnect switches, controllers, control stations, and control devices to complete equipment wiring requirements.

H. Install terminal block jumpers to complete equipment wiring requirements.

I. Install interconnecting conduit and wiring between devices and equipment to complete equipment wiring requirements.

J. Coolers and Freezers: Cut and seal conduit openings in freezer and cooler walls, floor, and ceilings.

3.3 ADJUSTING

A. Cooperate with utilization equipment installers and field service personnel during checkout and starting of equipment to allow testing and balancing and other startup operations. Provide personnel to operate electrical system and checkout wiring connection components and configurations.

END OF SECTION 260583

SECTION 26 09 23
AUTOMATIC LIGHTING CONTROL DEVICES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Remote control lighting relays.
2. Lighting contactors.
3. Wall mounted occupancy sensors.
4. Ceiling mounted occupancy sensors.
5. Photocells.

1.2 SYSTEM DESCRIPTION

A. Section includes sensors including multi-technology, ultrasonic, and passive infrared (PIR) technologies. This includes self-contained PIR sensors that are switch-mounted and ceiling-mounted, as well as a low voltage line, which works with a power pack and add-a-relay units.

B. Performance Requirements: Provide occupancy sensor lighting controls and power packs that have been manufactured, assembled, and installed to maintain performance criteria stated by manufacturer without defects, damage, or failure.

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's standard product data for each system component.

B. Manufacturer's Installation Instructions: Submit for each system component.

C. Shop Drawings: Indicate dimensioned drawings of lighting control system components and accessories.

1. One Line Diagram: Indicating system configuration indicating panels, number and type of switches or devices.
2. Include typical wiring diagrams for each component.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data:

1. Submit replacement parts numbers.
2. Submit manufacturer's published installation instructions and operating instructions.
3. Recommended renewal parts list.

B. Project Record Documents: Record following information:

1. Actual locations of components and record circuiting and switching arrangements.
2. Wiring diagrams reflecting field installed conditions with identified and numbered system components and devices.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum three years' experience.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Accept components on Site in manufacturer's packaging. Inspect for damage.

B. Protect components by storing in manufacturer's containers indoor protected from weather.

1.7 WARRANTY

A. Furnish five-year manufacturer's warranty for components.

** Include this section below if you are working on a Public Works project or required by client.

1.8 EXTRA MATERIALS

A. Furnish two of each power pack type.

B. Furnish two of each occupancy sensor type.

C. Furnish two of each photocell type.

PART 2 - PRODUCTS

2.1 WALL MOUNTED OCCUPANCY SENSORS

A. SINGLE SWITCH TYPE

1. Shall use microprocessor for motion signal analysis and internal, adaptive self-adjustment.
2. No manual adjustment shall be required at the time of installation or during operation.
3. Shall automatically adapt to changing room conditions—with the ability to disable adaptive features.
4. Shall save learned and adjusted settings in non-volatile memory that retains all settings during power outages.
5. Shall recognize motion detected within 20 seconds of turning off lighting as a false off. In response to a false off, the microprocessor shall increase the time-off setting.
6. Maximum adapted time-out shall not exceed 30 minutes.

7. Walk through feature shall shut off lights within 2.5 minutes after momentary occupancy.
8. Shall have a 3-position service switch: off, auto, and on.
9. Four, selectable manual timer settings shall be available from 30sec to 20min.
10. Rating: 1800W/VA @ 120V, 4000VA @ 277V, and 1/4HP @ 120VAC

B. DUAL SWITCH TYPE

1. No manual adjustment shall be required at the time of installation or during operation.
2. Shall provide switching for 2 separate banks from a single unit.
3. Shall use microprocessor for motion signal analysis and internal, adaptive self-adjustment.
4. Shall save learned and adjusted settings in non-volatile memory that retains all settings during power outages.
5. No manual adjustment shall be required at the time of installation or during operation.
6. Shall automatically adapt to changing room conditions—with the ability to disable adaptive features.
7. Maximum adapted time-out shall not exceed 30 minutes.
8. Walk through feature shall shut off lights within 2.5 minutes after momentary occupancy.
9. Shall offer two modes of operation:
10. Only one relay responds to photocell.
11. Both relays respond to photocell and lights return to the previous state on the next cycle.
12. Shall have a 3-position service switch: off, auto, and on.
13. Four, selectable manual timer settings shall be available from 30sec to 20min.
14. Ratings: Primary Relay - 800W @ 120V, 1200VA @120V, 2700VA @ 277V @ 120VAC; Secondary Relay - 800W @ 120V, 800VA @120V, 1200VA @ 277V.

2.2 CEILING MOUNTED OCCUPANCY SENSOR

A. Dual-Technology Ceiling/Upper Wall Mount

1. Shall incorporate Doppler shift ultrasonic and passive infrared motion detection technologies.
2. Shall mount on the ceiling or upper wall via supplied mounting bracket.
   a. Mounting bracket shall have a place to conceal the wiring bracket.
3. Shall be available in 180º and 360º coverage patterns.
4. Infrared lenses shall have a 360º field of view.
5. Coverage pattern: 1000 square feet minimum.
6. Shall be available in 40kHz ultrasonic frequencies.
7. Shall automatically adapt to changing room conditions—including background PIR levels and continuous airflow.
8. Sensor shall have two modes of operation:
   a. Multi-technology mode: where the sensors send infrared signal to the microprocessor, which makes the decision to turn on lighting based on the level of the signal.
   b. Single technology mode: where the user chooses technology that will turn on lighting.
9. Shall incorporate a real-time motion indicator LED, which is visible from the front of unit.
10. Shall have mask inserts for PIR rejection to prevent false tripping.
11. Low-Voltage sensors shall incorporate power/relay packs into their design, quantity specified, and location.

B. Ultrasonic Ceiling/Upper Wall Mount

1. Shall utilize Doppler shift ultrasonic detection technology.
2. Shall mount on the ceiling or upper wall via supplied mounting bracket.
   a. Mounting bracket shall have a place to conceal the wiring bracket.
3. Shall be available in 180º and 360º coverage patterns.
4. Coverage pattern: 450 square feet minimum.
5. Shall be available in 40kHz ultrasonic frequencies.
6. Shall automatically adapt to continuous airflow conditions.
7. Shall incorporate a real-time motion indicator LED, which is visible from the front of unit.
8. Operating status and setting confirmation shall be available via LED motion indicators.
9. Low-Voltage sensors shall incorporate power/relay packs into their design, quantity specified, and location.

C. Passive Infrared Ceiling/Upper Wall Mount

1. Shall incorporate passive infrared motion detection technologies.
2. Shall mount on the ceiling or upper wall via supplied mounting bracket.
   a. Mounting bracket shall have a place to conceal the wiring bracket.
3. Shall automatically adapt to changing room conditions—including background PIR levels and continuous airflow.
4. Coverage pattern: 500 square feet minimum.
5. Shall incorporate a real-time motion indicator LED, which is visible from the front of unit.
6. Shall have at least a 110° coverage pattern.
7. Low-Voltage sensors shall incorporate power/relay packs into their design, quantity specified, and location.

D. Power Pack

1. Shall be compatible with LED, incandescent, magnetic or electronic low voltage, and magnetic or electronic fluorescent, as well as motor loads.
2. Ratings: 20A LED, 20A incandescent, 20A fluorescent @ 50Hz or 60Hz. Shall utilize normally open, silver alloy dry contacts rated for a 20A-driver/ballast load at 120V, 277V.
3. Relay function shall not require more than 5-ma control current to operate.
4. Power Pack shall allow for separation of Class 1 and Class 2 wiring.
5. Power Pack Mounting Specifications
   a. Shall fit inside the driver/ballast cavity of a luminaire, and shall be qualified for installation in a driver/ballast cavity.
   b. Shall be sized to fit inside a standard, 4” x 4” junction box.
   c. Shall be mountable to a 1/2in. knockout within a driver/ballast cavity on the line voltage end, such that it may be mounted to the outside of a junction box with the line voltage wiring internal to the box and the low voltage wiring external.
   d. Shall be mountable to a 1/2in. knockout within a driver/ballast cavity on the low voltage end, such that it may be mounted to the inside of a driver/ballast cavity with the box and line voltage wiring internal to the cavity and the low voltage wiring external.

E. Automatic Daylighting Controller

1. The light level controller shall utilize an internal photocell that measures light in a 100 degree angle cutting the unwanted light from bright sources outside of this cone.

2. The light level controller shall be capable of controlling any type of lighting through use of power or relay packs. Light level controller shall operate from a 24 volts DC power supply; current draw is 22 milliamps.
3. The light level controller shall be capable of turning lighting on and off for a single zone and has a light sensors over 1 to 1400fc.
4. The light level controller shall have an adjustable deadband feature with 25%, 50%, 75% or 100% in relation to the set-points. This prevents lighting from cycling when lighting goes on and off and from minor changes due to cloud cover.
5. The light level controller shall have an adjustable time delay range of 3, 10, 15 or 30 minutes. This will prevent cycling on partly cloudy days and is necessary with HID lighting.
6. The sensor shall have an ON Set-point range from 1-850fc and when the daylight drops below that set-point for 20 seconds the electric lights will be turned ON.
7. The sensor shall have a microprocessor that allows the photosensor to respond with precision to deliver the desired intensity of electric lighting for the space.

2.3 PHOTOCELLS

A. General: Consist of sensor mounted as indicated on Drawings with separate control-calibration module. Sensor connected to control-calibration module via single shielded conductor with maximum distance of 500 feet. Control unit powered by 24 V ac.

B. Control-Calibration Module: Furnish with following:

1. Capable of being switched between 4 measurement ranges.
2. Separate trip points for high and low response settings.
3. Momentary contact device to override photocell relays.
4. Three minute time delay between switching outputs to avoid nuisance tripping.

C. Sensor Devices: Each sensor employs photo diode technology to allow linear response to daylight within illuminance range.

1. Exterior Lighting: Hooded sensor, horizontally mounted, employing flat lens, and working range [**1-10**] [**10-100**] fc in 10 percent increments. Entire sensor encased in optically clear epoxy resin.
2. Indoor Lighting: Sensor with Fresnel lens providing for 60-degree cone shaped response area to monitor indoor office lighting levels.
3. Atriums: Sensor with translucent dome with 180-degree field of view and respond in range of 100-1,000 fc.
4. Skylights: Sensor with translucent dome with 180-degree field of view and respond in range of 1,000-10,000 fc.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Mount sensors as indicated on Drawings.

B. Use only properly color coded, stranded wire. Install wire sizes as indicated on Drawings. Install non-plenum rated wire, or as indicated on drawings, in conduit.

C. Label each low voltage wire clearly indicating connecting relay panel.

D. Mount relay as indicated on Drawings. Wire numbered relays in panel to control power to each load. Install relays to be accessible. Allow space around relays for ventilation and circulation of air.

E. Identify power wiring with circuit breaker number controlling load. When multiple circuit breaker panels are feeding into relay panel, label wires to indicate originating panel designation.

F. Label each low voltage wire with relay number at each switch or sensor.

3.2 ADJUSTING

A. Test each system component after installation to verify proper operation.

B. Test relays, contactors, and switches after installation to confirm proper operation.

C. Adjust daylight controllers to automatically turn lights on and off at dusk and dawn.

D. Confirm correct loads are recorded on directory card in each panel.

3.3 DEMONSTRATION

A. Upon completion of all line, load and interconnection wiring, and after all fixtures are installed and lamped, a qualified technician shall completely check the installation prior to energizing the system. Each installed occupancy sensor shall be tested in the test mode to see that lights turn off and on based on occupancy.

B. At the time of checkout and testing, the owner’s representative shall be thoroughly instructed in the proper operation of the system.

C. Demonstrate operation of the following system components:

1. Operation of each type of occupancy sensors.

D. Furnish 4 hours to instruct Owner's personnel in operation and maintenance of system. Schedule training with Owner, provide at least 7 days notice to owner of training date.

END OF SECTION 260923

SECTION 26 27 26
WIRING DEVICES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes wall switches; receptacles; device plates; and decorative box covers.

1.2 REFERENCES

A. National Electrical Manufacturers Association:

1. NEMA WD 1 - General Requirements for Wiring Devices.
2. NEMA WD 6 - Wiring Devices-Dimensional Requirements.

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's catalog information showing dimensions, colors, and configurations.

B. Samples: Submit two samples of each wiring device and wall plate illustrating materials, construction, color, and finish.

1.4 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

PART 2 - PRODUCTS

2.1 WALL SWITCHES

A. Product Description: NEMA WD 1, Heavy-Duty, AC only general-use snap switch.

B. Body and Handle: White plastic with toggle handle. Red color for devices connected to emergency power system.

C. Indicator Light: Lighted handle type switch; red color handle.

D. Locator Light: Lighted handle type switch; red color handle.

E. Ratings:

1. Voltage: 120-277 volts, AC.

2. Current: 20 amperes.

3. Wiring: Back and side wired. Back wiring with clamp type terminals suitable for stranded or solid wire.

2.2 RECEPTACLES

A. Product Description: NEMA WD 1, [Hospital] [Specification] grade receptacle.

B. Device Body: [Ivory] [White] [Red] plastic. [Red color for devices connected to emergency power system.]

C. Configuration: NEMA WD 6.

D. Convenience Receptacle: Type 5-20.

E. GFCI Receptacle: Convenience receptacle with integral ground fault circuit interrupter to meet regulatory requirements.

F. Wiring: Back and side wired. Back wiring with clamp type terminals suitable for stranded or solid wire.

G. Tamper Resistant Receptacle: Convenience receptacle with internal spring loaded mechanical shutter. Type 5-20.

H. Special Purpose Receptacles: Type and rating and number of poles indicated or required for the anticipated purpose.

2.3 WALL PLATES

A. Decorative Cover Plate: White or Red plastic.

B. Jumbo Cover Plate: White or Red plastic.

C. Weatherproof Cover Plate: Gasketed cast metal plate with hinged and gasketed device cover. Provide extended cover for receptacles located in wet locations when attachment plug is inserted

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify outlet boxes are installed at proper height.

B. Verify wall openings are neatly cut and completely covered by wall plates.

C. Verify branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.

3.2 PREPARATION

A. Clean debris from outlet boxes.

3.3 INSTALLATION

A. Install devices plumb and level.

B. Install switches with OFF position down.

C. Install wall dimmers to achieve full rating specified and indicated after derating for ganging as instructed by manufacturer.

D. Do not share neutral conductor on load side of dimmers.

E. Install receptacles with grounding pole on top.

F. Connect wiring device grounding terminal to outlet box with bonding jumper and branch circuit equipment grounding conductor.

G. Install wall plates on flush mounted switches, receptacles, and blank outlets.

H. Install decorative plates on switch, receptacle, and blank outlets in finished areas.

I. Connect wiring devices by wrapping solid conductor around screw terminal. Install stranded conductor for branch circuits 10 AWG and smaller. When stranded conductors are used in lieu of solid, use crimp on fork terminals for device terminations. Do not place bare stranded conductors directly under device screws.

J. Use jumbo size plates for outlets installed in masonry walls.

K. Install galvanized steel plates on outlet boxes and junction boxes in unfinished areas, above accessible ceilings, and on surface mounted outlets.

L. Provide weather resistant GFI receptacles with specified weatherproof covers for all receptacles installed outdoors or in damp or wet locations.

M. Provide GFI receptacles for all receptacles installed within 6 feet of sinks.

N. Provide GFI receptacles for all receptacles installed in kitchens.

O. Provide GFI receptacles for all receptacles serving electric drinking fountains.

P. Unless noted otherwise, do not use combination switch/receptacle devices.

Q. For flush floor service fittings, use tile rings for installations in tile floors.

R. For flush floor service fittings, use carpet flanges for installations in carpeted floors.

3.4 INTERFACE WITH OTHER PRODUCTS

A. Coordinate locations of outlet boxes to obtain mounting heights [as specified and] as indicated on Architectural elevations.

B. Install wall switch 44 inches to center of box above finished floor.

C. Install convenience receptacle 18 inches to center of box above finished floor.

D. Install convenience receptacle 6 inches to center of box above counter or back splash of counter.

E. Install dimmer 44 inches to center of box above finished floor.

3.5 FIELD QUALITY CONTROL

A. Inspect each wiring device for defects.

B. Operate each wall switch with circuit energized and verify proper operation.

C. Verify each receptacle device is energized.

D. Test each receptacle device for proper polarity.

E. Test each GFCI receptacle device for proper operation.

3.6 ADJUSTING

A. Adjust devices and wall plates to be flush and level.

3.7 CLEANING

A. Clean exposed surfaces to remove splatters and restore finish.

END OF SECTION 262726

SECTION 26 56 00
EXTERIOR LIGHTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes exterior luminaries, poles, and accessories.

1.2 SUBMITTALS

A. Shop Drawings: Indicate dimensions and components for each luminaire not standard Product of manufacturer.

B. Product Data: Submit dimensions, ratings, and performance data.

1.3 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years experience.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Store and handle solid wood poles in accordance with ANSI O5.1.

1.5 COORDINATION

A. Furnish bolt templates and pole mounting accessories to installer of pole foundations.

** Include this section below if you are working on a Public Works project or required by client.

1.6 MAINTENANCE MATERIALS

A. Furnish two of each lamp installed.

B. Furnish one gallon of touch-up paint for each different painted finish and color.

C. Furnish two drivers/ballasts of each lamp type installed.

PART 2 - PRODUCTS

2.1 LUMINAIRES

A. Product Description: Complete exterior luminaire assemblies, with features, options, and accessories as scheduled.

2.2 LED DRIVERS

A. Product Description: High-power-factor type electronic driver certified by Certified Ballast Manufacturers, Inc. to comply with ANSI C82.15, suitable for environmental conditions specified, with voltage to match luminaire voltage.

2.3 LAMPS - GENERAL

A. Minimum Efficacy, Lamps Greater Than 100 Watts: 60 lumens/W, except where otherwise indicated or permitted by applicable code.

2.4 METAL POLES

A. Material and Finish: As indicated on Drawings.

B. Section Shape and Dimensions: As indicated on Drawings.

C. Height: As indicated on Drawings.

D. Base: As indicated on Drawings.

E. Accessories:

1. Handhole.
2. Anchor bolts.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify foundations are ready to receive fixtures.

3.2 INSTALLATION

A. Install concrete bases for lighting poles at locations as indicated on Drawings.

B. Install poles plumb. Install shims to adjust plumb. Grout around each base.

C. Install lamps, ballasts, and drivers in each luminaire.

D. Bond and ground luminaries, metal accessories, and metal poles.

3.3 FIELD QUALITY CONTROL

A. Operate each luminaire after installation and connection. Inspect for improper connections and operation.

B. Measure illumination levels to verify conformance with performance requirements.

C. Take measurements during night sky, without moon or with heavy overcast clouds effectively obscuring moon.

3.4 ADJUSTING

A. Aim and adjust luminaries to provide illumination levels and distribution as indicated on Drawings.

3.5 CLEANING

A. Clean photometric control surfaces as recommended by manufacturer.

B. Clean finishes and touch up damage.

3.6 PROTECTION OF FINISHED WORK

A. Relamp luminaries having failed lamps at Substantial Completion.

B. Replace ballast and drivers that have failed at Substantial Completion.

END OF SECTION 265600

SECTION 31 10 00
SITE CLEARING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Removing existing vegetation.
2. Clearing and grubbing.
3. Stripping and stockpiling topsoil.
4. Removing above- and below-grade site improvements.
5. Temporary erosion- and sedimentation-control measures.

B. Related Sections:

1. Section 015000 "Temporary Facilities and Controls" for temporary utility services, construction and support facilities, security and protection facilities**,** and temporary erosion- and sedimentation-control measures.
2. Section 017300 "Execution" for field engineering and surveying.

1.3 DEFINITIONS

A. Subsoil: All soil beneath the topsoil layer of the soil profile, and typified by the lack of organic matter and soil organisms.

B. Surface Soil: Soil that is present at the top layer of the existing soil profile at the Project site. In undisturbed areas, the surface soil is typically topsoil; but in disturbed areas such as urban environments, the surface soil can be subsoil.

C. Topsoil: Top layer of the soil profile consisting of existing native surface topsoil or existing in-place surface soil and is the zone where plant roots grow. Its appearance is generally friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects more than 2 inches (50 mm) in diameter; and free of subsoil and weeds, roots, toxic materials, or other non-soil materials.

D. Vegetation: Trees, shrubs, groundcovers, grass, and other plants.

1.4 MATERIAL OWNERSHIP

A. Except for stripped topsoil and other materials indicated to be stockpiled or otherwise remain HUMBOLDT COUNTY's property, cleared materials shall become subcontractor's property and shall be removed from Project site.

1.5 INFORMATIONAL SUBMITTALS

A. Existing Conditions: Documentation of existing trees and plantings, adjoining construction, and site improvements that establishes preconstruction conditions that might be misconstrued as damage caused by site clearing.

1. Use sufficiently detailed photographs or videotape.

B. Record Drawings: Identifying and accurately showing locations of capped utilities and other subsurface structural, electrical, and mechanical conditions.

1.6 QUALITY ASSURANCE

A. Preinstallation Conference: Conduct conference if requested by OWNER.

1.7 PROJECT CONDITIONS

A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site-clearing operations.

1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from HUMBOLDT COUNTY and authorities having jurisdiction.
2. Provide alternate routes around closed or obstructed traffic ways if required by ENGINEER or authorities having jurisdiction.

B. Salvable Improvements: Carefully remove items indicated to be salvaged or discovered on site and store on HUMBOLDT COUNTY's premises per HUMBOLDT COUNTY direction.

C. Utility Locator Service: Notify HUMBOLDT COUNTY for area where Project is located before site clearing.

D. Do not commence site clearing operations until temporary erosion- and sedimentation-control measures are in place.

E. The following practices are prohibited within protection zones:

1. Storage of construction material, debris, or excavated material.
2. Parking vehicles or equipment.
3. Foot traffic.
4. Erection of sheds or structures.
5. Impoundment of water.
6. Excavation or other digging unless otherwise indicated.
7. Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated.

F. Do not direct vehicle or equipment exhaust towards protection zones.

G. Prohibit heat sources, flames, ignition sources, and smoking within or near protection zones.

H. Soil Stripping, Handling, and Stockpiling: Perform as directed by geotechnical report**.**

I. Potential non-reusable soil – HUMBOLDT COUNTY shall remove or provide information on the location of any soil that does not meet HUMBOLDT COUNTY internal soil reuse policy.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Satisfactory Soil Material: Requirements for satisfactory soil material are specified in Section 312000 "Earth Moving."

1. Obtain approved borrow soil material off-site when satisfactory soil material is not available on-site.

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect and maintain benchmarks and survey control points from disturbance during construction.

B. Protect existing site improvements to remain from damage during construction.

1. Restore damaged improvements to their original condition, as acceptable to HUMBOLDT COUNTY.

3.2 TEMPORARY EROSION AND SEDIMENTATION CONTROL

A. Provide temporary erosion- and sedimentation-control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to erosion- and sedimentation-control Drawings and requirements of authorities having jurisdiction.

B. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross protection zones.

C. Inspect, maintain, and repair erosion- and sedimentation-control measures during construction until permanent vegetation has been established.

D. Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

3.3 TREE AND PLANT PROTECTION

A. General: Protect trees and plants remaining on-site according to requirements in Section 015639 "Temporary Tree and Plant Protection." Protect California red-legged frog per mandated conservation efforts documented by HUMBOLDT COUNTY.

3.4 EXISTING UTILITIES

A. HUMBOLDT COUNTY will arrange for disconnecting and sealing indicated utilities that serve existing structures before site clearing, when requested by subcontractor.

1. Verify that utilities have been disconnected and capped before proceeding with site clearing.

B. Locate, identify, disconnect, and seal or cap utilities indicated to be removed or abandoned in place.

1. Arrange with utility companies to shut off indicated utilities.

2. HUMBOLDT COUNTY will arrange to shut off indicated utilities when requested by subcontractor.

C. Interrupting Existing Utilities: Do not interrupt utilities serving facilities occupied by HUMBOLDT COUNTY or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:

1. Notify HUMBOLDT COUNTY not less than two days in advance of proposed utility interruptions.
2. Do not proceed with utility interruptions without HUMBOLDT COUNTY's written permission.

D. Excavate for and remove underground utilities indicated to be removed.

3.5 CLEARING AND GRUBBING

A. Remove obstructions, trees, shrubs, and other vegetation to permit installation of new construction.

1. Grind down stumps and remove roots, obstructions, and debris to a depth of 24 inches below exposed subgrade.
2. Use only hand methods for grubbing within protection zones.
3. Chip removed tree branches and dispose of off-site or per HUMBOLDT COUNTY recommendation.

B. Fill depressions caused by clearing and grubbing operations with satisfactory soil material unless further excavation or earthwork is indicated.

1. Place fill material in horizontal layers not exceeding a loose depth of 8 inches (200 mm), and compact each layer to a density equal to adjacent original ground, according to geotechnical recommendations.

3.6 TOPSOIL STRIPPING

A. Remove sod and grass before stripping topsoil.

B. Strip topsoil to depth of 8 inches (200 mm) in a manner to prevent intermingling with underlying subsoil or other waste materials.

1. Remove subsoil and nonsoil materials from topsoil, including clay lumps, gravel, and other objects more than 2 inches (50 mm) in diameter; trash, debris, weeds, roots, and other waste materials.

C. Stockpile topsoil away from edge of excavations without intermixing with subsoil. Grade and shape stockpiles to drain surface water. Cover to prevent windblown dust and erosion by water.

1. Limit height of topsoil stockpiles to 72 inches (1800 mm).
2. Do not stockpile topsoil within protection zones.
3. Dispose of surplus topsoil. Surplus topsoil is that which exceeds quantity indicated to be stockpiled or reused.
4. Stockpile surplus topsoil to allow for re-spreading deeper topsoil.

3.7 SITE IMPROVEMENTS

A. Remove existing above- and below-grade improvements as indicated and necessary to facilitate new construction.

B. Remove slabs, paving, curbs, gutters, and aggregate base as indicated.

1. Unless existing full-depth joints coincide with line of demolition, neatly saw-cut along line of existing pavement to remain before removing adjacent existing pavement. Saw-cut faces vertically.

3.8 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Remove surplus soil material, unsuitable topsoil, obstructions, demolished materials, and waste materials including trash and debris, and legally dispose of them off HUMBOLDT COUNTY's property.

B. Separate recyclable materials produced during site clearing from other non-recyclable materials. Store or stockpile without intermixing with other materials and transport them to recycling facilities. Do not interfere with other Project work.

END OF SECTION 31 10 00

SECTION 31 20 00
EARTH MOVING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Preparing subgrades for slabs-on-grade, walks, pavements, turf and grasses, and plants.
2. Excavating and backfilling for buildings and structures.
3. Drainage course for concrete slabs-on-grade.
4. Subbase course for concrete walks and pavements.
5. Subbase course and base course for asphalt paving.
6. Subsurface drainage backfill for walls and trenches.
7. Excavating and backfilling trenches for utilities and pits for buried utility structures.
8. Excavating well hole to accommodate elevator-cylinder assembly.

B. Related Sections:
1. Section 321313 "Concrete Paving" .
2. Section 311000 "Site Clearing" for site stripping, grubbing, stripping and stockpiling topsoil, and removal of above- and below-grade improvements and utilities.

1.3 UNIT PRICES

A. Work of this Section is affected by unit prices for earth moving specified in Section 012200 "Unit Prices."

B. Quantity allowances for earth moving are included in Section 012100 "Allowances."

1.4 DEFINITIONS

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

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

B. Base Course: Aggregate layer placed between the subbase course and hot-mix asphalt paving.

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

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

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

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

1. Authorized Additional Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions as directed by HUMBOLDT COUNTY. Authorized additional excavation and replacement material will be paid for according to Subcontract provisions for changes in the Work.
2. Bulk Excavation: Excavation more than 10 feet (3 m) in width and more than 30 feet (9 m) in length.
3. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by HUMBOLDT COUNTY. Unauthorized excavation, as well as remedial work directed by HUMBOLDT COUNTY, shall be without additional compensation.

G. Fill: Soil materials used to raise existing grades.

H. Rock: Rock material in beds, ledges, unstratified masses, conglomerate deposits, and boulders of rock material 3/4 cu. yd. (0.57 cu. m) or more in volume that exceed a standard penetration resistance of 100 blows/2 inches (97 blows/50 mm) when tested by a geotechnical testing agency, according to ASTM D 1586.

I. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.

J. Subbase Course: Aggregate layer placed between the subgrade and base course for hot-mix asphalt pavement, or aggregate layer placed between the subgrade and a cement concrete pavement or a cement concrete or hot-mix asphalt walk.

K. Subgrade: Uppermost surface of an excavation or the top surface of a fill or backfill immediately below subbase, drainage fill, drainage course, or topsoil materials.

L. Utilities: On-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of the following manufactured products required:

1. Geotextiles.
2. Warning tapes.

B. Samples for Verification: For the following products, in sizes indicated below:

1. Geotextile: 12 by 12 inches (300 by 300 mm).
2. Warning Tape: 12 inches (300 mm) long; of each color.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified testing agency.

B. Material Test Reports: For each on-site and borrow soil material proposed for fill and backfill as follows:

1. Classification according to ASTM D 2487.
2. Laboratory compaction curve according to ASTM D 1557.

C. Preexcavation Photographs or Videotape: Show existing conditions of adjoining construction and site improvements, including finish surfaces, that might be misconstrued as damage caused by earth moving operations. Submit before earth moving begins.

1.7 QUALITY ASSURANCE

A. Geotechnical Testing Agency Qualifications: Qualified according to ASTM E 329 and ASTM D 3740 for testing indicated.

1.8 PROJECT CONDITIONS

A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during earth moving operations.

1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from HUMBOLDT COUNTY and authorities having jurisdiction.
2. Provide alternate routes around closed or obstructed traffic ways if required by HUMBOLDT COUNTY or authorities having jurisdiction.

B. Improvements on Adjacent Property: Authority for performing earth moving indicated on property adjacent HUMBOLDT COUNTY's property will be obtained by HUMBOLDT COUNTY before award of Subcontract.

1. Do not proceed with work on adjacent property until directed by HUMBOLDT COUNTY.

C. Utility Locator Service: Notify HUMBOLDT COUNTY for area where Project is located before beginning earth moving operations.

D. Do not commence earth moving operations until temporary erosion- and sedimentation-control measures, specified in Section 015000 "Temporary Facilities and Controls," Section 311000 and "Site Clearing," are in place.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.

B. Satisfactory Soils: Materials shall be free of rock or gravel larger than 3 inches (75 mm) in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter per current geotechnical report.

1. Plasticity Index: R value greater than 40, P.I. 12 or less.

C. Subbase Material: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a 1-1/2-inch (37.5-mm) sieve and not more than 12 percent passing a No. 200 (0.075-mm) sieve.

D. Base Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 95 percent passing a 1-1/2-inch (37.5-mm) sieve and not more than 8 percent passing a No. 200 (0.075-mm) sieve.

E. Engineered Fill: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a 1-1/2-inch (37.5-mm) sieve and not more than 12 percent passing a No. 200 (0.075-mm) sieve.

F. Bedding Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; except with 100 percent passing a 1-inch (25-mm) sieve and not more than 8 percent passing a No. 200 (0.075-mm) sieve.

G. Drainage Course: Narrowly graded mixture of washed crushed stone, or crushed or uncrushed gravel; ASTM D 448; coarse-aggregate grading Size 57; with 100 percent passing a 1-1/2-inch (37.5-mm) sieve and 0 to 5 percent passing a No. 8 (2.36-mm) sieve.

H. Filter Material: Narrowly graded mixture of natural or crushed gravel, or crushed stone and natural sand; ASTM D 448; coarse-aggregate grading Size 67; with 100 percent passing a 1-inch (25-mm) sieve and 0 to 5 percent passing a No. 4 (4.75-mm) sieve.

I. Sand: ASTM C 33; fine aggregate.

J. Impervious Fill: Clayey gravel and sand mixture capable of compacting to a dense state.

2.2 ACCESSORIES

A. Detectable Warning Tape: Acid- and alkali-resistant, polyethylene film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches (150 mm) wide and 4 mils (0.1 mm) thick, continuously inscribed with a description of the utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches (750 mm) deep; colored as follows:

1. Red: Electric.
2. Yellow: Gas, oil, steam, and dangerous materials.
3. Orange: Telephone and other communications.
4. Blue: Water systems.
5. Green: Sewer systems.

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earth moving operations.

B. Protect and maintain erosion and sedimentation controls during earth moving operations.

C. Protect subgrades and foundation soils from freezing temperatures and frost. Remove temporary protection before placing subsequent materials.

3.2 DEWATERING

A. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.

B. Protect subgrades from softening, undermining, washout, and damage by rain or water accumulation.

1. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches.

3.3 EXCAVATION, GENERAL

A. Unclassified Excavation: Excavate to subgrade elevations regardless of the character of surface and subsurface conditions encountered. Unclassified excavated materials may include rock, soil materials, and obstructions. No changes in the Subcontract Sum or the Subcontract Time will be authorized for rock excavation or removal of obstructions.

1. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials.

B. Classified Excavation: Excavate to subgrade elevations. Material to be excavated will be classified as earth and rock. Do not excavate rock until it has been classified and cross sectioned by HUMBOLDT COUNTY. The Subcontract Sum will be adjusted for rock excavation according to unit prices included in the Subcontract Documents. Changes in the Subcontract Time may be authorized for rock excavation.

1. Earth excavation includes excavating pavements and obstructions visible on surface; underground structures, utilities, and other items indicated to be removed; together with soil, boulders, and other materials not classified as rock or unauthorized excavation.

3.4 EXCAVATION FOR STRUCTURES

A. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 1 inch (25 mm). If applicable, extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections.

1. Excavations for Footings and Foundations: Do not disturb bottom of excavation. Excavate by hand to final grade just before placing concrete reinforcement. Trim bottoms to required lines and grades to leave solid base to receive other work.
2. Excavation for Underground Tanks, Basins, and Mechanical or Electrical Utility Structures: Excavate to elevations and dimensions indicated within a tolerance of plus or minus 1 inch (25 mm). Do not disturb bottom of excavations intended as bearing surfaces.
3. Refer to building pad grading recommendations per latest Geotechnical Report.

3.5 EXCAVATION FOR WALKS AND PAVEMENTS

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

3.6 EXCAVATION FOR UTILITY TRENCHES

A. Excavate trenches to indicated gradients, lines, depths, and elevations.

B. Excavate trenches to uniform widths to provide the following clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches (300 mm) higher than top of pipe or conduit unless otherwise indicated.

1. Clearance: As indicated on drawings.

C. Trench Bottoms: Excavate and shape trench bottoms to provide uniform bearing and support of pipes and conduit. Shape subgrade to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits. Remove projecting stones and sharp objects along trench subgrade.

1. For pipes and conduit less than 6 inches (150 mm) in nominal diameter, hand-excavate trench bottoms and support pipe and conduit on an undisturbed subgrade.
2. For pipes and conduit 6 inches (150 mm) or larger in nominal diameter, shape bottom of trench to support bottom 90 degrees of pipe or conduit circumference. Fill depressions with tamped sand backfill.
3. For flat-bottomed, multiple-duct conduit units, hand-excavate trench bottoms and support conduit on an undisturbed subgrade.
4. Excavate trenches 6 inches (150 mm) deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.

D. Trenches in Tree- and Plant-Protection Zones:

1. Hand-excavate to indicated lines, cross sections, elevations, and subgrades. Use narrow-tine spading forks to comb soil and expose roots. Do not break, tear, or chop exposed roots. Do not use mechanical equipment that rips, tears, or pulls roots.
2. Do not cut main lateral roots or taproots; cut only smaller roots that interfere with installation of utilities.
3. Cut and protect roots according to requirements in Section 015639 "Temporary Tree and Plant Protection."

3.7 SUBGRADE INSPECTION

A. Notify HUMBOLDT COUNTY when excavations have reached required subgrade.

B. If HUMBOLDT COUNTY determines that unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material as directed.

C. Proof-roll subgrade below the building slabs and pavements with a pneumatic-tired or equivalent machine to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.

1. Completely proof-roll subgrade in one direction**,** repeating proof-rolling in direction perpendicular to first direction. Limit vehicle speed to 3 mph (5 km/h).
2. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by HUMBOLDT COUNTY, and replace with compacted backfill or fill as directed.

D. Authorized additional excavation and replacement material will be paid for according to Subcontract provisions for unit prices changes in the Work.

3.8 UNAUTHORIZED EXCAVATION

A. Fill unauthorized excavation under foundations or wall footings by extending bottom elevation of concrete foundation or footing to excavation bottom, without altering top elevation. Lean concrete fill, with 28-day compressive strength of 2500 psi (17.2 MPa), may be used when approved by HUMBOLDT COUNTY.

1. Fill unauthorized excavations under other construction, pipe, or conduit as directed by HUMBOLDT COUNTY at no additional cost to HUMBOLDT COUNTY.

3.9 STORAGE OF SOIL MATERIALS

A. Stockpile borrow soil materials and excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.

1. Stockpile soil materials away minimum 2 feet from edge of excavations for every 1 foot depth of excavation ratio (2:1). Do not store within drip line of remaining trees.

3.10 BACKFILL

A. Place and compact backfill in excavations promptly, but not before completing the following:

1. Construction below finish grade including, where applicable, subdrainage, dampproofing, waterproofing, and perimeter insulation.
2. Surveying locations of underground utilities for Record Documents.
3. Testing and inspecting underground utilities.
4. Removing concrete formwork.
5. Removing trash and debris.
6. Removing temporary shoring and bracing, and sheeting.
7. Installing permanent or temporary horizontal bracing on horizontally supported walls.

B. Place backfill on subgrades free of mud, frost, snow, or ice.

3.11 UTILITY TRENCH BACKFILL

A. Place backfill on subgrades free of mud, frost, snow, or ice.

B. Place and compact bedding course on trench bottoms and where indicated. Shape backfill course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.

C. Trenches under Footings: Backfill trenches excavated under footings and within 18 inches (450 mm) of bottom of footings with satisfactory soil then fill with concrete to elevation of bottom of footings. Concrete is specified in Section 033000 "Cast-in-Place Concrete".

D. Backfill voids with satisfactory soil while removing shoring and bracing.

E. Place and compact initial backfill of subbase material, free of particles larger than **1** inch (25 mm) in any dimension, to a height of 12 inches (300 mm) over the pipe or conduit.

1. Carefully compact initial backfill under pipe haunches and compact evenly up on both sides and along the full length of piping or conduit to avoid damage or displacement of piping or conduit. Coordinate backfilling with utilities testing.

F. Place and compact final backfill of satisfactory soil to final subgrade elevation.

G. Install detectable warning tape directly above utilities, 12 inches (300 mm) below finished grade, except 6 inches (150 mm) below subgrade under pavements and slabs.

3.12 SOIL FILL

A. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.

B. Place and compact fill material in layers to required elevations as follows:

1. Under grass and planted areas, use 12” of topsoil material.
2. Under walks and pavements, use satisfactory soil material.
3. Under steps and ramps, use engineered fill.

4. Under building slabs, use engineered fill.
5. Under footings and foundations, use engineered fill.

C. Place soil fill on subgrades free of mud, frost, snow, or ice.

3.13 SOIL MOISTURE CONTROL

A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to within 2 percent of optimum moisture content.

1. Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain frost or ice.
2. Remove and replace, or scarify and air dry, otherwise satisfactory soil material that exceeds optimum moisture content by 2 percent and is too wet to compact to specified dry unit weight.

3.14 COMPACTION OF SOIL BACKFILLS AND FILLS

A. Place backfill and fill soil materials in layers not more than 8 inches (200 mm) in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches (100 mm) in loose depth for material compacted by hand-operated tampers.

B. Place backfill and fill soil materials evenly on all sides of structures to required elevations, and uniformly along the full length of each structure.

C. Compact soil materials to not less than the following percentages of maximum dry unit weight according to ASTM D 1557:

1. Under structures, building slabs, steps, and pavements, scarify and recompact top 12 inches (300 mm) of existing subgrade and each layer of backfill or fill soil material at 95 percent.
2. Under walkways, scarify and recompact top 6 inches (150 mm) below subgrade and compact each layer of backfill or fill soil material at 92 percent.
3. Under turf or unpaved areas, scarify and recompact top 6 inches (150 mm) below subgrade and compact each layer of backfill or fill soil material at 90 percent.
4. For utility trenches, compact each layer of initial and final backfill soil material at 85 percent or as indicated on plans.

3.15 GRADING

A. General: Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.

1. Provide a smooth transition between adjacent existing grades and new grades.
2. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.

B. Site Rough Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to required elevations within the following tolerances:

1. Turf or Unpaved Areas: Plus or minus 1 inch (25 mm).
2. Walks: Plus or minus 1 inch (25 mm).
3. Pavements: Plus or minus 1/2 inch (13 mm).

C. Grading inside Building Lines: Finish subgrade to a tolerance of 1/2 inch (13 mm) when tested with a 10-foot (3-m) straightedge.

3.16 SUBBASE AND BASE COURSES UNDER PAVEMENTS AND WALKS

A. Place subbase course and base course on subgrades free of mud, frost, snow, or ice.

B. On prepared subgrade, place subbase course and base course under pavements and walks as follows:

1. Install separation geotextile if required on prepared subgrade according to manufacturer's written instructions, overlapping sides and ends.
2. Place base course material over subbase course under hot-mix asphalt pavement.
3. Shape subbase course and base course to required crown elevations and cross-slope grades.
4. Place subbase course and base course 6 inches (150 mm) or less in compacted thickness in a single layer.
5. Place subbase course and base course that exceeds 6 inches (150 mm) in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches (150 mm) thick or less than 3 inches (75 mm) thick.
6. Compact subbase course and base course at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 95 percent of maximum dry unit weight according to ASTM D 1557.

C. Pavement Shoulders: Place shoulders along edges of subbase course and base course to prevent lateral movement. Construct shoulders, at least 12 inches (300 mm) wide, of satisfactory soil materials and compact simultaneously with each subbase and base layer to not less than 95 percent of maximum dry unit weight according to ASTM D 1557.

3.17 DRAINAGE COURSE UNDER CONCRETE SLABS-ON-GRADE

A. Place drainage course on subgrades free of mud, frost, snow, or ice.

B. On prepared subgrade, place and compact drainage course under cast-in-place concrete slabs-on-grade as follows:

1. Install subdrainage geotextile on prepared subgrade according to manufacturer's written instructions, overlapping sides and ends.
2. Place drainage course 6 inches (150 mm) or less in compacted thickness in a single layer.
3. Place drainage course that exceeds 6 inches (150 mm) in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches (150 mm) thick or less than 3 inches (75 mm) thick.
4. Compact each layer of drainage course to required cross sections and thicknesses to not less than 95 percent of maximum dry unit weight according to ASTM D 1557.

3.18 FIELD QUALITY CONTROL

A. Special Inspections: HUMBOLDT COUNTY will engage a qualified special inspector to perform the following special inspections:

1. Determine prior to placement of fill that site has been prepared in compliance with requirements.
2. Determine that fill material and maximum lift thickness comply with requirements.
3. Determine, at the required frequency, that in-place density of compacted fill complies with requirements.

B. Testing Agency: HUMBOLDT COUNTY will engage a qualified geotechnical engineering testing agency to perform tests and inspections.

C. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earth moving only after test results for previously completed work comply with requirements.

D. Footing Subgrade: At footing subgrades, at least one test of each soil stratum will be performed to verify design bearing capacities. Subsequent verification and approval of other footing subgrades may be based on a visual comparison of subgrade with tested subgrade when approved by HUMBOLDT COUNTY.

E. Testing agency will test compaction of soils in place according to ASTM D 1556, ASTM D 2167, ASTM D 2922, and/or ASTM D 2937, as applicable. Tests will be performed at the following locations and frequencies:

1. Paved and Building Slab Areas: At subgrade and at each compacted fill and backfill layer, at least one test for every 2000 sq. ft. (186 sq. m) or less of paved area or building slab, but in no case fewer than three tests.
2. Foundation Wall Backfill: At each compacted backfill layer, at least one test for every 100 feet (30 m) or less of wall length, but no fewer than two tests.
3. Trench Backfill: At each compacted initial and final backfill layer, at least one test for every 150 feet (46 m) or less of trench length, but no fewer than two tests.

F. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil materials to depth required; recompact and retest until specified compaction is obtained.

3.19 PROTECTION

A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.

B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.

1. Scarify or remove and replace soil material to depth as directed by HUMBOLDT COUNTY; reshape and recompact.

C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.

1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.20 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Remove surplus satisfactory soil and waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of them off HUMBOLDT COUNTY's property.

B. Transport surplus satisfactory soil to designated storage areas on HUMBOLDT COUNTY's property. Stockpile or spread soil as directed by HUMBOLDT COUNTY.

1. Remove waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of them off HUMBOLDT COUNTY's property.

END OF SECTION 31 20 00

SECTION 31 23 00
TRENCHING, BACKFILLING, AND COMPACTING

PART 1 - GENERAL

1.1 SUMMARY

A. Trench, backfill, and compact as specified herein and as needed for installation of underground utilities associated with the Work.

B. Related work:

1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 01 of these Specifications.

1.2 SYSTEM DESCRIPTION

A. Quality Assurance:

1. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

2. Use equipment adequate in size, capacity, and numbers to accomplish the work in a timely manner.

3. In addition to complying with requirements of governmental agencies having jurisdiction, comply with the directions of the construction soil engineer.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

A. Fill and backfill materials:

1. Provide soil materials free from organic matter and deleterious substances, containing no rocks or lumps over 3” in greatest dimension, and with not more than 10% of the rocks or lumps larger than 1” in their greatest dimension.

2. Fill material is subject to the approval of the construction soil engineer, and is that material removed from excavations or imported from offsite borrow areas, predominantly granular, non-expansive soil free from roots and other deleterious matter.

3. Imported fill material shall, in addition, have 10 to 40% by weight passing the #200 sieve, a plasticity index of less than 15, and a liquid limit of less than 30%.

2.2 OTHER MATERIALS

A. Provide other materials, not specifically described but required for a complete and proper installation, as selected by the Contractor subject to the approval of the Architect.

PART 3 - EXECUTION

3.1 SURFACE CONDITIONS

A. Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the Work. Do not proceed until unsatisfactory conditions are corrected.

3.2 FINISH ELEVATIONS AND LINES

A. Comply with documents and existing elevations.

3.3 PROCEDURES

A. Utilities:

1. Unless shown to be removed, protect active utility lines shown on the Drawings or otherwise made known to the Contractor prior to trenching. If damaged, repair or replace at no additional cost to the Owner.

2. If active utility lines are encountered, and are not shown on the Drawings or otherwise made known to the Contractor, promptly take necessary steps to assure that service is not interrupted.

3. If service is interrupted as a result of work under this Section, immediately restore service by repairing the damaged utility at no additional cost to the Owner.

4. If existing utilities are found to interfere with the permanent facilities being constructed under this Section, immediately notify the Architect and secure his instructions.

5. Do not proceed with permanent relocation of utilities until written instructions are received from the Architect.

B. Protection of persons and property:

1. Barricade open holes and depressions occurring as part of the Work, and post warning lights on property adjacent to or with public access.

2. Operate warning lights during hours from dusk to dawn each day and as otherwise required.

3. Protect structures, utilities, sidewalks, pavements and other facilities from damage caused by settlement, lateral movement, washout, and other hazards created by operations under this Section.

C. De-watering:

1. Remove all water, including rainwater; encountered during trench and substructure work to an approved location by pumps, drains, and other approved methods.

2. Keep trenches and site construction area free from water.

D. Use means necessary to prevent dust becoming a nuisance to the public, to neighbors, and to other work being performed on or near the site.

E. Maintain access to adjacent areas at all times.

3.4 TRENCHING

A. Provide sheeting and shoring necessary for protection of the Work and for the safety of personnel.

1. Prior to backfilling, remove all sheeting.

2. Do not permit sheeting to remain in the trenches except when, in the opinion of the Architect, field conditions or the type of sheeting or methods of construction such as use of concrete bedding are such as to make removal of sheeting impracticable. In such cases, the Architect may permit portions of sheeting to be cut off and remain in the trench.

B. Open cut:

1. Excavate for utilities by open cut.

2. If conditions at the site prevent such open cut, and if approved by the Architect, trenching may be used.

3. Short sections of a trench may be tunneled if, in the opinion of the Architect, the conductor can be installed safely and backfill can be compacted properly into such tunnel.

4. Where it becomes necessary to excavate beyond the limits of normal excavation lines in order to remove boulders or other interfering objects, backfill the voids remaining after removal of the objects as directed by the construction soil engineer.

5. When the void is below the subgrade for the utility bedding, use approved earth materials and compact to the relative density directed by the construction soil engineer, but in no case to a relative density less than 90%.

6. When the void is the side of the utility trench or open cut, use approved earth or sand compacted as approved by the construction soil engineer, but in no case to a relative density less than 85%.

7. Remove boulders and other interfering objects, and backfill voids left by such removals, at no additional cost to the Owner.

8. Excavating for appurtenances:

a. Excavate for manholes and similar structures to a distance sufficient to leave at least 12” clear between outer surfaces and the embankment or shoring that may be used to hold and protect the banks.

b. Overdepth excavation beyond such appurtenances that has not been directed will be considered unauthorized. Fill with sand, gravel, or lean concrete as directed by the construction soil engineer, and at no additional cost to the Owner.

C. Trench to the minimum width necessary for proper installation of the utility, with sides as nearly vertical as possible. Accurately grade the bottom to provide uniform bearing for the utility.

D. Depressions:

1. Dig bell holes and depressions for joints after the trench has been graded. Provide uniform bearing for the pipe on prepared bottom of the trench.

2. Except where rock is encountered, do not excavate below the depth indicated or specified.

3. Where rock is encountered, excavate rock to a minimum overdepth of 4” below the trench depth indicated or specified.

E. Where utility runs traverse public property or are subject to governmental or utility company jurisdiction, provide depth, bedding, over, and other requirements as sedt forth by legally constituted authority having jurisdiction, but in no case less than the depth shown in the Contract Documents.

F. Where trenching occurs in existing lawns, remove turf in sections and keep damp. Replace turf upon completion of the backfilling.

G. Cover:

1. Provide minimum trench depth indicated below to maintain a minimum cover over the top of the installed item below the finish grade or subgrade:

a. Areas subject to vehicular traffic:

(1) Sanitary sewers: 24";

(2) Storm drains: 24".

b. Areas not subject to vehicular traffic:

(1) Sanitary sewers: 18";

(2) Storm drains: 18".

c. All areas:

(1) Water lines: 18";

(2) Natural gas lines: 18";

(3) Electrical cables: 24";

(4) Electrical ducts: 18".

d. Concrete encased:

(1) Pipe sleeves for water and gas lines: 18";

(2) Sanitary sewers and storm drains: 12";

(3) Electrical ducts: 18".

2. Where utilities are under a concrete structure slab or pavement, the minimum depth need only be sufficient to completely encase the conduit or pipe sleeve, and electrical long radius rigid metal conduit rise, provided it will not interfere with the structural integrity of the slab or pavement.

3. Where the minimum cover is not provided, encase the pipes in concrete as indicated. Provide concrete with a minimum 28-day compressive strength of 2500 psi.

3.5 BEDDING

A. Provide bedding as indicated in the Drawings.

3.6 BACKFILLING

A. General:

1. Do not completely backfill trenches until required pressure and leakage tests have been performed, and until the utilities systems as installed conform to the requirements specified in the pertinent Sections of these Specifications.

2. Except as otherwise specified or directed for special conditions, backfill trenches to the ground surface with selected material approved by the construction soil engineer.

3. Reopen trenches that have been improperly backfilled, to a depth as required for proper compaction. Refill and compact as specified, or otherwise correct to the approval of the construction soil engineer.

4. Do not allow or cause any of the Work performed or installed to be covered up or enclosed by work of this Section prior to required inspections, tests, and approvals.

5. Should any of the Work be so enclosed or covered up before it has been approved, uncover all such Work and, after approvals have been made, refill and compact as specified, all at no additional cost to the Owner.

B. Lower portion of trench:

1. Deposit approved backfill and bedding material in layers of 12” maximum thickness, and compact with suitable tampers to 90% relative density (85% in landscape areas), until there is a cover of not less than 24” over sewers and 12” over other utility lines.

2. Take special care in backfilling and bedding operations to not damage pipe and pipe coatings.

C. Remainder of trench:

1. Except for special materials for pavements, backfill the remainder of the trench with approved backfill.

2. Deposit backfill material in layers not exceeding the thickness specified, and compact each layer to the minimum density indicated by the construction soil engineer.

D. Adjacent to buildings: Mechanically compact backfill within ten feet of buildings.

E. Consolidation of backfill by jetting with water may be permitted, when specifically approved by the construction soil engineer, in areas other than building and pavement areas.

3.7 TEST FOR DISPLACEMENT OF SEWERS AND STORM DRAINS

A. Check sewers and storm drains to determine whether displacement has occurred after the trench has been backfilled to above the pipe and has been compacted as specified.

B. Flash a light between manholes or, if the manholes have not yet been constructed, between the locations of the manholes, by means of a flashlight or by reflecting sunlight with a mirror.

C. If the illuminated interior of the pipeline shows poor alignment, displaced pipes, or any other defects, correct the defects to the specified conditions and at no additional cost to the Owner.

3.8 PIPE JACKING

A. The Contractor may, at his option, install steel pipe casings, tongue and groove reinforced concrete pipes, and steel pipes under existing roads or pavements by jacking into place using procedures approved by the governmental agencies having jurisdiction and approved by the construction soil engineer.

3.9 TUNNELING OPERATIONS

A. The Contractor may, at his option, tunnel pipes into position using procedures approved by the construction soil engineer and the governmental agencies having jurisdiction.

3.10 FIELD QUALITY CONTROL

A. The construction soil engineer will instruct open cuts and trenches before installation of utilities, and will make the following tests:

1. Assure that trenches are not backfilled until all tests have been completed;

2. Check backfilling for proper layer thickness and compaction;

3. Verify that test results conform to the specified requirements, and that sufficient tests are performed;

4. Assure that defective work is removed and properly replaced.

END OF SECTION 31 23 00

SECTION 32 12 16
ASPHALT PAVING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 REFERENCES

A. The following documents form a part of these specifications to the extent stated herein.

B. State of California, Department of Transportation (CALTRANS)

CALTRANS Standard Specifications:
- Sec 26. Aggregate Bases
- Sec 37. Bituminous Seals
- Sec 39. Asphalt Concrete
- Sec 88 Geosynthetics
- Sec 92. Asphalts
- Sec 93. Liquid Asphalts
- Sec 94. Asphaltic Emulsions

1.3 SUMMARY

A. Section Includes:

1. Cold milling of existing asphalt pavement.
2. Hot-mix asphalt patching.
3. Hot-mix asphalt paving.
4. Hot-mix asphalt overlay.
5. Asphalt curbs.
6. Asphalt traffic-calming devices.
7. Asphalt surface treatments.

B. Related Requirements:

1. Section 312000 "Earth Moving" for subgrade preparation, fill material, unbound-aggregate subbase and base courses, and aggregate pavement shoulders.

1.4 PRECONSTRUCTION MEETINGS

A. Preconstruction Conference: Conduct conference if required by HUMBOLDT COUNTY.

1. Review methods and procedures related to hot-mix asphalt paving including, but not limited to, the following:

a. Review proposed sources of paving materials, including capabilities and location of plant that will manufacture hot-mix asphalt.
b. Review requirements for protecting paving work, including restriction of traffic during installation period and for remainder of construction period.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include technical data and tested physical and performance properties.
2. Job-Mix Designs: Certification, by authorities having jurisdiction, of approval of each job mix proposed for the Work.
3. Job-Mix Designs: For each job mix proposed for the Work.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For manufacturer and testing agency.

B. Material Certificates: For each paving material.

C. Material Test Reports: For each paving material, by a qualified testing agency.

D. Field quality-control reports.

1.7 QUALITY ASSURANCE

A. Manufacturer Qualifications: Perform work in accordance with the State of California, Department of Transportation (CALTRANS) Standard Specifications, Sec 26, 37, 39, 88 92, 93, and 94.

B. Regulatory Requirements: Comply with materials, workmanship, and other applicable requirements of State of California, Department of Transportation (CALTRANS) Standard Specifications for asphalt paving work.

1. Measurement and payment provisions and safety program submittals included in standard specifications do not apply to this Section.

1.8 FIELD CONDITIONS

A. Environmental Limitations: Do not apply asphalt materials if subgrade is wet or excessively damp, if rain is imminent or expected before time required for adequate cure, or if the following conditions are not met:

1. Tack Coat: Minimum surface temperature of 60 deg F (15.6 deg C).
2. Slurry Seal: Comply with CALTRANS Standard Specification Section 37-3.03D(4)(a)(iii);
3. Asphalt Base Course: Minimum surface temperature of 50 deg F (10 deg C) and rising at time of placement.
4. Asphalt Surface Course: Minimum surface temperature of 60 deg F (15.6 deg C) at time of placement.

PART 2 - PRODUCTS

2.1 AGGREGATES

General: Use materials and gradations that comply with CALTRANS Standard Specification Section 39-1.02E: Aggregate:

1. 1/2-inch maximum HMA, Type A for asphalt concrete overlay

2.2 ASPHALT MATERIALS

A. Asphalt Binder: Comply with CALTRANS Standard Specification Section 39-1.02C

Hot Mix Asphalt PG 64-10.

B. Tack Coat: Comply with CALTRANS Standard Specification Section 39-1.02B, Hot Mix Asphalt, grade SS1h asphaltic emulsion.

C. Fog Seal: Comply with CALTRANS Standard Specification Section 37-2.02D; Bituminous Seals, grade SS1h asphaltic emulsion.

D. Water: Potable.

2.3 AUXILIARY MATERIALS

A. Reclaimed Asphalt Pavement: Comply with CALTRANS Standard Specification Section 39-1.02F.

B. Herbicide: Commercial chemical for weed control, registered by the EPA, and not classified as "restricted use" for locations and conditions of application. Provide in granular, liquid, or wettable powder form.

C. Sand: Comply with CALTRANS Standard Specification Section 39-1.02E.

D. Geotechnical Subsurface Reinforcement: Comply with CALTRANS Standard Specification Section 88-102D

2.4 MIXES

A. Hot-Mix Asphalt: Dense-graded, hot-laid, hot-mix asphalt plant mixes complying with CALTRANS sec 39-1.03 and complying with the following requirements:

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that subgrade is dry and in suitable condition to begin paving.

B. Proceed with paving only after unsatisfactory conditions have been corrected.

3.2 COLD MILLING

A. Clean existing pavement surface of loose and deleterious material immediately before cold milling. Remove existing asphalt pavement by cold milling to grades and cross sections indicated.

1. Mill to a depth of 2 inches (50 mm).
2. Mill to a uniform finished surface free of excessive gouges, grooves, and ridges.
3. Control rate of milling to prevent tearing of existing asphalt course.
4. Repair or replace curbs, manholes, and other construction damaged during cold milling.
5. Excavate and trim unbound-aggregate base course, if encountered, and keep material separate from milled hot-mix asphalt.
6. Patch surface depressions deeper than 1 inch (25 mm) after milling, before wearing course is laid.
7. Handle milled asphalt material according to approved waste management plan required in Section 017419 "Construction Waste Management and Disposal."
8. Keep milled pavement surface free of loose material and dust.
9. Do not allow milled materials to accumulate on-site unless requested by HUMBOLDT COUNTY.

3.3 PATCHING

A. Asphalt Pavement: Saw cut perimeter of patch and excavate existing pavement section to sound base. Excavate rectangular or trapezoidal patches, extending 12 inches (300 mm) into perimeter of adjacent sound pavement, unless otherwise indicated. Cut excavation faces vertically. Remove excavated material. Recompact existing unbound-aggregate base course to form new subgrade.

B. Tack Coat: Before placing patch material, apply tack coat uniformly to vertical asphalt surfaces abutting the patch. Apply at a rate of 0.05 gal./sq. yd. (0.2 L/sq. m).

1. Allow tack coat to cure per manufacturers requirements, undisturbed before applying hot-mix asphalt paving.
2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.

C. Placing Patch Material: Fill excavated pavement areas with hot-mix asphalt base mix for full thickness of patch and, while still hot, compact flush with adjacent surface.

D. Placing Patch Material: Partially fill excavated pavements with hot-mix asphalt base mix and, while still hot, compact. Cover asphalt base course with compacted, hot-mix surface layer finished flush with adjacent surfaces.

3.4 REPAIRS

A. Leveling Course: Install and compact leveling course consisting of hot-mix asphalt surface course to level sags and fill depressions deeper than 1 inch (25 mm) in existing pavements.

1. Install leveling wedges in compacted lifts not exceeding 3 inches (75 mm) thick.

B. Crack and Joint Filling: Remove existing joint filler material from cracks or joints to a depth of 1/4 inch (6 mm).

1. Clean cracks and joints in existing hot-mix asphalt pavement.
2. Use emulsified-asphalt slurry to seal cracks and joints less than 1/4 inch (6 mm) wide. Fill flush with surface of existing pavement and remove excess.
3. Use hot-applied joint sealant to seal cracks and joints more than 1/2 inch (12 mm) wide. Fill flush with surface of existing pavement and remove excess.
4. Refer to “3.3 Patching” for cracks greater than ½ inch.

3.5 SURFACE PREPARATION

A. General: Immediately before placing asphalt materials, remove loose and deleterious material from substrate surfaces. Ensure that prepared subgrade is ready to receive paving.

B. Herbicide Treatment: Apply herbicide according to manufacturer's recommended rates and written application instructions. Apply to dry, prepared subgrade or surface of compacted-aggregate base before applying paving materials.

C. Tack Coat: Apply uniformly to surfaces of existing pavement at a rate of 0.15 gal./sq. yd. (0.6 L/sq. m).

1. Allow tack coat to cure per manufacturers requirements undisturbed before applying hot-mix asphalt paving.
2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.

3.6 GEOSYNTHETIC PAVEMENT INSTALLATION

A. Comply with CALTRANS Standard Specification Section 39-1.09.

B. Apply asphalt binder uniformly to existing pavement surfaces at a rate of 0.25 gal./sq. yd. (to 1.0 L/sq. m).

C. Place paving geosynthetic promptly according to manufacturer's written instructions. Broom or roll geotextile smooth and free of wrinkles and folds. Overlap longitudinal joints 4 inches (100 mm) and transverse joints 6 inches (150 mm).

D. Protect paving geosynthetic from traffic and other damage, and place hot-mix asphalt overlay the same day.

3.7 PLACING HOT-MIX ASPHALT

A. Machine place hot-mix asphalt on prepared surface, spread uniformly, and strike off. Place asphalt mix by hand in areas inaccessible to equipment in a manner that prevents segregation of mix. Place each course to required grade, cross section, and thickness when compacted.

1. Place hot-mix asphalt base course in number of lifts and thicknesses indicated.
2. Place hot-mix asphalt surface course in single lift.
3. Spread mix at a minimum temperature of 250 deg F (121 deg C).
4. Begin applying mix along centerline of crown for crowned sections and on high side of one-way slopes unless otherwise indicated.
5. Regulate paver machine speed to obtain smooth, continuous surface free of pulls and tears in asphalt-paving mat.

B. Place paving in consecutive strips not less than 10 feet (3 m) wide unless infill edge strips of a lesser width are required.

1. After first strip has been placed and rolled, place succeeding strips and extend rolling to overlap previous strips. Overlap mix placement about 1 to 1-1/2 inches (25 to 38 mm) from strip to strip to ensure proper compaction of mix along longitudinal joints.
2. Complete a section of asphalt base course before placing asphalt surface course.

C. Promptly correct surface irregularities in paving course behind paver. Use suitable hand tools to remove excess material forming high spots. Fill depressions with hot-mix asphalt to prevent segregation of mix; use suitable hand tools to smooth surface.

3.8 JOINTS

A. Construct joints to ensure a continuous bond between adjoining paving sections. Construct joints free of depressions, with same texture and smoothness as other sections of hot-mix asphalt course.

3.9 COMPACTION

A. General: Begin compaction as soon as placed hot-mix paving will bear roller weight without excessive displacement. Compact hot-mix paving with hot, hand tampers or with vibratory-plate compactors in areas inaccessible to rollers.

1. Complete compaction before mix temperature cools to 185 deg F (85 deg C).

B. Breakdown Rolling: Complete breakdown or initial rolling immediately after rolling joints and outside edge. Examine surface immediately after breakdown rolling for indicated crown, grade, and smoothness. Correct laydown and rolling operations to comply with requirements.

C. Intermediate Rolling: Begin intermediate rolling immediately after breakdown rolling while hot-mix asphalt is still hot enough to achieve specified density. Continue rolling until hot-mix asphalt course has been uniformly compacted to the following density:

1. Average Density: 96 percent of reference laboratory density according to ASTM D 6927, but not less than 94 percent or greater than 100 percent.

D. Finish Rolling: Finish roll paved surfaces to remove roller marks while hot-mix asphalt is still warm.

E. Edge Shaping: While surface is being compacted and finished, trim edges of pavement to proper alignment. Bevel edges while asphalt is still hot; compact thoroughly.

F. Repairs: Remove paved areas that are defective or contaminated with foreign materials and replace with fresh, hot-mix asphalt. Compact by rolling to specified density and surface smoothness.

G. Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened.

H. Erect barricades to protect paving from traffic until mixture has cooled enough not to become marked.

3.10 INSTALLATION TOLERANCES

A. Pavement Thickness: Compact each course to produce the thickness indicated within the following tolerances:

1. Base Course: Plus or minus 1/2 inch (13 mm).
2. Surface Course: Plus 1/4 inch (6 mm), no minus.

B. Pavement Surface Smoothness: Compact each course to produce a surface smoothness within the following tolerances as determined by using a 12-foot (3.6-m) straightedge applied transversely or longitudinally to paved areas:

1. Base Course: 1/4 inch (6 mm).
2. Surface Course: 1/8 inch (3 mm).
3. Crowned Surfaces: Test with crowned template centered and at right angle to crown. Maximum allowable variance from template is 1/4 inch (6 mm).

3.11 SURFACE TREATMENTS

A. Fog Seals: Apply fog seal at a rate of 0.10 to 0.15 gal./sq. yd. to existing asphalt pavement and allow to cure. With fine sand, lightly dust areas receiving excess fog seal.

B. Slurry Seals: Apply slurry seals according to CALTRANS Standard Specification Section 37-3.

1. Roll slurry seal to remove ridges and provide a uniform, smooth surface.

3.12 FIELD QUALITY CONTROL

A. Testing Agency: HUMBOLDT COUNTY will engage a qualified testing agency to perform tests and inspections.

B. Thickness: In-place compacted thickness of hot-mix asphalt courses will be determined according to ASTM D 3549.

C. Surface Smoothness: Finished surface of each hot-mix asphalt course will be tested for compliance with smoothness tolerances.

D. FLOOD TEST

A. Prior to application of seal coat, perform a flood test in the presence of HUMBOLDT COUNTY.

Method:

1. Flood the entire asphaltic concrete paved area with water by use of a tank truck or hoses.

2. If a depression is found where water ponds to a depth of more than 1/8" in six feet, fill or otherwise correct to provide proper drainage.

3. Feather and smooth the edges of fill so that the joint between fill and original surface is invisible.

3.13 WASTE HANDLING

A. General: Handle asphalt-paving waste according to approved waste management plan required in Section 017419 "Construction Waste Management and Disposal."

END OF SECTION 32 12 16

SECTION 33 11 00
WATER DISTRIBUTION SYSTEM

GENERAL

1.1 SUMMARY

A. Provide water distribution system as shown on the Drawings, specified herein, and needed for a complete and proper installation.

B. Related work:
1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division l of these Specifications.

1.2 SUBMITTALS

A. Comply with pertinent provisions of General Requirements.
1. Product data: Within 35 calendar days after the Contractor has received the Owner's Notice to Proceed, submit:
2. Materials list of items proposed to be provided under this Section;
3. Manufacturer's specifications and other data needed to prove compliance with the specified requirements;
4. Names and addresses of the nearest service and maintenance organization that readily stocks repair parts;
5. Manufacturer's recommended installation procedures which, when approved by the Architect, will become the basis for accepting or rejecting actual installation procedures used on the Work.

1.3 QUALITY ASSURANCE

A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

PART 2 - PRODUCTS

2.1 PIPE AND FITTINGS

A. General:
1. Assume connection point to building service lines as being approximately five feet outside buildings and structures to which service is required.
2. Pipe materials less than 3" size: Use rigid copper, type K pipes.
3. Pipe materials 3" size and larger: Use cast iron, ductile iron, or plastic pipes unless otherwise indicated or approved in advance by the Architect.

B. Pipe less than 3” diameter: All domestic water supply (potable) plumbing shall be rigid copper, type K including all pipes and fittings. Provide the following materials:
1. Above ground, provide Type “L” copper.
2. Below ground, provide Type “K” copper.

C. Pipe 3” diameter and larger:
1. Cast iron pipe:
a. Comply with ANSI A-21.6 or ANSI A-21.8, with working pressure of not less than 150 psi unless otherwise shown or specified.
b. Use cement mortar lining complying with ANSI A-21.4 or AWWA C205, standard thickness.

2. Ductile iron pipe:
   a. Comply with ANSI A 21.51, with working pressure of not less than 150 psi unless otherwise shown or specified.
   b. Use cement mortar lining complying with ANSI A 21.4 or AWWA C205, standard thickness.
3. Plastic pipe:
   a. Use polyvinyl-chloride (PVC) complying with AWWA C900, Class 150 DR 18.

D. Joints:
1. Copper Water Tube:
   a. Joints in copper tubing shall be made by the appropriate use of approved copper or copper alloy fittings.
   b. All connections to be sweated.
   c. Excessive Water Pressure. Where local static water pressure is in excess of eighty (80) pounds per square inch (551 kPa), an approved type pressure regulator preceded by an adequate strainer shall be installed and the static pressure reduced to eighty (80) pounds per square inch (551 kPa) or less. For potable water services up to and including one and one-half (1-1/2) inch (38.1 mm) regulators, provision shall be made to prevent pressure on the building side of the regulator from exceeding main supply pressure. Approved regulators with integral bypasses are acceptable. Each such regulator and strainer shall be accessibly located and shall have the strainer readily accessible for cleaning without removing the regulator or strainer body or disconnecting the supply piping. All pipe size determinations shall be based on eighty (80) percent of the reduced pressure when using Table 6-4.
2. Insulating joints:
   a. Provide between non-threaded ferrous and non-ferrous metallic pipe, fittings, and valves.
   b. Use sandwich type flange insulating gasket of the dielectric type, insulating washers, and insulating sleeves for flange bolts.
   c. Use full faced insulating gaskets with outside diameter equal to the flange outside diameter.
   d. Use full length bolt insulating sleeves.
   e. Install in a manner to prevent metal-to-metal contact of dissimilar metallic piping elements.

E. Valves
1. Gate valves:
   a. Use ball valves designed for a working pressure of not less than 150 psi. Ball valves district standard on all sites.
   b. Provide connections as required for the piping in which they are installed.
   c. Provide a clear waterway equal to the full nominal diameter of the valve, openable by turning counter clockwise.
   d. Provide an arrow on the operating nut or wheel, cast in metal, indicating direction of opening.
   e. Valves smaller than 3":
      1) Provide all bronze, screwed, single wedge disc, screw-in bonnet, packing gland, and nut, with non-rising stem.
      2) Buried valves: Install in suitable precast concrete hand hole with cover marked "WATER."
   f. Valves 3" and larger:
      1) Design in accordance with AWWA C500, standard, bronze trimmed, non-rising stem, solid wedge disc valves.
      2) Buried valves: Provide 2" operating nuts and in a suitable valve box with extension and marked cover.
      3) Provide tee handle socket operating wrenches of suitable size.
2. Check valves:
   a. Use check valves designed for a working pressure of not less than 150 psi, or as indicated or directed, with a clear waterway equal to the full nominal diameter of the valve.

b. Use valves designed to permit flow in one direction, when the inlet pressure is greater than the discharge pressure, and to close tightly to prevent return flow when discharge pressure exceeds inlet pressure.
c. Distinctly cast on the body of each valve:
1) Manufacturer's name, initials, or trademark by which he can be identified readily;
2) Valve size;
3) Working pressure;
4) Direction of flow.
d. Valves 2" and smaller: Provide all bronze, designed for screwed fittings.
e. Valves larger than 2":
1) Provide iron body, bronze mounted, with flanged ends, of the non-slam type;
2) Provide class 125 flanges complying with ANSI B-16.1.

F. Service fittings:
1. PVC mains smaller than 2" in diameter:
a. Make 3/4" maximum service with tees or plastic valve tees.
b. Acceptable products:
1) As manufactured by Mueller Company, Decatur, Illinois.
2. PVC mains 2" to 3-1/2" in diameter: For 3/4" service to 1" service, use bronze service clamp and bronze corporation stop designed for PVC pipe.
3. Service clamps and corporation stops:
a. Use bronze.
b. Provide service clamp with flattened straps and molded neoprene gaskets.
4. Services larger than those stated above: Make with standard tees on new lines, and tapping tees on existing lines.

2.2 TAPPING SLEEVES

A. Provide sleeve type coupling for existing water mains, furnished with outlet flanged to American 125 standard (ASA series 15):
1. Acceptable products:
a. Clow Corporation, Corona, California; boltless type:
1) Model C1 series for existing cast iron mains, complying with AWWA class A;
2) Model CA for class 150 and class 200 existing asbestos cement mains.
b. Coordinate requirements of tapping sleeves with gate valves and other fittings as required.

2.3 VALVE BOXES

A. Valves 3" and larger:
1. Use service box of cast iron, extension type of the required length, with screw adjustment.
2. Provide the word "WATER" cast into the cover.
3. Acceptable products:
a. Alhambra Foundry Company, Alhambra, California:
1) For valves 6" and smaller: Model A-3004;
2) For valves 8" and larger: Model 3005.

B. Valves 2-1/2" and smaller:
1. Use precast concrete box with the word "WATER" cast into the cover.
2. Provide risers on pipe line to place valve within box depth.
3. Acceptable products:
a. Manufactured by Brooks Products, Inc., El Monte, CA.
b. Or equal

PART 3 - EXECUTION

3.1 SURFACE CONDITIONS

A. Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the Work. Do not proceed until unsatisfactory conditions are corrected.

3.2 FIELD MEASUREMENT

A. Make necessary measurements in the field to assure precise fit of items in accordance with the approved design.

3.3 HANDLING

A. Handle pipe accessories so as to ensure delivery to the trench in sound, undamaged condition:
   1. Carry pipe into position; do not drag.
   2. Use pinch bars or tongs for aligning or turning the pipe only on the bare end of the pipe.

B. Thoroughly clean interior of pipe and accessories before lowering pipe into trench. Keep clean during laying operations by plugging or other method approved by the Architect.

C. Before installation, inspect each piece of pipe and each fitting for defects:
   1. Material found to be defective before or after laying: Replace with sound material meeting the specified requirements, and without additional cost to the Owner.

D. Rubber gaskets: Store in a cool dark place until just prior to time of installation.

3.4 PIPE CUTTING

A. Cut pipe neatly and without damage to the pipe.

B. Unless otherwise recommended by the pipe manufacturer, and authorized by the Architect, cut pipe with mechanical cutter only.
   1. Use wheel cutters when practicable.
   2. Cut plastic pipe square, and remove all burrs.

3.5 LOCATING

A. Locate water pipe at least ten feet away, horizontally, from sewer pipes.
   1. Where bottom of the water pipe will be at least 12" above top of the sewer pipe, locate water pipe at least six feet away, horizontally, from the sewer pipe.

B. Where water lines cross under gravity-flow sewer lines, fully encase the sewer pipe in concrete for a distance of at least ten feet each side of the crossing, or provide pressure pipe with no joint located within 36" of the crossing.
   1. Cross water lines in cases above sewage force mains or inverted siphons at least 24" above the sewer line.
   2. Encase in concrete those joints in the sewer main closer, horizontally, than 36" to the crossing.

C. Do not place water lines in the same trench with sewer lines or electric wiring.

3.6 JOINT DEFLECTION

A. Cast iron pipe:
   1. Maximum allowable deflection will be given in AWWA C600.
   2. Table I shows maximum deflections for 18 foot lengths of pipe. For other lengths, deflection may vary proportionately.

3. If alignment requires deflection exceeding limits shown in Table I, furnish special bends or a sufficient number of shorter lengths of pipe to provide angular deflections within the limits shown.
4. Table I, deflection in inches:

Diameter:	Push-on joint pipe:	Mechanical joint pipe:
3"	19"	31"
4"	19"	31"
6"	19"	27"
8"	19"	10"

B. Plastic pipe: Unless a lesser amount is recommended by the pipe manufacturer, maximum allowable deflections from a straight line or grade, or offsets, will be five degrees.

3.7 PLACING AND LAYING

A. General:
1. Lower pipe and accessories into trench by means of derrick, ropes, belt slings, or other equipment approved by the Architect.
2. Do not dump or drop any of the materials of this Section into the trench.
3. Except where necessary in making connections to other lines, lay pipe with the bells facing in the direction of laying.
4. Rest the full length of each section of pipe solidly on the pipe bed, with recesses excavated to accommodate bells, couplings, and joints.
5. Take up and relay pipe that has the grade or joint disturbed after laying.
6. Do not lay pipe in water, or when trench conditions are unsuitable for the work; keep water out of the trench until jointing is completed.
7. Securely close open ends of pipe, fittings, and valves when work is not in progress.
8. Where any part of coating or lining is damaged, repair to the approval of the Architect and at no additional cost to the Owner.

B. Plastic pipe:
1. Position pipe and fittings in trench in a manner that identifying markings will be readily visible for inspection.
2. Cutting and joining:
   a. Protect against abrasion from serrated holding devices.
   b. Remove burrs and glosses from surfaces to be jointed; use abrasive paper, file, or steel wool.
   c. Remove dirt, dust, and moisture by wiping clean with chemical cleaner or dry cloth.
   d. Using a pure bristle paint brush, apply an even coat of the specified solvent cement in the fitting socket and on the surface of the pipe to be joined
   e. Promptly insert pipe into bottom of the fitting socket; turn the pipe slightly to assure an even distribution of cement.
   f. Remove excess solvent cement from exterior of the joint.
   g. Should cement begin to dry before the joint is made, reapply cement before assembling.
   h. Allow at least one hour for the joint to gain strength before handling or installing the pipe.
3. Do not thread plastic pipe; make connections only with the solvent cement or with special adapter fittings designed for the purpose.
4. Align pipe system components without strain.
5. Support piping at intervals of not more than four feet, at ends, branch fittings, and change of direction or elevation.
6. Support plastic pipe in trenches with a 3" layer of sand. Allow no rocks, debris, or potentially damaging substances within 6" of plastic pipe in trenches.

7. Provide an electrically continuous type tracing wire insulated number 12 – gauge copper wire tracer wire in the trench along the pipe, fastened to the pipe at 20 foot intervals, and terminating aboveground with a 12" lead taped around each riser.

C. Connections: Use specials and fittings to suit the actual conditions where connections are made between new work and existing mains. Use only those specials and fittings approved by the utility having jurisdiction.

D. Sleeves:
1. Where pipe passes through walls of valve pits or structures, provide cast iron wall sleeves.
2. Fill annular space between walls and sleeves with rich cement mortar.
3. Fill annular space between pipe and sleeves with mastic.

3.8 JOINTING

A. Joints:
1. Cast iron pipe, ductile iron pipe, mechanical joints, and push-on type joints: Install in accordance with AWWA C600, modified as necessary by the recommendation of the manufacturer to provide for special requirements of ductile iron pipe.
2. Make connections between different types of pipe and accessories with transition fittings.
3. Rubber gaskets: Handle, lubricate where necessary, and install in strict accordance with the recommendations of the manufacturer.

3.9 SETTING VALVES AND VALVE BOXES

A. General:
1. Center valve boxes on the valves, setting plumb.
2. Tamp earth fill around each valve box to a distance of four feet on all sides, or to the undisturbed trench face if less than four feet.
3. Tighten stuffing boxes, and fully open and close each valve to assure that all parts are in working condition.

B. Service boxes:
1. Where water lines are located below paved streets having curbs, install boxes directly back of the curbs.
2. Where no curbing exists, install boxes in accessible locations beyond limits of street surfacing, walks, and driveways.

3.10 THRUST BLOCKS

A. General:
1. Provide thrust blocks, or metal tie rods and clamps or lugs, on plugs, caps, tees, and bends deflecting 22-1/2 degrees or more either vertically or horizontally, and on water lines 6" in diameter or larger.
2. Provide concrete thrust blocking with a compressive strength of at least 2500 psi in 28 days.

B. Installation:
1. Locate thrust blocking between solid ground and the fitting to be anchored.
2. Unless otherwise shown or directed by the Architect, place the base and thrust bearing sides of thrust blocking directly against undisturbed earth.
3. Sides of thrust blocking not subject to thrust may be placed against forms.
4. Place thrust blocking so the fitting joints will be accessible for repair.
5. Protect steel rods and clamps by galvanizing or by coating with bituminous paint.

3.11 TESTING AND INSPECTING

A. Closing uninspected work: Do not allow or cause any of the work of this Section to be covered up or enclosed until after it has been completely inspected and tested, and has been approved by the Architect.

B. Hydrostatic tests:
1. Where any section of a water line is provided with concrete thrust blocking for fittings, do not make hydrostatic tests until at least five days after installation of the concrete thrust blocking, unless otherwise directed by the Architect.
2. Devise a method for disposal of waste water from hydrostatic tests, and for disinfection, as approved in advance by the Architect.

C. Pressure tests:
1. After the pipe is laid, the joints completed, fire hydrants permanently installed, and the trench partially backfilled leaving the joints exposed for examination, subject the newly laid piping and valved sections of water distribution and service piping to a hydrostatic pressure of 200 psi.
2. Open and close each valve several times during the test.
3. Carefully examine exposed pipe, joints, fittings, and valves.
4. Replace or remake joints showing visible leakage.
5. Remove cracked pipe, defective pipe, and cracked or defective joints, fittings, and valves. Replace with sound material and repeat the test until results are satisfactory.
6. Make repair and replacement without additional cost to the Owner.

D. Leakage test:
1. Conduct leakage test after the pressure test has been completed satisfactorily.
2. Duration of each leakage test: At least two hours.
3. During the test, subject water lines to a pressure of 200 psi.
4. Leakage is defined as the quantity of water to be supplied into the newly laid pipe, or any valved or approved section thereof, necessary to maintain the specified leakage test pressure after the pipe has been filled with water and the air expelled.
5. No piping installation will be accepted until the leakage is less than the number of gallons per hour as determined by formula: "L = 0.00304 ND x sq root of P," where:
   a. L = allowable leakage in gallons per hour;
   b. N = number of joints in length of pipe under test;
   c. D = nominal diameter of pipe in inches; and
   d. P = average test pressure in lbs per sq inch.
6. The allowable leakage in gallons per hour, per joint, at 200 psi average test pressure shall be in accordance with Table II.
7. Should any test of pipe disclose leakage greater than that specified in Table II, locate and repair the defective joint or joints until the leakage is within the specified allowance, and at no additional cost to the Owner.
8. Table II:

Diameter:	Leakage in gal:	Diameter	Leakage in gal:
2"	0.0153	12"	0.0915
3"	0.0231	14"	0.1070
4"	0.0306	16"	0.1225
6"	0.0458	18"	0.1375
8"	0.0610	20"	0.1530
10"	0.0765	24"	0.1830

E. Time for making test:
1. Except for joint material setting, or where concrete reaction backing necessitates a five day delay, pipelines jointed with rubber gaskets, mechanical, or pushon joints, or couplings may

be subjected to hydrostatic pressure, inspected, and tested for leakage at any time after partial completion of backfill.

2. Cement mortar lined pipe may be filled with water as recommended by the manufacturer before being subjected to the pressure test and subsequent leakage test.

F. Disinfection:

1. Before acceptance of the potable water system, disinfect each unit of completed water supply, distribution, and service line in accordance with AWWA C651-92.
2. Perform all such tests and disinfection in a manner approved by governmental agencies having jurisdiction.
3. Furnish two copies of a Certificate of Disinfection to the Architect.

3.12 PAINTING

A. Paint valves, pipe, and vents exposed to view.

END OF SECTION 33 11 00

SECTION 33 12 00
UTILITY VALVES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Valves and hydrants used in piped utility distribution systems

1.2 RELATED SECTIONS

A. Section 33 11 00 "Utility Distribution Systems"

1.3 REFERENCES

A. The following documents form a part of these specifications to the extent stated herein.

B. Code of Federal Regulations (CFR)

1. 29 CFR 1910.7 Definitions and Requirements for a Nationally Recognized Testing Laboratory (NRTL)

C. American National Standards Institute (ANSI)

D. American Society of Mechanical Engineers (ASME)

1. ASME B16.1 Cast Iron Pipe Flanges and Flanged Fittings

E. ASTM International (ASTM)

1. ASTM A 48 Gray Iron Castings
2. ASTM A 126 Gray Iron Castings for Valves, Flanges, and Pipe Fittings
3. ASTM A 436 Austenitic Gray Iron Castings
4. ASTM A 536 Ductile Iron Castings

F. American Water Works Association (AWWA)

1. AWWA C500 Metal-Seated Gate Valves for Water Supply Service
2. AWWA C502 Dry-Barrel Fire Hydrants
3. AWWA C504 Rubber-Seated Butterfly Valves
4. AWWA C509 Resilient-Seated Gate Valves for Water Supply Service
5. AWWA C550 Protective Interior Coatings for Valves and Hydrants

1.4 DEFINITIONS

BB	=	Bolted bonnet
IBBM	=	Iron body, bronze mounted
NBR	=	Acrylonitrile/butadiene
NRS	=	Nonrising stem
NST	=	National Standard fire hose thread
OS&Y	=	Outside screw and yoke
PTFE	=	Polytetrafluoroethylene
WOG	=	Water, oil, and gas (pressure)
WP	=	Working pressure

PART 2 - PRODUCTS

2.1 VALVES

A. Gate Valves:

1. V-1F: Sizes 2 through 12 inches, IBBM, 200-lb cold water, class 125 ANSI flange, double-disc, NRS with 2-inch square operating nut (installed with adapter if necessary), o-ring stem seal (packing gland not acceptable), coal tar or asphalt-varnish dipped, AWWA C500; Mueller "A2380-6," Stockham "G-745-0," American-Darling "52," or equal.
2. V-1N: Sizes 4 through 12 inches, resilient wedge, 200-lb cold water, class 125 ANSI flange, NRS with 2-inch square operating nut, cast-iron body, SBR resilient seat on disc, o-ring stem seal, AWWA C509; epoxy-lined and coated in accordance with AWWA C550; Stockham "G-700-0," Waterous "Series 500," M&H "AWWA C509-306B," or equal.
3. V-1P: Sizes 4 through 12 inches, resilient wedge, 200-lb cold water, class 125 ANSI flange, NRS with hand wheel, cast-iron body, styrene-butadiene-rubber (SBR) resilient seat on disc, o-ring stem seal, AWWA C509; epoxy-lined and coated in accordance with AWWA C550; Stockham "G-700-0," Waterous "Series 500," M&H "AWWA C509-306B," or equal.

4. V-2Q: Sizes 2-1/2 through 12 inches, tested and listed or labeled by any nationally recognized testing laboratory (NRTL) recognized under 29 CFR 1910.7; IBBM, 175-lb cold water, class 125 ANSI flange, solid wedge, OS&Y, bronze stem; Mueller "A2073-6," American-Darling "55," or equal.

B. Check Valves:

1. V-50E: Sizes 2-1/2 through 12 inches, swing type, NRTL approved, IBBM, 175-lb cold water, class 125 ANSI flange, BB, for use in vertical or horizontal position, renewable composition disc and bronze seat ring; Stockham "G-940," American-Darling "52-SC," Mueller "A2122-6," or equal.
2. V-50P: Alarm check valve, sizes 4 through 8 inches, NRTL approved, 125-lb ASME B16.1 flange, 175-lb cold water; Grinnell "F200," Reliable "E," Viking "F-1," or equal.
3. V-50Q: Wafer check valve, sizes 4 through 8 inches, 175-lb cold water, NRTL approved, iron body, buna-n seat, spring loaded; Stockham "WG-990," ITT Kennedy, or equal.

2.2 HYDRANTS

A. Wet-Barrel Fire Hydrants (V-100B): 6-inch California-type fire hydrant with wet barrel, 175-lb working pressure, cast iron, bronze trim, 6-inch inside diameter (I.D.) waterway, two 2-1/2 inch fire hose outlets, and one 4-1/2 inch lower steamer outlet each outlet with NSFHT (National Standard Fire Hose Thread) and independently valved with 1-1/8 inch pentagon operating nut on cap; 29-3/4 inch overall height from bottom of body flange; hydrant complete with 6-inch bury (length of bury to suit depth of water main connection as indicated on the drawings) with manufacturer's standard factory-applied primer; Rich "76," Logan "651," or equal. Substitutes shall also have dimensions identical to Rich "76."

B. Dry-Barrel Fire Hydrants (V-100W):

1. Hydrants shall be designed, manufactured, and tested in accordance with AWWA C502.
2. Hydrants shall be traffic-type with a replaceable breakable unit immediately above the ground line for minimizing repairs due to traffic damage.
3. Hydrants shall be of a dry-barrel configuration to prevent water loss due to traffic damage and freezing.
4. Hydrants shall be constructed such that the main valve closes with water pressure to assure no loss of water in the event of damage to the upper portion of the fire hydrant.
5. Main valve opening shall have a diameter of at least 5-1/4 inches to assure optimum flow.
6. Standpipe (hydrant barrel) inside diameter shall not be less than 7-1/4 inches.
7. Hydrant shall be of a "dry top" design with o-ring seals to ensure that the operating threads will be protected from water entry.
8. Hydrant operating nut shall turn LEFT to open in order to maintain uniformity with presently installed hydrants, and direction of OPEN shall be clearly marked at the top of the hydrant.
9. Operating and cap nuts shall be pentagon in shape; dimension shall be 1-1/2 inches point to flat (standard).
10. Hydrants shall have a 6-inch inlet of flanged design for ease of installation.
11. Hydrants shall have an automatic drain that is operated by the main valve rod and shall have two plugged drains in the shoe of the hydrants. These plugged drains shall be brass lined to prevent rusting.
12. Hydrants shall have two 2-1/2 inch nozzles having NST threads and one 4-1/2 inch pumper nozzle having NST threads. Provide the caps with rubber gaskets to prevent leakage; if nut design caps are supplied, they shall conform to item 9. Caps shall be equipped with stainless steel chains and pear

links. Wire chains and cables are unacceptable. The minimum distance from the ground line to the center line of the lowest nozzle shall be 18 inches.

13. Hydrant nozzle section shall be able to rotate through 360 degrees with respect to the standpipe. Such rotation shall not place the operating rod in a position so as to obstruct the flow through any nozzle.
14. The fire hydrants shall be tagged with the bury length shown on the drawings.
15. The outside of the hydrant top section shall be painted with at least one coat of primer and one finished coat of industrial enamel, yellow in color to match existing hydrants in the system.
16. Hydrants with springs, toggles, and other excessive parts which may present expensive maintenance problems will not be considered.
17. Flow characteristics and friction loss through the hydrant shall not exceed AWWA C502.
18. Hydrants shall be Waterous Pacer "WB-67" or equal (no known equal).

C. Fire Hose Adapters (V-101C): 2-1/2 inch bronze, class 150 ANSI flange one end, male NSFHT other end, with cap and chain, to be assembled from the following components:

1. 2-1/2 inch class 150 ANSI threaded bronze flange
2. Bronze male hose nipple; one end 2-1/2 inch iron pipe thread, other end 2-1/2 inch NSFHT; Western Fire Equipment Co. "3A008," Potter-Roemer Inc. "146," Wilkirk Inc. "14-146," or equal
3. Bronze hose cap; Western Fire Equipment Co. "3A05," Potter-Roemer Inc. "126," Wilkirk Inc. "17-126," or equal
4. Bronze chain for attaching hose cap to hose nipple

D. Post Indicator Valves (PIV):

1. V-102A: Gate valve, 4 through 14 inches, indicator post type; NRTL approved; IBBM, 175-lb cold water, class 125 ANSI flange, double disc, NRS, with indicator post flange and 2-inch square operating nut, asphalt-varnish dipped; Clow "F-5722," Waterous Co. "series 300," or equal; for use with indicator post V-102B (specified below).
2. V-102B: Indicator post, adjustable type; NRTL approved; for use with indicator-post type gate valve V-102A (specified above); cast iron, 1-1/4 inch wrench nut; Clow "F-5750," Waterous Co. "A240," or equal. Specify valve size; lengths as required.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Refer to section 33 00 00 "Utility Distribution Systems" for installation.

END OF SECTION 33 12 00

SECTION 33 31 00
SANITARY UTILITY SEWERAGE PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Pipe and fittings.
2. Non-pressure couplings.
3. Expansion joints and deflection fittings.
4. Cleanouts.

1.3 ACTION SUBMITTALS

A. Product Data: For the following:

1. Expansion joints and deflection fittings.
2. Backwater valves.

1.4 INFORMATIONAL SUBMITTALS

A. Construction Drawings: Show pipe sizes, locations, and elevations. Show other piping in same trench and clearances from sewer system piping. Indicate interface and spatial relationship between manholes, piping, and proximate structures.

B. Profile Drawings: Show system piping in elevation. Draw profiles to horizontal scale of not less than 1 inch equals 50 feet (1:500) and to vertical scale of not less than 1 inch equals 5 feet (1:50). Indicate manholes and piping. Show types, sizes, materials, and elevations of other utilities crossing system piping.

C. Product Certificates: For each type of cast-iron soil pipe and fitting, from manufacturer.

D. Field quality-control reports.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Do not store plastic manholes, pipe, and fittings in direct sunlight.

B. Protect pipe, pipe fittings, and seals from dirt and damage.

1.6 PROJECT CONDITIONS

A. Interruption of Existing Sanitary Sewerage Service: Do not interrupt service to facilities occupied by MVWSD or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:

1. Notify MVWSD no fewer than two days in advance of proposed interruption of service.
2. Do not proceed with interruption of service without MVWSD written permission.

PART 2 - PRODUCTS

2.1 PVC PIPE AND FITTINGS

A. PVC Type PSM Sewer Piping:

1. Pipe: ASTM D 3034, SDR 26, PVC Type PSM sewer pipe with bell-and-spigot ends for gasketed joints.
2. Fittings: ASTM D 3034, PVC with bell ends.
3. Gaskets: ASTM F 477, elastomeric seals.

2.2 CLEANOUTS

A. Cast-Iron Cleanouts:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Alhambra foundry A-1241.
   b. Or equal

2. Description: ASTM A-48, round, gray-iron housing with clamping device and round, secured, scoriated, gray-iron cover. Include gray-iron ferrule with inside calk or spigot connection and countersunk, tapered-thread, brass closure plug.

3. Sewer Pipe Fitting and Riser to Cleanout: ASTM A 74, Service class, cast-iron soil pipe and fittings.

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

2.3 CONCRETE

A. General: Cast-in-place concrete complying with ACI 318, ACI 350/350R and the following:

1. Cement: ASTM C 150, Type II.
2. Fine Aggregate: ASTM C 33, sand.
3. Coarse Aggregate: ASTM C 33, crushed gravel.
4. Water: Potable.

B. Portland Cement Design Mix: 3000 psi (27.6 MPa) minimum, with 0.58 maximum water/cementitious materials ratio.

1. Reinforcing Fabric: ASTM A 185/A 185M, steel, welded wire fabric, plain if required.
2. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (420 MPa) deformed steel if required.

C. Ballast and Pipe Supports: Portland cement design mix, 3000 psi (20.7 MPa) minimum, with 0.58 maximum water/cementitious materials ratio.

1. Reinforcing Fabric: ASTM A 185/A 185M, steel, welded wire fabric, plain if required.

2. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (420 MPa) deformed steel if required.

PART 3 - EXECUTION

3.1 EARTHWORK

A. Excavating, trenching, and backfilling are specified in Section 31 20 00 "Earth Moving."

3.2 PIPING INSTALLATION

A. General Locations and Arrangements: Drawing plans and details indicate general location and arrangement of underground sanitary sewer piping. Location and arrangement of piping layout take into account design considerations. Install piping as indicated, to extent practical. Where specific installation is not indicated, follow piping manufacturer's written instructions.

B. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions for using lubricants, cements, and other installation requirements.

C. Install proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.

D. When installing pipe under streets or other obstructions that cannot be disturbed, use pipe-jacking process of microtunneling.

E. Install gravity-flow, nonpressure, drainage piping according to the following:

1. Install piping pitched down in direction of flow, at minimum slope shown on drawings unless otherwise indicated.
2. Install PVC Type PSM sewer piping according to ASTM D 2321 and ASTM F 1668.

F. Clear interior of piping and manholes of dirt and superfluous material as work progresses. Maintain swab or drag in piping, and pull past each joint as it is completed. Place plug in end of incomplete piping at end of day and when work stops.

3.3 PIPE JOINT CONSTRUCTION

A. Join gravity-flow, nonpressure, drainage piping according to the following:
1. Join PVC Type PSM sewer piping according to ASTM D 2321 and ASTM D 3034 for elastomeric-seal joints or ASTM D 3034 for elastomeric-gasket joints.

3.4 CLEANOUT INSTALLATION

A. Install cleanouts and riser extensions from sewer pipes to cleanouts at grade. Use PVC pipe fittings in sewer pipes at branches for cleanouts, and use PVC pipe for riser extensions to cleanouts. Install piping so cleanouts open in direction of flow in sewer pipe.

B. Set cleanout frames and covers in earth in cast-in-place-concrete block, per details . Set with tops flush with above surrounding grade.

C. Set cleanout frames and covers in concrete pavement and roads with tops flush with pavement surface.

3.5 CONNECTIONS

A. Connect nonpressure, gravity-flow drainage piping to building's sanitary building drains specified in Section 221316 "Sanitary Waste and Vent Piping."

B. Make connections to existing piping and underground manholes.

1. Use commercially manufactured wye fittings for piping branch connections. Remove section of existing pipe, install wye fitting into existing piping, and encase entire wye fitting plus 6-inch (150-mm) overlap with not less than 6 inches (150 mm) of concrete with 28-day compressive strength of 3000 psi (20.7 MPa).
2. Make branch connections from side into existing piping, NPS 4 to NPS 20 (DN 100 to DN 500). Remove section of existing pipe, install wye fitting into existing piping, and encase entire wye with not less than 6 inches (150 mm) of concrete with 28-day compressive strength of 3000 psi (20.7 MPa).
3. Make branch connections from side into existing piping, NPS 21 (DN 525) or larger, or to underground manholes by cutting opening into existing unit large enough to allow 3 inches (76 mm) of concrete to be packed around entering connection. Cut end of connection pipe passing through pipe or structure wall to conform to shape of and be flush with inside wall unless otherwise indicated. On outside of pipe or manhole wall, encase entering connection in 6 inches (150 mm) of concrete for minimum length of 12 inches (300 mm) to provide additional support of collar from connection to undisturbed ground.

    a. Use concrete that will attain a minimum 28-day compressive strength of 3000 psi (20.7 MPa) unless otherwise indicated.
    b. Use epoxy-bonding compound as interface between new and existing concrete and piping materials.

4. Protect existing piping and manholes to prevent concrete or debris from entering while making tap connections. Remove debris or other extraneous material that may accumulate.

3.6 IDENTIFICATION

A. Comply with requirements in Section 31 20 00 "Earth Moving" for underground utility identification devices. Arrange for installation of green warning tapes directly over piping and at outside edges of underground manholes.

1. Use detectable warning tape over ferrous piping.
2. Use detectable warning tape over nonferrous piping and over edges of underground manholes.

3.7 FIELD QUALITY CONTROL

A. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches (600 mm) of backfill is in place, and again at completion of Project.

1. Submit separate report for each system inspection.
2. Defects requiring correction include the following:

    a. Alignment: Less than full diameter of inside of pipe is visible between structures.
    b. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.
    c. Damage: Crushed, broken, cracked, or otherwise damaged piping.
    d. Infiltration: Water leakage into piping.
    e. Exfiltration: Water leakage from or around piping.

3. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.
4. Reinspect and repeat procedure until results are satisfactory.

B. Test new piping systems, and parts of existing systems that have been altered, extended, or repaired, for leaks and defects.

1. Do not enclose, cover, or put into service before inspection and approval.
2. Test completed piping systems according to requirements of authorities having jurisdiction.
3. Schedule tests and inspections by authorities having jurisdiction with at least 24 hours' advance notice.
4. Submit separate report for each test.
5. Hydrostatic Tests: Test sanitary sewerage according to requirements of authorities having jurisdiction and the following:

    a. Fill sewer piping with water. Test with pressure of at least 10-foot (3-m) head of water, and maintain such pressure without leakage for at least 15 minutes.
    b. Close openings in system and fill with water.
    c. Purge air and refill with water.
    d. Disconnect water supply.
    e. Test and inspect joints for leaks.

6. Air Tests: Test sanitary sewerage according to requirements of authorities having jurisdiction, UNI-B-6, and the following:

    a. Option: Test plastic gravity sewer piping according to ASTM F 1417.
    b. Option: Test concrete gravity sewer piping according to ASTM C 924 (ASTM C 924M).

7. Manholes: Perform hydraulic test according to ASTM C 969 (ASTM C 969M).

C. Leaks and loss in test pressure constitute defects that must be repaired.

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

3.8 CLEANING

A. Clean dirt and superfluous material from interior of piping. Flush with potable water.

END OF SECTION 33 31 00

SECTION 33 41 00
STORM UTILITY DRAINAGE PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Pipe and fittings.
2. Cleanouts.
3. Drains.
4. Catch basins.
5. Pipe outlets.

1.3 ACTION SUBMITTALS

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

B. Shop Drawings:

C.

1. Catch basins. Include plans, elevations, sections, details, frames, covers, and grates.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Do not store plastic manholes, pipe, and fittings in direct sunlight.

B. Protect pipe, pipe fittings, and seals from dirt and damage.

C. Handle catch basins according to manufacturer's written rigging instructions.

1.5 PROJECT CONDITIONS

A. Interruption of Existing Storm Drainage Service: Do not interrupt service to facilities occupied by HUMBOLDT COUNTY or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:

1. Notify HUMBOLDT COUNTY no fewer than two days in advance of proposed interruption of service.
2. Do not proceed with interruption of service without HUMBOLDT COUNTY's written permission.

PART 2 - PRODUCTS

2.1 PVC PIPE AND FITTINGS

A. PVC Type PSM Sewer Piping:

1. Pipe: ASTM D 3034, SDR 26, PVC Type PSM sewer pipe with bell-and-spigot ends for gasketed joints.
2. Fittings: ASTM D 3034, PVC with bell ends.
3. Gaskets: ASTM F 477, elastomeric seals.

2.2 CLEANOUTS

A. Cast-Iron Cleanouts:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

   a. Alhambra Foundary
   b. Or equal

2. Description: ASME A112.36.2M, round, gray-iron housing with clamping device and round, secured, scoriated, gray-iron cover. Include gray-iron ferrule with inside calk or spigot connection and countersunk, tapered-thread, brass closure plug.
3. Sewer Pipe Fitting and Riser to Cleanout: PVC pipe and fittings.
4. Description: PVC body with PVC threaded plug. Include PVC storm utility pipe fitting and riser to cleanout of same material as storm utility piping.

2.3 CONCRETE

A. General: Cast-in-place concrete according to ACI 318, ACI 350/350R, and the following:

1. Cement: ASTM C 150, Type II.
2. Fine Aggregate: ASTM C 33, sand.
3. Coarse Aggregate: ASTM C 33, crushed gravel.
4. Water: Potable.

B. Portland Cement Design Mix: 4000 psi (27.6 MPa) minimum, with 0.45 maximum water/cementitious materials ratio.

1. Reinforcing Fabric: ASTM A 185/A 185M, steel, welded wire fabric, plain.
2. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (420 MPa) deformed steel.

2.4 CATCH BASINS

A. Standard Precast Concrete Catch Basins:

1. Description: ASTM C 478, precast, reinforced concrete, of depth indicated, with provision for sealant joints.
2. Base Section: 6-inch (150-mm) minimum thickness for floor slab and 4-inch (102-mm) minimum thickness for walls and base riser section, and separate base slab or base section with integral floor.
3. Riser Sections: 4-inch (102-mm) minimum thickness, 48-inch (1200-mm) diameter, and lengths to provide depth indicated.
4. Top Section: Eccentric-cone type unless concentric-cone or flat-slab-top type is indicated. Top of cone of size that matches grade rings.

5. Joint Sealant: ASTM C 990 (ASTM C 990M), bitumen or butyl rubber.
6. Adjusting Rings: Interlocking rings with level or sloped edge in thickness and shape matching catch basin frame and grate. Include sealant recommended by ring manufacturer.
7. Grade Rings: Include two or three reinforced-concrete rings, of 6- to 9-inch (150- to 225-mm) total thickness, that match 24-inch- (610-mm-) diameter frame and grate.
8. Pipe Connectors: ASTM C 923 (ASTM C 923M), resilient, of size required, for each pipe connecting to base section.

B. Frames and Grates: ASTM A 536, Grade 60-40-18, ductile iron designed for A-16, structural loading. Include flat grate with small square or short-slotted drainage openings.

1. Size: 24 by 24 inches (610 by 610 mm) minimum unless otherwise indicated.
2. Grate Free Area: Approximately 50 percent unless otherwise indicated.

C. Frames and Grates: ASTM A 536, Grade 60-40-18, ductile iron designed for A-16, structural loading. Include 24-inch (610-mm) ID by 7- to 9-inch (175- to 225-mm) riser with 4-inch (102-mm) minimum width flange, and 26-inch- (660-mm-) diameter flat grate with small square or short-slotted drainage openings.

1. Grate Free Area: Per ADA standards.

2.5 PIPE OUTLETS

A. Head Walls: Cast-in-place reinforced concrete, with apron and tapered sides.
B. Riprap Basins: Broken, irregularly sized and shaped, graded stone according to the National Stone, Sand & Gravel Association (NSSGA's) "Quarried Stone for Erosion and Sediment Control."

1. Average Size: NSSGA No. R-5, screen opening 5 inches (127 mm).

PART 3 - EXECUTION

3.1 EARTHWORK

A. Excavation, trenching, and backfilling are specified in Section 312000 "Earth Moving."

3.2 PIPING INSTALLATION

A. General Locations and Arrangements: Drawing plans and details indicate general location and arrangement of underground storm drainage piping. Location and arrangement of piping layout take into account design considerations. Install piping as indicated, to extent practical. Where specific installation is not indicated, follow piping manufacturer's written instructions.

B. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements.

C. Install manholes for changes in direction unless fittings are indicated. Use fittings for branch connections unless direct tap into existing sewer is indicated.

D. Install proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.

E. When installing pipe under streets or other obstructions that cannot be disturbed, use pipe-jacking process of microtunneling.

F. Install gravity-flow, nonpressure drainage piping according to the following:

1. Install piping pitched down in direction of flow.
2. Install piping with 36-inch (915-mm) minimum cover or per plan.
3. Install PVC profile gravity sewer piping according to ASTM D 2321 and ASTM F 1668.

3.3 PIPE JOINT CONSTRUCTION

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

1. Join PVC profile gravity sewer piping according to ASTM D 2321 for elastomeric-seal joints or ASTM F 794 for gasketed joints.

3.4 CLEANOUT INSTALLATION

A. Install cleanouts and riser extensions from sewer pipes to cleanouts at grade. Use PVC pipe fittings in sewer pipes at branches for cleanouts and PVC pipe for riser extensions to cleanouts. Install piping so cleanouts open in direction of flow in sewer pipe.

B.

1. Use Heavy-Duty, top-loading classification cleanouts in vehicle-traffic service areas.

C. Set cleanout frames and covers in earth in cast-in-place concrete block, 18 by 18 by 12 inches deep. Set with tops 1 inch (25 mm) above surrounding earth grade.

D. Set cleanout frames and covers in concrete pavement and roads with tops flush with pavement surface.

3.5 DRAIN INSTALLATION

A. Install type of drains in locations indicated on plans.

B. Fasten grates to drains if indicated.

C. Set drain frames and covers with tops flush with pavement surface.

D. Assemble trench sections with flanged joints.

3.6 CATCH BASIN INSTALLATION

A. Construct catch basins to sizes and shapes indicated.

B. Set frames and grates to elevations indicated.

3.7 STORMWATER INLET AND OUTLET INSTALLATION

A. Construct inlet head walls, aprons, and sides of reinforced concrete, as indicated.

B. Construct riprap of broken stone, as indicated.

C. Install outlets that spill onto grade, anchored with concrete, where indicated.

D. Install outlets that spill onto grade, with flared end sections that match pipe, where indicated.

E. Construct energy dissipaters at outlets, as indicated.

3.8 CONCRETE PLACEMENT

A. Place cast-in-place concrete according to ACI 318.

3.9 CONNECTIONS

A. Connect nonpressure, gravity-flow drainage piping in building's storm building drains specified in Section 221413 "Facility Storm Drainage Piping."

B. Make connections to existing piping and underground manholes.

1. Use commercially manufactured wye fittings for piping branch connections. Remove section of existing pipe; install wye fitting into existing piping; and encase entire wye fitting, plus 6-inch (150-mm) overlap, with not less than 6 inches (150 mm) of concrete with 28-day compressive strength of 3000 psi (20.7 MPa).
2. Make branch connections from side into existing piping, NPS 4 to NPS 20. Remove section of existing pipe, install wye fitting into existing piping, and encase entire wye with not less than 6 inches (150 mm) of concrete with 28-day compressive strength of 3000 psi (20.7 MPa).
3. Protect existing piping, manholes, and structures to prevent concrete or debris from entering while making tap connections. Remove debris or other extraneous material that may accumulate.

3.10 IDENTIFICATION

A. Materials and their installation are specified in Section 312000 "Earth Moving." Arrange for installation of green warning tape directly over piping and at outside edge of underground structures.

1. Use detectable warning tape over ferrous piping.
2. Use detectable warning tape over nonferrous piping and over edges of underground structures.

3.11 FIELD QUALITY CONTROL

A. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches (610 mm) of backfill is in place, and again at completion of Project.

1. Submit separate reports for each system inspection.
2. Defects requiring correction include the following:

    a. Alignment: Less than full diameter of inside of pipe is visible between structures.
    b. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.
    c. Damage: Crushed, broken, cracked, or otherwise damaged piping.
    d. Infiltration: Water leakage into piping.
    e. Exfiltration: Water leakage from or around piping.

3. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.
4. Reinspect and repeat procedure until results are satisfactory.

B. Test new piping systems, and parts of existing systems that have been altered, extended, or repaired, for leaks and defects.

1. Do not enclose, cover, or put into service before inspection and approval.

2. Test completed piping systems according to requirements of authorities having jurisdiction.
3. Schedule tests and inspections by authorities having jurisdiction with at least 24 hours' advance notice.
4. Submit separate report for each test.
5. Gravity-Flow Storm Drainage Piping: Test according to requirements of authorities having jurisdiction, UNI-B-6, and the following:

    a. Exception: Piping with soiltight joints unless required by authorities having jurisdiction.
    b. Option: Test plastic piping according to ASTM F 1417.
    c. Option: Test concrete piping according to ASTM C 924 (ASTM C 924M).

6. Force-Main Storm Drainage Piping: Perform hydrostatic test after thrust blocks, supports, and anchors have hardened. Test at pressure not less than 1-1/2 times the maximum system operating pressure, but not less than 150 psig (1035 kPa).

    a. PVC Piping: Test according to AWWA M23, "Testing and Maintenance" Chapter.

C. Leaks and loss in test pressure constitute defects that must be repaired.

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

3.12 CLEANING

A. Clean interior of piping of dirt and superfluous materials. Flush with potable water.

END OF SECTION 334100