CITY OF GRAND JUNCTION
DEPARTMENT OF PUBLIC WORKS AND UTILITIES
ENGINEERING DIVISION

**G Road Bridge Replacement Project**

# SPECIAL PROVISIONS

## GENERAL:

The descriptions of the pay items listed in the Bid Schedule for this Project may not agree with those listed in the Standard Specifications. Payment for all Work performed, as required in the Contract Documents, will be in accordance with the items and units listed in the Bid Schedule.

## STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION:

The ***City of Grand Junction Standard Specifications for Road and Bridge Construction*** are hereby modified or supplemented for this Project by the following modifications to ***The Standard Specifications for Road and Bridge Construction***, State Department of Highways, Division of Highways, State of Colorado:

## SP-1 SECTION 203 – POTHOLING

Section 203 of the Standard Specifications is hereby revised for this project as follows:

Subsection 203.05(g) shall include the following:

All potholing shall be accomplished using noninvasive, vacuum equipment. All potholing methods and locations shall be preapproved by the Project Engineer. Any potholing that has not been preapproved by the Project Engineer shall be at the Contractor's expense.

## SP-2 SECTION 203 – PROOF ROLLING

Section 203 of the Standard Specifications is hereby revised for this project as follows:

Delete Subsection 203.11(f)

In Subsection 203.12, delete the pay item Proof Rolling and add the following:

Proof Rolling will not be measured and paid for separately but shall be included in the work.

## SP-3 SECTION 206 – EXCAVATION AND BACKFILL FOR STRUCTURES

Section 206 of the Standard Specifications is hereby revised for this project as follows:

Subsection 206.07 shall include the following:

Structure excavation and structure backfill required for all manholes, valve boxes, inlets, walls, pipes, culverts, utility conduits, extensions, removed pipes and removed conduits will not be measured and paid for separately but shall be included in the work.

## SP-4 SECTION 212 – SEEDING, FERTILIZER, SOIL CONDITIONER, AND SODDING

Section 212 of the Standard Specifications is hereby revised for this project as follows:

In Subsection 212.04, delete section (a) and replace with the following:

(a) Soil Preparation. Preparatory to seeding, the soil surface shall be loosened by rototilling to a minimum depth of 6". Spread organic soil amendment at a rate of 6 cubic yards per 1,000 square feet evenly over the surface and mix thoroughly into soil surface to minimum depth of 8 inches by a means of rototiller or soil mixer (ripper, discs, and chisel plows are not acceptable). Irregularities in the ground surface shall be removed.

In Subsection 212.05, delete section (a) and replace with the following:

(a) Soil Preparation. Preparatory to sodding, the soil surface shall be loosened by rototilling to a minimum depth of 6". Sticks, stones, debris, clods, asphalt, concrete, and other material more than 1 inch in any dimension shall be removed. Spread organic soil amendment at a rate of 6 cubic yards per 1,000 square feet (2 inches thick) evenly over the surface and mix thoroughly into soil surface to minimum depth of 8 inches by a means of rototiller or soil mixer (ripper, discs, and chisel plows are not acceptable). Irregularities in the ground surface shall be removed.

## SP-5 SECTION 504 – WALLS

Section 504 of the Standard Specifications is hereby revised for this project as follows:

### 504.01 Description

Add the following:

The work shall consist of furnishing materials, labor, equipment and supervision for the construction of a precast modular block (PMB) retaining wall structure in accordance with

the requirements of this section and in acceptable conformity with the lines, grades, design and dimensions shown in the project site plans.

**504.02 Materials**

Add the following:

The precast modular blocks shall be Redi-Rock units manufactured under license from Redi-Rock International, and meet the following requirements:

a) All units shall be wet-cast precast modular retaining wall units conforming to ASTM C1776.

b) All units for the project shall be obtained from the same manufacturer. The manufacturer shall be licensed and authorized to produce the retaining wall units by the precast modular block system patent holder/licensor and shall document compliance with the published quality control standards of the proprietary precast modular block system licensor for the previous three (3) years, or the total time the manufacturer has been licensed, whichever is less.

c) Concrete used in the production of the precast modular block units shall be first-purpose, fresh concrete. It shall not consist of returned, reconstituted, surplus or waste concrete. It shall be an original production mix meeting the requirements of ASTM C94 and exhibit the properties as shown in the following table:

## TABLE 504-1 Concrete Mix Properties

| Freeze Thaw Exposure Class[1] | Minimum 28-Day Compressive Strength[2] | Maximum Water Cement Ratio | Nominal Maximum Aggregate Size | Aggregate Class Designation[3] | Air Content[4] |
|---|---|---|---|---|---|
| Moderate | 4,000 psi (27.6 MPa) | 0.45 | 1 inch (25 mm) | 3M | 4.5% +/- 1.5% |
| Severe | 4,000 psi (27.6 MPa) | 0.45 | 1 inch (25 mm) | 3S | 6.0% +/- 1.5% |
| Very Severe | 4,500 psi (30.0 MPa) | 0.40 | 1 inch (25 mm) | 4S | 6.0% +/- 1.5% |
| **Maximum Water-Soluble Chloride Ion ($Cl^-$) Content in Concrete, Percent by Weight of Cement[5,6]** | | | | | 0.15 |
| **Maximum Chloride as $Cl^-$ Concentration in Mixing Water, Parts Per Million** | | | | | 1000 |
| **Maximum Percentage of Total Cementitious Materials By Weight [7,9] (Very Severe Exposure Class Only):** | | | | | |
| Fly Ash or Other Pozzolans Conforming to ASTM C618 | | | | | 25 |
| Slag Conforming to ASTM C989 | | | | | 50 |
| Silica Fume Conforming to ASTM C1240 | | | | | 10 |
| Total of Fly Ash or Other Pozzolans, Slag, and Silica Fume[8] | | | | | 50 |
| Total of Fly Ash or Other Pozzolans and Silica Fume[8] | | | | | 35 |
| **Alkali-Aggregate Reactivity Mitigation per ACI 201** | | | | | |
| **Slump (Conventional Concrete) per ASTM C143[10]** | | | | 5 inches +/- 1½ inches (125 mm +/- 40 mm) | |
| **Slump Flow (Self-Consolidating Concrete) per ASTM C1611** | | | | 18 inches – 32 inches (450 mm – 800 mm) | |

[1]Exposure class is as described in ACI 318. "Moderate" describes concrete that is exposed to freezing and thawing cycles and occasional exposure to moisture. "Severe" describes concrete that is exposed to freezing and thawing cycles and in continuous contact with moisture. "Very Severe" describes concrete that is exposed to freezing and thawing cycles and in continuous contact with moisture and exposed to deicing chemicals. Exposure class should be specified by owner/purchaser prior to order placement.

[2]Test method ASTM C39.

[3]Defined in ASTM C33 Table 3 *Limits for Deleterious Substances and Physical Property Requirements of Coarse Aggregates for Concrete*.

[4]Test method ASTM C231.

[5]Test method ASTM C1218 at age between 28 and 42 days.

[6]Where used in high sulfate environments or where alkali-silica reactivity is an issue, water soluble chloride shall be limited to no more than trace amounts (from impurities in concrete-making components, not intended constituents.)

[7]The total cementitious material also includes ASTM C150, C595, C845, C1157 cement. The maximum percentages shall include:

(a) Fly ash or other pozzolans in type IP, blended cement, ASTM C595, or ASTM C1157.
(b) Slag used in the manufacture of an IS blended cement, ASTM C595, or ASTM C1157.
(c) Silica fume, ASTM C1240, present in a blended cement.

[8]Fly ash or other pozzolans and silica fume shall constitute no more than 25 and 10 percent, respectively, of the total weight of the cementitious materials.

[9]Prescriptive limits shown may be waived for concrete mixes that demonstrate excellent freeze/thaw durability in a detailed and current testing program.

[10]Slump may be increased by a high-range water-reducing admixture.

d) Each concrete block shall be cast in a single continuous pour without cold joints. With the exception of half-block units, corner units and other special application units, the precast modular block units shall conform to the nominal dimensions listed in the table below and be produced to the dimensional tolerances shown.

**TABLE 504-2 Block Tolerances**

| Block Type | Dimension | Nominal Value | Tolerance |
|---|---|---|---|
| 28" (710 mm) Block | Height | 18" (457 mm) | +/- 3/16" (5 mm) |
| | Length | 46-1/8" (1172 mm) | +/- 1/2" (13 mm) |
| | Width* | 28" (710 mm) | +/- 1/2" (13 mm) |
| 41" (1030 mm) Block | Height | 18" (457 mm) | +/- 3/16" (5 mm) |
| | Length | 46-1/8" (1172 mm) | +/- 1/2" (13 mm) |
| | Width* | 40-1/2" (1030 mm) | +/- 1/2" (13 mm) |
| 60" (1520 mm) Block | Height | 18" (457 mm) | +/- 3/16" (5 mm) |
| | Length | 46-1/8" (1172 mm) | +/- 1/2" (13 mm) |
| | Width* | 60" (1520 mm) | +/- 1/2" (13 mm) |

* Block tolerance measurements shall exclude variable face texture

e) Individual block units shall have a nominal height of 18 inches (457 mm).

f) With the exception of half-block units, corner units and other special application units, the precast modular block units shall have two (2), circular dome shear knobs that are 10 inches (254 mm), 7.5 inches (190 mm), or 6.75 inches (171 mm) in diameter and 4 inches (102 mm) or 2 inches (51 mm) in height. The shear knobs shall fully index into a continuous semi-cylindrical shear channel in the bottom of the block course above. The peak interlock shear between any two (2) vertically stacked precast modular block units, with 10 inch (254 mm) diameter shear knobs, measured in accordance with ASTM D6916 shall exceed 6,500 lb/ft (95 kN/m) at a minimum normal load of 500 lb/ft (7kN/m). as well as an ultimate peak interface shear capacity in excess of 11,000 lb/ft (160 kN/m). The peak interlock shear between any two (2) vertically stacked precast modular block units, with 7.5 inch (190 mm) or 6.75 inch (171 mm) diameter shear knobs, measured in accordance with ASTM D6916 shall exceed 1,850 lb/ft (27 kN/m) at a minimum normal load of 500 lb/ft (7kN/m) as well as an ultimate peak interface shear capacity in excess of 10,000 lb/ft (146 kN/m).Test specimen blocks tested under ASTM D6916 shall be actual, full-scale production blocks of known compressive strength. The interface shear capacity reported shall be corrected for a 4,000 psi (27.6 MPa) concrete compressive strength. Regardless of precast modular block configuration, interface shear testing shall be completed without the inclusion of unit core infill aggregate.

g) The 28" (710 mm) and 41" (1030 mm) precast modular block units may be cast with a 13" (330 mm) wide, continuous vertical core slot completely through the block, or solid concrete.

h) Without field cutting or special modification, the precast modular block units shall be capable of achieving a minimum radius of 14 ft 6 in (4.42 m).

i) The precast modular block units shall be manufactured with an integrally cast shear knobs that establishes a standard horizontal set-back for subsequent block courses. The precast modular block system shall be available in the four (4) standard horizontal set-back facing batter options listed below:

| Horizontal Set-Back/Blk. Course | Max. Facing Batter |
|---|---|
| 3/8" (10 mm) | 1.2˚ |
| 1-5/8" (41 mm) | 5.2˚ |
| 9-3/8" (238 mm) | 27.5˚ |
| 16-5/8" (422 mm) | 42.7˚ |

The precast modular block units shall be furnished with the required shear knobs that provide the facing batter required in the construction shop drawings.

j) The precast modular block unit face texture shall be Ledgestone or City approved equal. Each textured block facing unit shall be a minimum of 5.76 square feet (0.54 square meters) with a unique texture pattern that repeats with a maximum frequency of once in any 15 square feet (1.4 square meters) of wall face.

k) The block color shall be Sandstone.

l) All precast modular block units shall be sound and free of cracks or other defects that would interfere with the proper installation of the unit, impair the strength or performance of the constructed wall. PMB units to be used in exposed wall construction shall not exhibit chips or cracks in the exposed face or faces of the unit that are not otherwise permitted. Chips smaller than 1.5" (38 mm) in its largest dimension and cracks not wider than 0.012" (0.3 mm) and not longer than 25% of the nominal height of the PMB unit shall be permitted. PMB units with bug holes in the exposed architectural face smaller than 0.75" (19 mm) in its largest dimension shall be permitted. Bug holes, water marks, and color variation on non-architectural faces are acceptable. PMB units that exhibit cracks that are continuous through any solid element of the PMB unit shall not be incorporated in the work regardless of the width or length of the crack.

m) Preapproved Manufacturers.

Manufacturers of Redi-Rock Retaining Wall Systems as licensed by Redi-Rock International, LLC, 05481 US 31 South, Charlevoix, MI 49720 USA; telephone (866) 222-8400; website www.redi- rock.com.

n) Substitutions. Technical information demonstrating conformance with the requirements of this specification for an alternative precast modular block retaining wall system must be submitted to the City for preapproval before the inquiry deadline of the City's solicitation. Acceptable alternative PMB retaining wall systems, otherwise found to be in conformance with this specification, shall be approved in writing by the City in the final posted addendum. The City reserves the right to provide no response to submissions made out of the time requirements of this section or to submissions of block retaining wall systems that are determined to be unacceptable to the owner.

o) Value Engineering Alternatives. The owner may evaluate and accept systems that meet the requirements of this specification after the bid date that provide a minimum cost savings of 20% to the Owner. Construction expediency will not be considered as a contributing portion of the cost savings total.

The precast modular block units shall be placed on a leveling pad constructed from crushed stone or unreinforced concrete. The leveling pad shall be constructed to the dimensions and limits shown on the retaining wall design drawings prepared by the Retaining Wall Design Engineer.

a) Crushed stone used for construction of a granular leveling pad shall meet the requirements of the drainage aggregate and wall infill in Section 206 or a preapproved alternate material.

b) Concrete used for construction of an unreinforced concrete leveling pad shall satisfy the criteria for AASHTO Class B. The concrete should be cured a minimum of 12 hours prior to placement of the precast modular block wall retaining units and exhibit a minimum 28-day compressive strength of 2,500 psi (17.2 MPa).

The Drainage collection pipe shall be a 4” (100 mm) diameter, 3-hole perforated, HDPE pipe with a minimum pipe stiffness of 22 psi (152 kPa) per ASTM D2412. The drainage pipe shall be manufactured in accordance with ASTM D1248 for HDPE pipe and fittings.

**504.03 Construction Requirements**

Add the following:

Prior to construction, the General Contractor, Grading Contractor, Retaining Wall Installation Contractor and Project Engineer shall examine the areas in which the retaining wall will be constructed to evaluate compliance with the requirements for installation tolerances, worker safety and any site conditions affecting performance of the completed structure. Installation shall proceed only after unsatisfactory conditions have been corrected.

A. PREPARATION

1) Fill Soil.
   a. The Project Engineer shall verify that retained backfill material placed within a horizontal distance of one (1.0) times the wall height behind the wall blocks satisfies the criteria of this section.
   b. The Project Engineer shall verify that any fill soil installed in the foundation and retained soil zones of the retaining wall satisfies the specification of the Retaining Wall Design Engineer as shown on the construction drawings.

2) Excavation.
   a. The Contractor shall excavate to the lines and grades required for construction of the precast modular block retaining wall as shown on the construction drawings. The Contractor shall minimize over-excavation. Excavation support, if required, shall be the responsibility of the Contractor.

   b. Over-excavated soil shall be replaced with compacted fill in conformance with the specifications of the Retaining Wall Design Engineer and “Division 31, Section 31 20 00 – Earthmoving” of these project specifications.

3) Foundation Preparation.
   a. Prior to construction of the precast modular block retaining wall, the leveling pad area and undercut zone (if applicable) shall be cleared and grubbed. All topsoil, brush, frozen soil and organic material shall be removed. Additional foundation soils found to be unsatisfactory beyond the specified undercut limits shall be undercut and replaced with approved fill as directed by the Project Engineer.

   b. Following excavation for the leveling pad and undercut zone (if applicable), the Project Engineer shall evaluate the in-situ soil in the foundation and retained soil zones.

      I. The Project Engineer shall verify that the shear strength of the in-situ soil assumed by the Retaining Wall Design Engineer is appropriate.

      II. The Project Engineer shall verify that the foundation soil exhibits sufficient ultimate bearing capacity to satisfy the requirements indicated on the retaining wall construction shop drawings per paragraph 1.06 I of this section.

4) Leveling Pad.
   a. The leveling pad shall be constructed to provide a level, hard surface on which to place the first course of precast modular block units. The leveling pad shall be placed in the dimensions shown on the retaining wall construction drawings and extend to the limits indicated.

   b. Crushed Stone Leveling Pad. Crushed stone shall be placed in uniform maximum lifts of 6” (150 mm). The crushed stone shall be compacted by a minimum of 3 passes of a vibratory compactor capable of exerting 2,000 lb (8.9 kN) of centrifugal force and to the

satisfaction of the Inspection Engineer.

c. Unreinforced Concrete Leveling Pad. The concrete shall be placed in the same dimensions as those required for the crushed stone leveling pad. The Retaining Wall Installation Contractor shall erect proper forms as required to ensure the accurate placement of the concrete leveling pad according to the retaining wall construction drawings.

B. PRECAST MODULAR BLOCK WALL SYSTEM INSTALLATION

1) The precast modular block structure shall be constructed in accordance with the construction drawings, these specifications and the recommendations of the retaining wall system component manufacturers. Where conflicts exist between the manufacturer's recommendations and these specifications, these specifications shall prevail.

2) Drainage components. Pipe, geotextile and drainage aggregate shall be installed as shown on the construction shop drawings.

3) Precast Modular Block Installation
   a. The first course of block units shall be placed with the front face edges tightly abutted together on adjacent blocks, on the prepared leveling pad at the locations and elevations shown on the construction drawings. The Retaining Wall Installation Contractor shall take special care to ensure that the bottom course of block units are in full contact with the leveling pad, are set level and true and are properly aligned according to the locations shown on the construction drawings.

   b. Backfill shall be placed in front of the bottom course of blocks prior to placement of subsequent block courses. Nonwoven geotextile fabric shall be placed in the V-shaped joints between adjacent blocks. Drainage aggregate shall be placed in the V-shaped joints between adjacent blocks, and extend to a minimum distance of 12" (300 mm) behind the block unit.

   c. Drainage aggregate shall be placed in 9 inch maximum lifts and compacted by a minimum of three (3) passes of a vibratory plate compactor capable exerting a minimum of 2,000 lb (8.9 kN) of centrifugal force.

   d. Unit core fill shall be placed in the precast modular block unit vertical core slot. The core fill shall completely fill the slot to the level of the top of the block unit. The top of the block unit shall be broom-cleaned prior

to placement of subsequent block courses. No additional courses of precast modular blocks may be stacked before the unit core fill is installed in the blocks on the course below.

e. Base course blocks for gravity wall designs (without geosynthetic soil reinforcement) may be furnished without vertical core slots. If so, disregard item 4 above, for the base course blocks in this application.

f. Nonwoven geotextile fabric shall be placed between the drainage aggregate and the retained soil (gravity wall design) if required on the retaining wall construction drawings.

g. Subsequent courses of block units shall be installed with a running bond (half block horizontal course-to-course offset). With the exception of 90 degree corner units, the shear channel of the upper block shall be fully engaged with the shear knobs of the block course below. The upper block course shall be pushed forward to fully engage the interface shear key between the blocks and to ensure consistent face batter and wall alignment. Drainage aggregate, unit core fill, geotextile and properly compacted backfill shall be complete and in-place for each course of block units before the next course of blocks is stacked.

h. The elevation of retained soil fill shall not be less than 1 block course (18” (457 mm)) below the elevation of the retained backfill throughout the construction of the retaining wall.

i. If included as part of the precast modular block wall design, cap units shall be secured with an adhesive in accordance with the precast modular block manufacturer’s recommendation.

4) Construction Tolerance. Allowable construction tolerance of the retaining wall shall be as follows:

a. Deviation from the design batter and horizontal alignment, when measured along a 10’ (3 m) straight wall section, shall not exceed 3/4” (19 mm).

b. Deviation from the overall design batter shall not exceed 1/2“ (13 mm) per 10’ (3 m) of wall height.

c. The maximum allowable offset (horizontal bulge) of the face in any precast modular block joint shall be 1/2” (13 mm).

d. The base of the precast modular block wall excavation shall be within 2” (50 mm) of the staked elevations, unless otherwise approved by the Inspection Engineer.

e. Differential vertical settlement of the face shall not exceed 1’ (300 mm) along any 200’ (61 m) of wall length.

f. The maximum allowable vertical displacement of the face in any precast modular block joint shall be 1/2“ (13 mm).

g. The wall face shall be placed within 2” (50 mm) of the horizontal location staked.

C. WALL INFILL AND BACKFILL PLACEMENT

1) Backfill material placed immediately behind the drainage aggregate shall be compacted as follows:
   a. 98% of maximum dry density at ± 2% optimum moisture content per ASTM D698 standard proctor or 85% relative density per ASTM D4254.

2) Compactive effort within 3’ (0.9 m) of the back of the precast modular blocks should be accomplished with walk-behind compactors. Compaction in this zone shall be within 95% of maximum dry density as measured in accordance with ASTM D698 standard proctor or 80% relative density per ASTM D 4254. Heavy equipment should not be operated within 3’ (0.9 m) of the back of the precast modular blocks.

3) Backfill material shall be installed in lifts that do not exceed a compacted thickness of 9” (230 mm).

4) At the end of each work day, the Retaining Wall Installation Contractor shall grade the surface of the last lift of the granular wall infill to a 3% ± 1% slope away from the precast modular block wall face and compact it.

5) The Contractor shall protect the precast modular block wall structure against surface water runoff at all times through the use of berms, diversion ditches, silt fence, temporary drains and/or any other necessary measures to prevent soil staining of the wall face, scour of the retaining wall foundation or erosion of the reinforced backfill or wall infill.

D. OBSTRUCTIONS IN THE INFILL ZONE

1) The Retaining Wall Installation Contractor shall make all required allowances for obstructions behind and through the wall face in accordance with the approved construction shop drawings.

2) Should unplanned obstructions become apparent for which the approved construction shop drawings do not account, the affected portion of the wall shall not be constructed until the Retaining Wall Design Engineer can

appropriately address the required procedures for construction of the wall section in question.

E. COMPLETION

1) For walls supporting unpaved areas, a minimum of 12” (300 mm) of compacted, low-permeability fill shall be placed over the granular wall infill zone of the precast modular block retaining wall structure. The adjacent retained soil shall be graded to prevent ponding of water behind the completed retaining wall.

2) The Contractor shall confirm that the as-built precast modular block wall geometries conform to the requirements of this section. The Contractor shall notify the Owner of any deviations.

**504.04 Method of Measurement**

Add the following:

Precast concrete block retaining walls will be measured by the number of square feet of facial area

**504.05 Basis of Payment**

Add the following:

Payment will be made under:

| **Pay Item** | **Pay Unit** |
|---|---|
| Precast Concrete Block Retaining Wall System | Facial Square Foot |

**SP-6 SECTION 613 – ELECTRICAL CONDUIT - GENERAL**

Section 613 of the Standard Specifications is hereby revised for this project as follows:

Subsection 613.07 shall include the following:

All conduit installed under the paved roadway shall be Schedule 80 PVC. All conduit bends, including factory installed bends, shall not have a bend radius less than six times the inside diameter of the conduit.

Off-street trenches shall be backfilled with the same material that was removed and shall be compacted and shaped to match the surrounding surface.

All empty conduit runs shall have a #10 A.W.G. solid copper conductor (tracer wire) placed inside for locating purposes. In addition, a pull rope should be left in each conduit after installation. At least 18 inches above the conduit, a red plastic tape shall be placed to warn of the electrical conduit. Locating conductor (tracer wire), pull rope, and tape will not be measured and paid separately, but shall be included in the unit price for conduit.

## SP-7 SECTION 630 – PORTABLE MESSAGE SIGN PANEL

Section 630 of the Standard Specifications is hereby revised for this project as follows:

Subsection 630.01 shall include the following:

This project shall require the mobilization, operation, and maintaining of portable message sign panels. Three (3) portable message sign panels will be required to be available for utilization on the project, within 12 hours of the Project Engineer's request, for the duration of the project. Additional portable message sign panels may be required during the progress of the work. Multiple mobilizations of the sign panels may also be required.

Add Subsection 630.031 immediately following subsection 630.03 as follows:

**630.031 Portable Message Sign Panel.** Portable message sign panel shall be furnished as a device fully self-contained on a portable trailer, capable of being licensed for normal highway travel, and shall include leveling and stabilization jacks. The panel shall display a minimum of three – eight character lines. The panel shall be a dot-matrix type with an LED legend on a flat black background. LED signs shall have a pre-default message that activates before a power failure. The sign shall be solar powered with independent back-up battery power. The sign shall be capable of 360 degrees rotation and shall be able to be elevated to a height of at least five feet above the ground measured at the bottom of the sign. The sign shall be visible from one-half mile under both day and night conditions. The message shall be legible from a minimum of 750 feet. The sign shall automatically adjust its light source to meet the legibility requirements during the hours of darkness. The sign enclosure shall be weather tight and provide a clear polycarbonate front cover.

Solar powered message signs shall be capable of operating continuously for 10-days with any sun. All instrumentation and controls shall be contained in a lockable enclosure. The sign shall be capable of changing and displaying sign messages and other sign features such as flash rates, moving arrow, etc.

The Contractor and Project Engineer shall decide together the best locations for the portable message sign panels. The portable message sign panels shall be placed at strategic locations at least 10-days prior to any roadway closures.

## SP-8 FORCE ACCOUNT ITEMS

### FORCE ACCOUNT ITEMS
### DESCRIPTION

The special provision contains the City's estimate for force account items included in the Contract. Force Account work shall be performed as directed by the Project Engineer.

### BASIS OF PAYMENT

Payment will be made in accordance with subsection 109.04 in CDOT's Standard Specifications for Road and Bridge Construction. Payment will constitute full compensation for all work necessary to complete the item.

| Force Account Item | Quantity | Estimated Amount |
|---|---|---|
| F/A Furnish & Install Electrical Service | F.A. | $12,000 |
| F/A Sprinklers | F.A. | $5,000 |

F/A Furnish & Install Electrical Service – This force account will be used to reimburse the Contractor for the Utility company (Xcel Energy) furnishing and installing the electrical service.

F/A Sprinklers – This force account will be used to reimburse the Contractor for labor and supplies used to repair the private irrigation system at the Golden Gate Gas Station.

## STANDARD SPECIFICATIONS FOR CONSTRUCTION OF WATER LINES, SANITARY SEWERS, STORM DRAINS, UNDERDRAINS AND IRRIGATION SYSTEMS

The City of Grand Junction ***Standard Specifications for Construction of Water Lines, Sanitary Sewers, Storm Drains, Underdrains and Irrigation Systems*** are hereby modified for this Project as follows:

## SP-9 WATERLINE SPECIFICATIONS

For waterline construction, this G Road Bridge Replacement Project shall reference Ute Water Conservancy District's waterline specifications and standard waterline details. Ute Water's waterline specifications are provided within Appendix B – Project Manual. Ute Water's standard waterline details are provided in the construction plans. Any questions regarding waterline construction shall be directed to the City Project Engineer who will then contact Ute Water for advice and answers.

## SP-10 SECTION 102 – MATERIALS

Section 102 of the Standard Specification is hereby revised for this project as follows:

Within subsection 102.11, replaced the first sentence within the Corrosion Protection section with the following sentence:

> All drop manholes (manholes with fall greater than 0.40' fall through the manhole), force main outlet manholes, and lift station wet wells shall be coated on the interior surfaces of the riser, cone and other exposed concrete surfaces with a **minimum 100 mil dry film thickness** of Sherwin Williams COR-COTE SC Sewer Cote; Tnemec Perma-Glaze Series 435; Sauereisen SewerGard 210 XHB, or an approved equal.

## SP-11 SECTION 103 – REMOVALS, EXCAVATION, BACKFILLING & RESTORATION

Section 103 of the Standard Specifications is hereby revised for this project as follows:

Subsection 103.10, Cutoff Walls, shall include the following:

> Payment for this work will not be measured or paid for separately and will be considered incidental to the installation of Gravity Sewer Pipe. Refer to Section 108.13 for list of Incidental Construction items.

Subsection 103.16, Earth Backfill Material, shall include the following:

> Native material excavated on site shall be used for backfill on all pipelines and appurtenances above the bedding and haunching material unless the native

material is too wet and/or otherwise unsuitable for backfill as determined by the Project Engineer or the Project Inspector. In such case, imported trench backfill material, or other approved material, shall be used and paid for per ton of material supplied, placed and compacted. The Contractor will be required to salvage useable materials from the project excavations and mix the useable material with imported trench backfill prior to placing backfill in the trench. The contract price for “Imported Trench Backfill” shall include the disposal of the unsuitable material.

## SP-12 SECTION 105 – PIPELINE TESTING

This is a new sewer installation project, and as a result, the new sewer pipe shall be tested for leakage and alignment before final acceptance per Section 105 – Pipeline Testing.

The City will provide CCTV video inspection of the new sewer lines. The Contractor will not be responsible for CCTV video inspection. The Contractor shall notify either the Project Engineer or Project Inspector when the sewer line is ready for CCTV video inspection. If requested by the City, the Contractor shall provide water to dump down the new sewer lines before CCTV video inspection starts.

# Ute Water Specifications

**SECTION 01043**
**COORDINATION AND CONTROL OF THE WORK**

## PART 1: GENERAL

1.1 SCOPE

A) This section includes coordination and control of the work.

## PART 2: PRODUCTS

None

## PART 3: EXECUTION

3.1 FIELD RECORD PLANS

A) Contractor shall maintain one complete set of plans at the construction site whereon he will record any approved deviations in construction from the approved plans. Prior to final payment, the Contractor shall provide the following record information on a clean set of drawings which shall be submitted to the Engineer or Ute Water Conservancy District:

1) Water Mainline - Station and depth of all fittings, valves and service taps.

2) Water Services - Length from mainline and side tie to property pin.

3) Existing Utilities - Station locations, size, material and depth at crossings.

3.2 CONFORMITY WITH DRAWINGS AND ALLOWABLE DEVIATIONS

A) Finished surfaces in all cases shall conform to lines, grades, cross sections and dimensions shown on the Final For Construction drawings. Deviations from the approved drawings and working drawings will in all cases be determined by the Engineer and authorized in writing.

3.3 PROTECTION OF EXISTING FACILITIES

A) The Contractor shall protect from damage due to his construction operations, all existing facilities including but not limited to survey monuments, fence lines,

trees, underground utilities, drainage facilities, landscaping, roadway surfaces etc., which are not specifically designated for removal or alteration.

B) The locations of these facilities as shown on the plans were derived from the best information available. However, the completeness and accuracy of these locations as shown is not guaranteed. It shall be the responsibility of the Contractor to verify the existence and locations of underground facilities in advance of construction.

C) Any existing facilities not designated for removal or alteration, which are damaged by the Contractor's operations shall be restored or replaced to an "in kind" or better condition at the expense of the Contractor.

D) The Contractor shall notify all public and private utility companies serving in the area in advance of construction, so underground utility locations can be confirmed and existing facilities relocated if necessary to facilitate construction. Make excavations and borings ahead of work, as necessary, to determine the exact location of interfering utilities or underground utilities.

## 3.4 PROTECTION OF PROPERTY

A) Protect all public and private property, insofar as it may be endangered by operations and take every reasonable precaution to avoid damage to such property.

B) Restore and bear the cost of any public or private improvement, facility, or structure within the right-of-way or easement which is damaged or injured directly or indirectly by or on account of any act, omission, or neglect in the execution of the work and which is not designated for removal but visibly evident or correctly shown on the plans. Restore to a condition substantially equivalent to that existing before such damage or injury occurred, by repairing, rebuilding, or otherwise affecting restoration thereof, or if this is not feasible, make a suitable settlement with the Owner of the damaged property, all at no expense to the Owner.

C) Give reasonable notice to occupants of buildings on property adjacent to the work to permit the occupants to remove vehicles, trailers, and other possessions as well as salvage or relocate plants, trees, fences, sprinkler systems, or other improvements in the right-of-way which are designated for removal or which might be destroyed or damaged by work operations.

D) Review with Engineer the location, limits and methods to be used prior to clearing work. Clearing and grubbing shall be performed in strict compliance with all local, State and Federal laws.

E) The Contractor shall be responsible for the protection of public and private property adjacent to the work and shall exercise due caution to avoid damage to such property.

F) Trees, lawns, and shrubbery that are not to be removed shall be protected from damage or injury. If damaged or removed because of the Contractor's operations, they shall be restored or replaced in as nearly the original condition and location as is reasonably possible. Lawns shall be reseeded after replacement of topsoil and covered with suitable mulch except as noted otherwise.

G) The costs to the Contractor for protecting, repairing, removing, replacing, or restoring existing improvements not required as a part of this work shall be incidental to other bid items.

## 3.5 REMOVAL OF DEFECTIVE OR UNAUTHORIZED WORK

A) All work which does not conform to the requirements of these Contract Documents shall be considered as unacceptable. Immediately remove unacceptable and defective work found to exist prior to acceptance of or final payment for the work. Replace with work and materials which conform to the Contract Documents, or remedy otherwise in an approved manner. This provision shall have full effect regardless of the fact that the unacceptable work may have been done or the defective materials used with the full knowledge of the Inspector.

## 3.6 HOURS OF WORK

A) Construction working hours shall be from 7:00 A.M. to 6:00 P.M. local time, Monday through Friday, excluding Federal, State and local holidays, unless otherwise approved by the Owner and Engineer.

## 3.7 RESTORATION AND CLEANUP

A) Periodically, or as directed by the Engineer, as the work progresses, and immediately after completion of the work, clean up and remove all refuse, debris, equipment, and unused materials of any kind resulting from the work. Upon failure to do so within 72 hours after directed, the work may be done by the Owner or third party and the cost thereof be deducted from any payment due the Contractor.

B) As a condition precedent to final acceptance of the project, remove all equipment and temporary structures, and all rubbish, waste and general clean up the right-of-way and premises to conform substantially to conditions as they existed before the commencement of work, as approved.

## 3.8 FINAL INSPECTION

A) When all construction work on the project is complete and all extra work bills, forms and documents required under the Contract are submitted, notify the Engineer in writing. Engineer will make an inspection of the project and project records within 15 days of receiving said notice. If, at such inspection, all construction provided for and ordered under the Contract is found completed and satisfactory and all certificates, bills, forms, and documents have been properly submitted, such inspection shall constitute final inspection.

B) If work is found unsatisfactory, or if all certificates, bills, forms and documents have not been properly submitted, the Engineer will so notify the Contractor. After corrections are made, or all certificates, bills, forms, or documents are properly submitted, notify the Engineer in writing. Engineer will make another inspection within five (5) days after such notice, and if all work is satisfactory, then this inspection shall constitute the final inspection.

## 3.9 WARRANTY BOND

A) The Contractor shall be responsible for a period of one year after written acceptance of improvements by Approving Agencies for all workmanship and materials furnished for the improvements or under the Contract. Prior to final payment, Contractor shall provide a one-year warranty bond. One-year period to begin upon Approving Agencies final acceptance of all work. The bond shall be in a form acceptable to Owner and Approving Agency.

## 3.10 VERBAL AGREEMENTS

A) No verbal agreement or conversation with any officer, agent or employee of the Owner, either before or after execution of the Agreement, shall affect or modify any of the terms or obligations contained in any of the documents comprising the Agreement. Any such verbal agreement or conversation shall be considered as unofficial information and in no way binding upon the Owner.

## 3.11 COOPERATION OF CONTRACTOR

A) The Contractor shall conduct his operations so as to interfere as little as possible with those of the Owner, other Contractors, utilities, or any public authority on or near the work. The Owner reserves the right to perform other work by Contract or otherwise; to permit other public bodies, public utility companies and others to do work on or near the project during progress of the work. If a conflict arises, the Owner shall determine when and how the work shall proceed.

B) Claims for delay or inconvenience due to operations of such other parties on work indicated or shown on the drawings will not be allowed.

## 3.12 MANDATORY PROJECT SUPERINTENDENT

A) The Contractor shall designate one person as primary project superintendent to oversee and coordinate construction. The superintendent shall be capable of reading and thoroughly understanding the plans and specifications, thoroughly experienced in the type of work being performed. If the Contractor is a joint venture, designate one person from the joint venture organization, with these qualifications, to act as project superintendent. This person's work time shall be devoted exclusively to this project to ensure that work coordination, quality and timelines are met.

B) For short periods of time during the performance of minor or incidental portions of the work, the Contractor may designate another person to act for the superintendent. This designation shall be in writing, stating the person's name, duration of appointment and scope of authority. The acting superintendent shall be available to the Engineer at all times for contact by telephone or radio.

C) Failure to provide the superintendence required by these provisions is sufficient cause for termination of the Contract, or other action the Engineer may deem to be appropriate.

## 3.13 EMERGENCY MAINTENANCE SUPERVISOR

A) The Contractor shall submit to the Owner/Engineer the names, addresses and telephone numbers of two employees responsible for performing emergency maintenance and repairs when the Contractor is not working. These employees shall be designated, in writing by the Contractor, to act as his representatives and shall have full authority to act on his behalf.

3.14 CONDUCT

A) The Contractor and his men shall at all times be civil and courteous around private citizens and property owners. If ever directed to leave private property by the property owner or his representative, the Contractor and his personnel shall do so immediately. If any property owner or his representative makes demands, the Contractor is to remain courteous and report the matter to the Engineer. No foul language, obscene gestures, or rudeness directed to private citizens will be tolerated. Radios and personal stereos will not be permitted. If, in the Engineer's opinion, the Contractor or any of his men fail to conduct themselves as stipulated or follow the direction of the Engineer, the Engineer shall bar the offending individual from the project. His order shall be final.

3.15 TRESPASS

A) The Contractor will be solely responsible for any trespass upon private property or injury thereto resulting from or in connection with his operations. He will be liable for any claims made because of his trespass or his deposit of debris of any kind on private property.

3.16 USE OR POSSESSION PRIOR TO FINAL COMPLETION

A) The Owner or his agents shall have the right to take possession of or use for his own benefit any completed or partially completed part of the work. Such possession or use shall not be deemed an acceptance of the occupied portion of the project. While the Owner is in such possession, the Contractor shall be relieved of the responsibility for injury or damage to the said completed portion of the work other than that resulting from the Contractor's fault or negligence. Continued operation or use of facilities being rehabilitated shall not be construed as use or possession prior to final completion.

B) Prior to the Owner or his agents taking possession of or using any completed or partially completed part of the work, written notice shall be given by the Engineer to the Contractor at least 24 hours in advance of the Owner actually assuming possession.

3.17 UNAUTHORIZED WORK

A) Work done beyond the lines shown on the drawings or ordered, work done without required inspection, except as herein provided, or any extra work done without authority will be considered as unauthorized and will not be paid for under the provisions of these Contract Documents. Work so done may be ordered

removed at the Contractor's expense. Work done without lines and grades being given may also be considered as unauthorized and will be subject to rejection.

## 3.18 SUBSURFACE DATA

A) All information obtained by Engineer regarding subsurface conditions and groundwater elevations will be available for inspection at the office of the Engineer upon request.

B) Logs of test holes, test pits, soils reports, groundwater levels, and other supplementary subsurface information are offered as the best available information of underlying materials and conditions at the locations actually tested. The Owner will not be liable for any loss sustained by the Contractor as a result of any variance between conditions contained in or interpretations of test reports and the actual conditions encountered during progress of the work.

C) Contractor shall examine the site and available records. The submission of a Proposal shall be conclusive evidence that the Bidder has investigated and is satisfied as to the subsurface conditions to be encountered as to the character, quality, and quantities of work to be performed and materials to be furnished, and as to the requirements of the Contract Documents.

## 3.19 TEMPORARY WATER

A) The Contractor shall provide all water, required to construct and protect the work until the work is placed in service by the Owner for beneficial use of the Owner.

B) The source for temporary water shall be from the Owner's distribution system as approved by the Owner.

## 3.20 BARRICADES

A) The Contractor must provide and maintain proper barricades, fences, signal lights, flares or watchmen to properly protect the work, equipment, persons, animals and property against injury.

B) In areas of public travel and/or on all approaches leading to this work, all barricades and obstructions shall be illuminated at night. All lights for this purpose shall be kept burning from sunset to sunrise.

C) Temporary traffic control devices and facilities shall be furnished, erected and maintained in accordance with all Local and State requirements.

## 3.21 MAINTAINING TRAFFIC

A) Where Contract work is within streets or other public thoroughfares, the Contractor shall so plan and schedule his work as to cause as little interference with general public traffic. Street surfaces shall be maintained and kept clean where construction work under this Contract has been performed until inspection and acceptance of all such work.

B) Access of fire, police and ambulance vehicles to property abutting and adjacent to such thoroughfares shall be maintained whether or not permission has been granted to restrict other traffic. The Contractor shall obtain all permits from Municipal, County, State or other authority having jurisdiction over traffic in thoroughfares, and shall comply with all regulations and directions of such authority concerning erecting barricades and detouring movement of traffic.

C) The Contractor shall maintain the roads for operating personnel, deliveries of operating supplies, normal maintenance vehicles and other equipment incidental to the operation and maintenance of the Owner's facility.

## 3.22 DISPOSAL OF DEBRIS

A) All debris resulting from construction operations, i.e., packaging, waste materials, damaged equipment, etc., shall be trucked from the site by the Contractor and disposed of at an approved off site location.

B) The Contractor shall police the hauling of debris to ensure that all spillage from haul trucks is promptly and completely removed.

C) All debris shall be disposed of in accordance with Federal, State and City rules and regulations.

D) Excavated materials not suitable or not required for backfill or embankment shall be deposited on one or both of the following waste sites:

1) Waste sites designated in the Contract Documents.

2) Waste sites provided by the Contractor.

E) All costs for disposing of this excess material shall be incidental to other items of work contained in the Proposal unless otherwise specified.

F) Either type of waste site shall be operated in such a manner as to meet all safety and health requirements of State and local agencies. Sites, operations, or the

result of such operations, which create a nuisance problem, or which result in damage to public or private properties will not be permitted.

G) Permits for dumping on sites designated in the Contract Documents will be provided by the Owner. Contractor shall obtain permits for other sites at no expense to Owner. Furnish copies of issued permits to Engineer prior to commencing filling operations.

## 3.23 SANITARY REGULATIONS

A) Toilet accommodations shall also be maintained for the use of the employees on the work. The accommodations shall be in approved locations, properly screened from public observance and shall be maintained in a strictly sanitary manner.

B) The Contractor shall obey and enforce all other sanitary regulations and orders and shall take precautions against infectious diseases.

C) The Contractor shall maintain at all times, satisfactory sanitary conditions around all parts of the work all in accordance with all Federal, State and Local ordinances, regulations and requirements.

## 3.24 DUST CONTROL

A) The Contractor shall apply water or dust palliative, or both, for the alleviation or prevention of dust nuisance caused by his operations. Dust control operations shall be performed by the Contractor at the time(s) as required or as ordered by the Owner. Failure of the Owner to issue such order will not relieve the Contractor of this responsibility.

B) The Contractor shall comply with all Federal, State and Local ordinances, regulations and requirements.

C) Unless otherwise specified, no direct payment will be made for any such work performed or material used to control dust under these Contract Documents.

## 3.25 SMOKE PREVENTION

A) Strict compliance with all ordinances regulating the production and emission of smoke will be required and the Contractor shall accept full responsibility for all damage that may occur to property as a result of negligence in providing required control. The Contractor shall comply with all Federal, State and local regulations.

## 3.26 CONTROL OF NOISE

A) The Contractor shall eliminate noise to as great an extent as possible at all times. Air compressors shall be equipped with silencers and the exhaust of all gasoline motors and other power equipment shall be provided with mufflers. In the vicinity of hospitals, libraries and schools, precautions shall be taken to avoid noise and other nuisance. The Contractor shall require strict observances of all pertinent ordinances and regulations.

## 3.27 USE OF EXPLOSIVES

A) The use of explosives shall not be permitted.

## 3.28 WEATHER CONDITIONS

A) In the event of temporary suspension of the work or during inclement weather, or whenever the Engineer shall direct, the Contractor shall carefully protect (and cause his Subcontractors to similarly protect) all work and materials against damage or injury from the weather.

B) If, in the opinion of the Engineer, any work or materials have been damaged by reason of failure on the part of the Contractor or any of his Subcontractors to so protect his work, such materials shall be removed and replaced at the expense of the Contractor.

## 3.29 FAIR EMPLOYMENT PRACTICES ACT

A) The Contractor agrees that neither he nor his Subcontractors will discriminate against any employee or applicant for employment, to be employed in the performance of this Contract, with respect to his hire, tenure, terms, conditions or privileges of employment, or any matter directly or indirectly related to employment, because of his race, color, religion, national origin or ancestry.

B) Breach of this covenant shall be regarded as a material breach of this Contract.

## 3.30 CONSTRUCTION ACCESS

A) The Contractor shall be responsible for design, construction and maintenance of any and all structures required for access to the site for construction or delivery of materials, including but not limited to construction access roads. The Owner's responsibility to provide access easements or right-of-ways to the construction site shall not be interpreted as relieving the Contractor of his responsibilities under this section.

## PART 4: SPECIAL PROVISIONS

### 4.1 MEASUREMENT AND PAYMENT

A) When not listed in the proposal, all "COORDINATION AND CONTROL OF THE WORK" costs will be considered incidental work for which no separate payment will be made.

### 4.2 COORDINATION OF WORK

A) The Contractor shall cooperate with the Owner's field representative for coordination and expeditious execution of his work in relation to total project work required.

### 4.3 TECHNICAL REQUIREMENTS

A) All materials and workmanship shall conform to all Federal, State and Local codes and the technical specifications contained herein.

B) All materials and workmanship for facilities in street right-of-way or easements shall conform to approving agencies' construction specifications. The Contractor must review the construction specifications and take these requirements into consideration in the preparation of his bid.

END OF SECTION

**SECTION 01090**
**REFERENCE STANDARDS**

## PART 1: GENERAL

1.1 SCOPE

A) This Section includes reference standards.

1.2 DESIGNATION OF ASSOCIATIONS, INSTITUTIONS, SOCIETIES AND STANDARDS

A) Whenever in these Specifications reference is made to Associations, Institutions, Societies or Standards, they will be designated as follows:

| | |
|---|---|
| **AASHTO** | American Association of State Highway and Transportation Officials |
| **ACI** | American Concrete Institute |
| **ADA** | American Disability Act |
| **AGA** | American Gas Association |
| **AIA** | American Institute of Architects |
| **AISC** | American Institute of Steel Construction |
| **AISI** | American Iron and Steel Institute |
| **ANSI** | American National Standards Institute |
| **API** | American Petroleum Institute |
| **APWA** | American Public Works Association |
| **AREA** | American Railway Engineering Association |
| **ASA** | American Standards Association |
| **ASCE** | American Society of Civil Engineers |
| **ASME** | American Society of Mechanical Engineers |
| **ASTM** | American Society for Testing and Materials |
| **AWPA** | American Wood Preservers Association |
| **AWS** | American Welding Society |
| **AWWA** | American Water Works Association |
| **BLIS** | Bureau of Labor and Industries Standards |
| **BLM** | Bureau of Land Management |
| **CDOT** | Colorado Department of Transportation |
| **CISPI** | Cast Iron Soil Pipe Institute |
| **COE** | Corps of Engineers |
| **CRSI** | Concrete Reinforcing Steel Institute |
| **DEQ** | Department of Environmental Quality |

| | |
|---|---|
| **CDPHE** | Colorado Department of Public Health and the Environment |
| **EPA** | Environmental Protection Agency |
| **FHWA** | Federal Highway Administration |
| **FS** | Federal Standards |
| **IRI** | Industrial Risk Insurance |
| **ISA** | Instrument Society of America |
| **ISO** | Insurance Service Office |
| **ITE** | Institute of Traffic Engineers |
| **MUTCD** | Manual of Uniform Traffic Control Devices |
| **NBS** | National Bureau of Standards |
| **NEC** | National Electrical Code |
| **NESC** | National Electric Safety Code |
| **NEMA** | National Electrical Manufacturer's Association |
| **NFPA** | National Fire Protection Association |
| **NLMA** | National Lumber Manufacturer's Association |
| **OSHA** | Occupational Safety and Health Administration |
| **PCA** | Portland Cement Association |
| **SSPC** | Steel Structures Painting Council |
| **UBC** | Uniform Building Code |
| **UFC** | Uniform Fire Code |
| **UL** | Underwriter's Laboratories, Inc. |
| **UPC** | Uniform Plumbing Code |
| **USBM** | United States Bureau of Mines |
| **WWPA** | Western Wood Products Association |

Wherever specific standard numbers are indicated, i.e., ASTM C-150, it shall be understood to mean the latest revision thereof.

## PART 2: PRODUCTS

None

## PART 3: EXECUTION

None

## PART 4: SPECIAL PROVISIONS

### 4.1 MEASUREMENT AND PAYMENT

A) When not listed in the proposal, all "REFERENCE STANDARDS" costs will be considered incidental work for which no separate payment will be made.

END OF SECTION

# SECTION 01300
# CONSTRUCTION SUBMITTALS

## PART 1: GENERAL

1.1 SCOPE

A) This section includes requirements for construction submittals.

1.2 COORDINATION OF SUBMITTALS

A) All submittals to the Owner's Representative, with the exception of the laboratory test certificates, shall be made only by the Contractor. Direct submittals from subcontractor or suppliers will not be accepted.

B) All submittals shall reference the Specification item that it covers, the Contractor's name, the Contract title and location, and the date of submission. Submittal shall also indicate whether the information is for the Owner's Representative's review and approval, for record purposes or for the fulfillment of the operation and maintenance requirements.

C) Prior to Submitting Information to the Engineer:

1) The Contractor shall carefully review the correctness and thoroughness of the material, verify all field measurements, and coordinate all aspects of each item being submitted.

2) The Contractor shall verify his review by affixing his stamp of approval and signature to each page of each required copy of the submittal.

## PART 2: PRODUCTS

2.1 GENERAL

A) Three Categories of Information Are Normally Required:

1) Information for record.

2) Information for the Engineer's review and approval.

3) Operation and maintenance information.

B) All submittals shall be tailored to the project by highlighting appropriate information and/or deleting or crossing out non-applicable information. All options furnished shall be so indicated.

C) Manufacturers submitting proposals for equipment which will require changes to the design shown on the drawings or specified herein shall also include detailed information on structural, electrical, mechanical and other miscellaneous changes or modifications required to adapt their equipment to the design shown.

2.2 INFORMATION FOR RECORD

A) Laboratory Certificates: Certificates shall include the results of tests by an independent laboratory for comparison to Specification requirements, mix design data and approval, plan inspection reports and certification, and other required information from the laboratory. All information submitted shall be signed by an authorized agent of the laboratory.

B) Licenses and Permits: The Contractor shall obtain all licenses and permits required by Local, State and Federal laws and submit copies of them to the Engineer.

C) Installation and Calibration Certificates: Certificates shall be submitted for equipment as indicated in the individual sections. These certificates shall indicate manufacturer's satisfaction with the installation, the accuracy of calibration and alignment, and the operation of the equipment. Such certificates must be signed by an authorized agent of the manufacturer.

D) Manufacturers' Literature: Literature indicating the compliance of the product with the Specifications shall be included with all submittals. This shall include catalogs and other descriptive bulletins. Relevant portions of the literature shall be clearly identified by highlighting or under lining.

E) Manufacturers' or Suppliers' Certificates: Certificates shall state that the products have been sampled and tested in accordance with the proper industrial and governmental standards and meet the requirements of the Contract Documents. Certificates shall be signed by an authorized agent of the manufacturer.

F) Design Data: Design data shall include the calculations, supporting theories, safety factors and assumptions used in designing the product.

G) Samples: Samples shall be provided as required in the individual sections. Samples shall be of the precise material proposed to be furnished. The number of samples and sample size shall be of the industry standard unless otherwise stated in the individual sections.

H) Substitutions: Submittals for substitute materials or equipment shall include but not be limited to manufacturer's literature, design criteria, dimensions and installation instruction. The submittal shall also include any certifications or test results required to demonstrate that the proposed materials or equipment meets the requirements of the specifications and is equivalent or better than the specified materials or equipment.

## 2.3 INFORMATION FOR THE ENGINEER'S REVIEW AND APPROVAL

A) Construction Schedules: Unless otherwise specified, construction schedules shall include:

1) Prior to starting construction of this Contract, the Contractor shall submit through the Engineer for the Owner's review four (4) copies of a schedule, in the form of a bar chart, of the proposed operations. The schedule shall be complete and show in detail the manner in which he proposes to complete the work within the specified time. The schedule shall include purchase lead time and delivery schedule for major equipment. The Engineer will distribute copies of the approved schedule to the Owner, the Contractor and the Owner's Representative.

2) The Contractor shall update the construction schedule monthly to show the work completed and any changes in the schedule.

B) Shop Drawings: Shop drawings shall include the following along with any special requirements listed in the individual Specification Sections:

1) Scaled details

2) Scaled dimensional drawings

3) Sectional assembly drawings

4) Fabrication information

5) Installation instructions and drawings

6) Wiring schematics with termination point identification

7) Motor information, Electric Motors

8) Piping schematics

9) Materials of construction

10) Manufacturer's name and model

11) Manufacturer's catalog data

C) The Contractor shall indicate on the submittals all variances from the Specifications.

2.4 OPERATION AND MAINTENANCE INFORMATION

A) The Contractor shall furnish four (4) copies of information for all equipment requiring maintenance.

B) This information will be accepted only if properly identified with Contract Section Numbers and only after revised, where necessary, to conform to the Owner's Representative notes on previous submittals that have been "Approved as Noted." Manuals shall be tailored to suit the specified equipment provided.

C) Submittals shall include but not be limited to the following:

1) Descriptive literature, bulletins or other data covering the equipment or system.

2) Complete list of equipment and appurtenances included with the system, complete with manufacturer and model number.

3) Utility requirements.

4) General arrangement drawing.

5) Sectional assembly.

6) Dimension print.

7) Materials of construction.

8) Certified performance curve.

9) Performance guarantee.

10) Parts list with assembly drawings.

11) Recommended spare parts list with part and catalog number.

12) Lubrication recommendations and instructions.

13) Schematic wiring diagrams.

14) Schematic piping diagrams.

15) Description of associated instrumentation.

16) Drive dimensions and data.

17) Operating instructions.

18) Maintenance instructions including trouble shooting guidelines, lubrication and preventive maintenance instructions with task schedule.

19) Special tools and equipment required for operation and maintenance.

20) Description of equipment controls.

21) Pump seal data

22) Assembly, installation, alignment, adjustment and checking instructions.

23) Confirmation of all corrections noted on shop drawings "Approved as Noted."

24) Suppliers name, address and telephone number along with manufacturers job number and/or Purchase order number.

D) All manuals shall be tailored to the project by high lighting appropriate information and/or deleting or crossing out non-applicable information. All options furnished shall be indicated.

E) Manuals shall be printed on heavy, first quality paper, 8-1/2" x 11" size with standard three hole punching. Large manuals shall be submitted in three ring binders. Drawings shall be reduced to 11" x 17". Where reduction is not possible,

larger drawings shall be folded separately and placed in envelopes which are bound into the manual. A Table of Contents and index tabs shall be furnished for all manuals containing data for three or more items of equipment.

F) Equipment shall not be considered substantially complete until all associated O & M submittals are accepted by the Engineer.

G) Field modifications to equipment during installation shall be included in the manual so that the manual reflects as-built conditions. Revisions to the manual may be submitted for incorporation into the manual where appropriate. However, the Engineer reserves the right to return all four manuals for revision to reflect as-built conditions.

2.5 OTHER SUBMITTALS

A) Other submittals are required under various sections of these Specifications.

## PART 3: EXECUTION

3.1 GENERAL

A) Delivery prior to approval of any material or equipment for which submittals are required will be at the Contractor's risk. Material or equipment for which submittals are required shall not be incorporated into the work until after the submittals have been reviewed and approved.

B) Any material or equipment on-site which is rejected by the Owner's Representative after review of submittals shall be removed from the job site by the Contractor within two (2) working days of notification of rejection.

3.2 DISTRIBUTION

A) Distribution of submittals shall be as follows unless otherwise directed in the individual Sections:

1) Information for Record - The Contractor or the laboratory shall submit one (1) copy of all test certificates, licenses, permits and installation and calibration certificates directly to the Owner's Representative.

2) Information for Engineer's Review and Approval

a) The Contractor shall submit to the Owner's Representative four (4) copies of all documents requiring review.

b) The Owner's Representative will review the submittals with reasonable promptness for their compliance with the design concept and the Contract Documents.

c) If the submittals are found insufficient three copies will be returned to the Contractor for correction. The Contractor shall than resubmit four (4) copies of the corrected information.

d) Upon acceptance, the Owner's Representative will distribute marked copies as follows:

(1) One (1) copy - Owner's Representative

(2) Two (2) copies – Contractor

(3) One (1) copy - Engineer

## PART 4: SPECIAL PROVISIONS

4.1 MEASUREMENT AND PAYMENT

A) When not listed in the proposal, all "CONSTRUCTION SUBMITTAL" costs will be considered incidental work for which no separate payment will be made.

END OF SECTION

**SECTION 01350**
**COMMON PRODUCT REQUIREMENTS**

## PART 1: GENERAL

1.1 SCOPE

A) This section includes several product requirements common to most products.

B) This section defines the minimum requirements of these common traits. The requirements specified herein apply to all products furnished under the Contract except where modified in other sections or otherwise recommended by the manufacturer.

1.2 SUBMITTALS

A) Submittals shall be in accordance with the requirements of these Contract Documents and shall include:

1) Manufacturer's certification that all materials and products which will come in contact with potable water meet the requirements of the specifications contained herein.

## PART 2: PRODUCTS

2.1 GENERAL

A) Whenever any material, article, device, product, or fixture is indicated or specified by patent or proprietary name, by name of manufacturer, or by catalog number, such specifications shall be deemed to be used for the purpose of establishing a standard of quality and facilitating the description of the material or process desired. This procedure is not to be construed as eliminating from competition other products of equal or better quality by other manufacturers where fully suitable in design, and shall be deemed to be followed by the words "or approved equal". The decision relative to equality shall be by the Engineer and Owner, and shall be final.

B) All material incorporated into the project shall be new and previously unused, unless the express approval for items is received from the Owner.

2.2 MATERIALS IN CONTACT WITH POTABLE WATER

A) All materials or products specified in these Contract Documents or required to complete the work which will come in contact with or which will be used on material or products which will come in contact with potable water shall conform to all State and Federal Requirements.

B) All materials or products as specified above shall meet the requirements of the National Sanitation Foundation Standard 61 (NSF/ANSI 61), Drinking Water System Components - Health Effects, latest revision.

C) Whenever any material or product is indicated or specified by patent or proprietary name, name of manufacturer or model number, such specification is used for the purpose of establishing a standard of quality and facilitating the description of the material or process desired. Such specification of a particular product shall not be construed as acceptability under the above listed criteria. It shall be the Contractor's responsibility to provide certification as required above or provide an equal quality product for which certification can be provided."

D) Any material or product installed without certification that it conforms to requirements as specified above shall be removed and replaced by the Contractor at no additional cost to the Owner.

## PART 3: EXECUTION

3.1 DELIVERY, HANDLING AND STORAGE OF PRODUCTS, MATERIALS, EQUIPMENT

A) Unless otherwise specified in the individual sections, the Contractor shall deliver, handle and store materials and equipment in accordance with the requirements of the manufacturer and the following:

1) Delivered materials and equipment shall be in the manufacturer's original, unopened packaging with labels intact and legible.

2) Delivered materials should be in sufficient quantity to allow continuity of work.

3) The delivered materials and equipment shall be stored on clean raised platforms in conformance with the manufacturer's requirements.

4) The materials and equipment shall be protected from the weather, dust, mud, oil, moisture and other elements that are detrimental to the material or equipment.

5) Materials and equipment shall be protected against damage by construction traffic.

6) Materials and equipment that are damaged or do not conform to the Specifications shall be removed immediately from the project site.

7) Storage of materials, equipment and incidentals shall comply with all Local, State and Federal ordinances, regulations and requirements.

8) Emulsions and paints shall be stored in temperatures above 40°C or according to the manufacturer's requirements.

B) Materials, equipment and articles to be incorporated into the work shall be stored so as to facilitate inspection and in such manner as to ensure the preservation of their quality and fitness for the work. Stocked materials, even though approved before storage, shall be subject to test and shall meet requirements of the Specifications at the time they are to be used in the work.

C) Where construction is in roads, streets, etc., that portion of the right-of-way not required for public travel may be used for storage purposes, unless otherwise prohibited, and for placing of the Contractor's plant and equipment. Any other additional space required for construction facilities or storage of materials and equipment shall be provided by the Contractor at his expense.

D) The Contractor will confine his equipment, the storage of materials and equipment and the operations of his workmen to areas permitted by law, ordinances, permits or the requirements of the Contract Documents, and shall not unreasonably encumber the premises with materials or equipment.

## PART 4: SPECIAL PROVISIONS

### 4.1 MEASUREMENT AND PAYMENT

A) When not listed in the proposal, all "COMMON PRODUCT REQUIREMENTS" costs will be considered incidental work for which no separate payment will be made.

END OF SECTION

**SECTION 02226**
**TRENCH EXCAVATION AND BACKFILL**

## PART 1: GENERAL

1.1 SCOPE

A) This section includes all trench excavation, backfill and related work for the construction of the designated pipelines, service lines, hydrant assemblies, appurtenances, and other incidental work.

B) Trench Excavation and Backfill Includes:

1) Clearing, grubbing, grading, excavation, fill, backfill, trenching, excess excavation, bedding, pipe zone and borrow material, and surface restoration that may be required to complete the work.

2) Furnishing, placing and use of sheeting, shoring and sheet piling necessary in excavating to prevent widening or sloughing of the trench which could be hazardous to human safety, the pipe or appurtenances being installed, existing utilities and structures, or any other existing facility.

3) Performing all pumping and fluming necessary to keep the trenches free from water. The method of dewatering shall provide for a completely dry foundation at the final lines and grades of the excavation and be in accordance with NPDES and CDPHE's permitting requirements.

4) If the bottom of the excavation is soft or unstable and cannot satisfactorily support the pipe or structure in the opinion of the Engineer, a further depth and width shall be excavated and refilled with material as directed by the Engineer.

5) Providing for uninterrupted flow of existing drains and sewers and the temporary disposal of water from other sources during the progress of the work.

6) Supporting and protecting all structures, pipes, conduits, culverts, posts, poles, wires, fences, buildings and other public and private property adjacent to the work.

7) Removing and replacing existing sewers, culverts, pipelines and bulkheads where necessary.

8) Removal and proper disposal of all surplus or excess excavated material from the jobsite.

9) Performing all backfilling, grading and compaction to the limits specified or ordered by the engineer.

10) Restoring all property damaged as a result of the work included under this section.

C) The Work includes obtaining and transporting suitable fill material from off-site when on-site material is not available.

D) The Work includes transporting surplus excavated material not needed for backfill at the location where the excavation is made, to other parts of the work where filling is required, or disposal of all surplus on other sites provided by the Contractor or as directed by the Owner.

1.2 LABORATORY SERVICES

A) Owner will provide for the backfill compaction testing services as described below.

1) Sieve analysis (ASTM C136): One test for each select material source and type:

a) Selected bedding and pipe zone backfill material.

b) Crushed rock aggregate base course material.

c) Pit run aggregate material.

2) Backfill Compaction:

a) One moisture density curve (AASHTO T180) for each size and type of material used for backfill. The maximum dry weight and optimum moisture content shall be indicated. The cost of all retests required due to any unauthorized change in backfill material shall be borne by the Contractor.

b) Test consolidated backfill material in trenches around pipes for conformance with specified "compaction requirements," contained herein:

(1) Where tests indicate insufficient values, perform additional tests as required by the Owner's representative. Testing shall continue until specified values have been attained by additional compaction effort.

(2) Retests shall be referenced to the corresponding failing test. The cost of all retests shall be borne by the Contractor.

1.3 CONSTRUCTION WITHIN ROADWAY AND RAILROAD RIGHT-OF-WAYS

A) Permits: the contractor shall be responsible for ensuring that all permits required for construction are obtained.

B) Contractor shall provide bonds and insurance as required by affected agency prior to proceeding with any work.

C) Notification: the Contractor shall give written notice to appropriate officials of the affected Federal or State Highway Department, City, County or railroad at least five days, not including weekends and holidays, before starting construction within highway or railroad right-of-ways and as required under other roadways.

1.4 SUBMITTALS

A) Submittals shall be in accordance with the requirements of these Contract Documents and shall include:

1) When excess excavated material is disposed of at locations off the project site, the contractor shall obtain and submit written permission from the Owner of the property upon which the material is to be placed.

2) Executed copy of permit(s) to dispose of material specified under this section.

1.5 PROTECTION

A) Test Pits: The Contractor shall dig such exploratory test pits as may be necessary in advance of excavation to determine the exact location and elevation of subsurface structures, pipelines and conduits which are likely to be encountered and shall make acceptable provision for their protection, support, and maintenance in operation.

B) Sheeting, Shoring and Bracing

1) The Contractor shall furnish and install adequate sheeting, shoring, and bracing to maintain safe working conditions, and to protect newly built work and all adjacent and neighboring structures from damage by settlement.

2) Bracing and sheeting shall conform to the recommendations in the Occupational Safety and Health Administration Standards for Construction (OSHA). A trench box may be used in lieu of sheeting and bracing as permitted by OSHA. Unless otherwise approved, all trench support materials shall be removed in a manner that will prevent caving of the sides and movement or damage to the pipe.

3) Bracing shall be arranged so as not to place a strain on portions of completed work until the construction has proceeded far enough to provide ample strength. Sheeting and bracing may be withdrawn and removed at the time of backfilling, but the Contractor shall be responsible for all damage to newly built work and adjacent and neighboring structures.

4) All sheeting, shoring and bracing shall be of Contractor's design and shall be in accordance with all Federal, State and Local codes and requirements.

C) Removal of water

1) The contractor shall at all times during construction provide and maintain ample means and devices with which to remove promptly and dispose of properly all water entering the excavations or other parts of the work and shall keep said excavations dry until the pipelines to be placed therein are completed. In water bearing sand, well points and/or sheeting shall be supplied, together with pumps and other appurtenances of ample capacity to keep the excavation dry as specified.

2) The contractor shall dispose of water from the work in a suitable manner without damage to adjacent property or structures.

3) Water shall not be allowed to rise until concrete has set for a minimum of 24 hours. Water shall not be allowed to rise unequally against an unsupported structure.

4) Contractor shall provide silt fences, straw bales, and/or sedimentation basins as required to clarify waters prior to discharge in accordance with Federal, State and Local requirements.

1.6 DEFINITIONS

A) Classification of Excavated Materials

1) Unclassified Native Material shall be defined as all material not classified as rock excavation or unsuitable material that is removed from the trench by required excavation.

2) Rock Excavation shall be defined as follows:

a) Rock excavation shall consist only of that solid bedrock or ledge rock and boulders over two (2) cubic yards in volume which cannot be removed by a D8K (or approved equal) with four barrel hydraulics and dual rippers or 90,000 pound class Excavator (P.C. 400 Komatsu or 235 Caterpillar or approved equal) with single shank ripper on back of bucket, which shall not be more than thirty-six inches (36") in width, but which requires systematic drilling, blasting or the use of rock splitters pneumatic hammers and wedges. All D8K's and 90,000 pound class Excavators shall be in excellent operating condition and operated by personnel competent to operate like machinery.

b) Removal of existing concrete and asphaltic surfaces does not qualify as rock excavation.

3) Unsuitable Materials

a) Unsuitable material shall be defined as all material that is either too wet, contains grass, roots, brush or other vegetation, large rocks or is classified under ASTM D 2487 as PT, OH, CH, MH or OL and materials which cannot be compacted to achieve the required percentage of maximum density for the intended use shall not be used in the work.

B) Trench Backfill Zones

1) Pipe embedment zone - The area from 4-inches under the pipe to 1/6 the outside pipe diameter distance above the bottom of pipe for the width of the trench.

2) Pipe zone - The area from the top of the pipe embedment zone to 6-inches above the pipe for the width of the trench.

3) Trench backfill zone - The area from 6-inches above the pipe to bottom line of surface restoration for the width of the trench.

C) Trench Classifications

1) Class I Trench - Class I trench shall have select granular material in all three zones for backfill material. For use under paved or graveled roadways, road shoulders, gravel and paved driveways, or as directed by the Engineer. The type of material required for each backfill zone shall be as follows:

| **Class I Trench** | |
|---|---|
| **Backfill Zone** | **Backfill Material** |
| Pipe Embedment Zone | Type B or C |
| Pipe Zone | Type A, B or C |
| Trench Backfill Zone | Type A and/or E<br>*(Top 12-inch under asphalt must be Type A)* |

2) Class II Trench - Class II trench shall have select granular material in the pipe embedment and pipe zones and suitable native excavated material in the trench backfill zone to 6-inches below finish grade. The top 6-inches shall be select aggregate base course material as specified. For use under gravel roads, driveways, road shoulders and future or current paved areas, or as directed by the Engineer.

| **Class II Trench** | |
|---|---|
| **Backfill Zone** | **Backfill Material** |
| Pipe Embedment Zone | Type B or C |
| Pipe Zone | Type A, B or C |
| Trench Backfill Zone | Type A and D<br>*(Top 6-inch must be Type A)* |

3) Class III Trench - Class III trench shall have select granular material in the pipe embedment zone and native excavated material in the pipe zone and trench backfill zone. For use under unimproved open areas or under gravel roads, road shoulders and driveways or future paved areas with the top surface of select aggregate base course material to the depth specified or shown on the drawings or as directed by the Engineer.

| **Class III Trench** | |
|---|---|
| **Backfill Zone** | **Backfill Material** |
| Pipe Embedment Zone | Type B or C |
| Pipe Zone | Type D |
| Trench Backfill Zone | Type A and D<br>*(Type A surface depth as specified)* |

4) Class IV Trench - Class IV trench shall have unclassified native excavated material in the pipe embedment and pipe zones and unclassified native excavated material in the backfill zone for backfill material. For use under unimproved open rural area or as directed by the Engineer.

| **Class IV Trench** | |
|---|---|
| **Backfill Zone** | **Backfill Material** |
| Pipe Embedment Zone | Type D |
| Pipe Zone | Type D |
| Trench Backfill Zone | Type D |

## PART 2: PRODUCTS

2.1 SELECTED GRANULAR BACKFILL MATERIAL REQUIREMENTS

A) Selected backfill material shall consist of well-graded pit run, sand or crushed rock or screenings, meeting the following requirements:

1) Type A: 3/4-inch crushed rock aggregate base course material that meets the gradation requirements of CDOT for class 6 aggregate base course.

| **Type A - Class 6 CDOT Aggregate Base Course** | |
|---|---|
| **Sieve Size** | **Total Percent Passing by Weight** |
| 3/4 - inch | 100 |
| No. 4 | 30-65 |
| No. 8 | 25-55 |
| No. 200 | 3-12 |

2) Type B: Selected bedding and pipe zone backfill material shall be 3/4-inch minus screened rock durable and free from slaking or decomposition under action of alternate wetting and drying. The material shall meet the following gradation requirements:

| **Type B – ¾-inch Minus Screened Rock** | |
|---|---|
| **Sieve Size** | **Total Percent Passing by Weight** |
| 3/4 - inch | 100 |
| No. 4 | 15 maximum |

3) Type C: 3/8-inch minus crusher screenings for bedding material with one hundred percent (100%) passing the 3/8-inch sieve and fifty percent (50%) or less passing the No. 8 sieve.

| **Type C – 3/8-inch Minus Crusher Screenings** | |
|---|---|
| **Sieve Size** | **Total Percent Passing by Weight** |
| 3/8 - inch | 100 |
| No. 8 | 50 maximum |

4) Type D: All materials considered as suitable for fill and backfill obtained from the required excavation meeting the requirements of paragraphs 2.1 and 2.2 herein.

5) Type E: Pit run aggregate that is relatively uniformly graded having a maximum rock size of 8-inches and no more than 20% by weight passing the No. 200 sieve size.

| **Type E – Pit Run Aggregate 8-inch minus** | |
|---|---|
| **Sieve Size** | **Total Percent Passing by Weight** |
| 8 - inch | 100 |
| No. 200 | 20 maximum |

2.2 UNCLASSIFIED NATIVE MATERIAL

A) Excavated material free of vegetable matter, large rocks and debris.

B) Excavated material approved by the Engineer for use as backfill in designated trench backfill zones.

C) Individual particles no larger than 8 inches in diameter within trench backfill zone and no larger than 2 inches in diameter within embedment and pipe zones.

2.3 FOUNDATION STABILIZATION

A) Gravel or crushed aggregate with 100% passing the 1.5-inch sieve size or Engineer approved clean, well-graded granular material.

B) Excavation Below Grade: Where the excavation is carried beyond or below the lines and grades shown on the plans or staked, the Contractor shall, at his own expense, refill all such excavated space with required pipe bedding material.

C) Unstable Trench Bottom: Where the excavation is found to consist of muck, organic matter or any other material that the Engineer determines to be unsuitable for supporting the pipe, an additional depth shall be excavated as directed by the Engineer and replaced with an approved granular stabilization material. Payment shall be made on the unit price provided in the bidding schedule.

## PART 3: EXECUTION

### 3.1 PREPARATION

A) The site of an open cut excavation shall be first cleared of all obstructions preparatory to excavation. Wherever paved or surfaced streets are cut, saw wheel or approved cutting devices shall be used. Width of pavement cut shall not be less than 12-inches greater than trench width. All cut or broken pavement shall be removed from site during excavation.

B) The Contractor shall maintain street traffic at all times and erect and maintain barricades, warning signs, traffic cones, and other safety devices during construction in accordance with Manual of Uniform Traffic Control Devices (MUTCD) to protect the traveling public. Provide flagmen as required during active work in roadway areas.

C) Intent of specifications is that all streets, structures, and utilities be left in condition equal to or better than original condition. Where damage occurs and cannot be repaired or replaced, Contractor shall purchase and install new material which is satisfactory to Owner. Plans and/or specifications cover and govern replacement and restoration of foreseeable damage.

D) The operations shall be confined to the work limits provided. Avoid encroachment on, or damage to, private property or existing utilities unless prior arrangements have been made with copy of said arrangement submitted to Engineer.

### 3.2 TRENCHING

A) Excavation for trenches in which pipelines are to be installed shall provide adequate space for workmen to place and join the pipe properly, but in every case the trench shall be kept to a minimum width. The width of trench at the top of the

pipe shall not exceed the limits specified in Section 02667 or as shown on the drawings.

B) Excavation shall be to the depth necessary for placing of granular bedding material under the pipe as shown on the drawings. If over digging occurs, the trench bottom shall be filled to grade with compacted granular bedding material.

C) Unless otherwise permitted by the Engineer, trenching operations shall not be performed beyond the distance which will be backfilled and compacted the same day.

D) In general, backfilling shall begin as soon as the conduit is in approved condition to receive it and shall be carried to completion as rapidly as possible. New trenching shall not be started when earlier trenches need backfilling or the surfaces of streets or other areas need to be restored to a safe and proper condition.

E) Where the excavation activities require the removal of portions of an abandoned pipeline, 2,500 psi concrete plugs shall be installed in the open ends of the pipe. Concrete plugs to be a minimum one and one-half (1-1/2) times the diameter of the pipe.

F) Water facilities, including pipe, fittings, valves, meter services, hydrants, and other appurtenances or at least every 50 linear feet shall not be installed without line and grade stakes approved by Ute Water Inspector. Line and grade for water mains shall be established under the direct supervision of a PLS.

## 3.3 EXCAVATION OF UNSUITABLE MATERIALS

A) Unsuitable materials existing below the contract bottom limits for excavation shall be removed only as directed by the Engineer. Such excavation shall be conducted at a time when the engineer is present and shall not exceed the vertical and lateral limits as prescribed by the engineer.

B) Where soft subgrade is encountered in which satisfactory stability cannot be obtained by moisture control and compaction, the unstable material shall be excavated to the depth required by the Engineer.

C) Backfill with foundation stabilization material compacted in layers not exceeding 12-inches depth to required density and compaction.

## 3.4 DISPOSAL OF UNSUITABLE AND SURPLUS MATERIAL

A) All excavated materials which are unsuitable for use in backfilling trenches or around structures, and materials excavated that are in excess of that required for backfilling and for constructing fills and embankments as shown on the drawings, shall be disposed of by the Contractor at own expense and at disposal sites provided by him as may be required.

B) Surplus or excess excavated material shall be disposed of at designated spoil sites in a legal manner, in full compliance with applicable codes and ordinances.

## 3.5 ROCK EXCAVATION

A) Where the bottom of the trench encounters ledge rock and/or boulders and large stones which meet the definition of "rock" as described herein, said rock shall be removed to provide additional clearance below the pipe zone as shown in the Contract Documents.

B) Excavations below subgrade in rock shall be backfilled to subgrade with approved bedding material and thoroughly compacted as shown in the Contract Documents.

C) Contractor to excavate and remove the overburden exposing the rock surface, allowing the Engineer to profile the excavated trench for rock measurement. The profiling of the exposed rock surface shall be done prior to commencement of rock removal activities.

D) Blasting for excavation shall be permitted with approval by the Engineer and only after securing approval(s) from federal, state, and other authorities having jurisdiction.

## 3.6 REMOVAL OF CONCRETE CURBS & SIDEWALKS

A) Where trench excavation requires removal of concrete curbs and/or sidewalks, the curbs and/or sidewalks shall be sawcut as required and removed at a tooled joint unless otherwise authorized by the Engineer.

B) The intention of this requirement is to facilitate the replacement of curbs and sidewalks to the joint pattern of the existing and surrounding curbs and/or sidewalks. The sawcut lines for concrete sidewalk and curb cuts shown on the drawings are schematic and not intended to show the exact alignment of such cuts.

## 3.7 BACKFILL AND COMPACTION

A) General

1) Backfill Immediately: All trenches and excavations shall be backfilled immediately after pipe is laid therein, unless otherwise directed by the Engineer. Under no circumstances shall water be permitted to rise in un-backfilled trenches after pipe has been placed.

2) Backfilling with Excavated material: Where specified or directed, material excavated in connection with the work shall be used for backfilling, in accordance with the type of trench classification shown on the contract drawings. No material shall be used for backfilling that contains stones, rock or pieces of masonry greater than 8-inches within the trench zone or greater than 2-inches within the pipe and embedment zones. No material shall be used for backfilling that contains frozen earth, debris, organic material, or marl.

3) In no case shall backfill material deposited by machinery be allowed to fall directly on the pipe and in all cases the bucket shall be lowered so that the shock of the falling backfill material will not cause damage.

4) All backfill material shall be placed with moisture-density control in accordance with the typical trench detail shown on the Standard Detail Sheets. All approved backfill material shall be adjusted to within two percent (2%) of the optimum moisture content prior to its placement in the trench. Jetting or water soaking trenches to achieve compaction of the backfill will not be permitted except when the backfill consists of gravel or other granular material having less than twenty percent (20%) by weight passing a No. 200 sieve.

5) During initial backfilling, the contractor shall take all necessary precautions to prevent movement or distortion of the pipe or structure being backfilled. Pipe zone material shall be placed and compacted in even lifts on both sides of the pipe to above the top of the pipe. Above the pipe bedding and pipe zone the earth backfill material shall be placed full width in uniform layers not more than twelve (12) inches thick. Each layer shall be compacted to the required density with approved mechanical or hand tamping equipment.

B) <u>Embedment Zone</u>

1) Pipe embedment material shall be placed in the trench, compacted and shaped to provide continuous support for the pipe between joints or fittings.

2) Bell holes shall be provided for all joints or fittings as required to permit assembly.

3) Pipe shall be laid directly on the embedment materials; embedment material particle size must be limited to less than 2-inch in diameter.

C) Pipe Zone

1) Backfill shall be placed in uniform layers on both sides of the pipe. Each layer shall be placed, then carefully and uniformly tamped to the specified density so as to eliminate the possibility of lateral displacement of the pipe.

2) Care shall be taken to ensure that the material under the haunches of the pipe is sufficiently compacted with handheld tamping bars supplemented by walking in and slicing material under the haunches with a shovel to ensure voids are completely filled.

3) Pipe zone material particle size must be limited to less than 2-inch in diameter.

D) Trench Backfill Zone

1) After the backfill has been placed and compacted around the pipe and structures to a height of 6-inches over the top as specified above, the remainder of the trench may be backfilled appropriately with proper equipment.

2) The backfill material shall be deposited in horizontal layers not exceeding 12-inches thick, and each layer shall be thoroughly compacted to the specified density by approved methods before the succeeding layer is placed.

E) Backfilling Under Existing Conduits

1) Where it is necessary to undercut or replace existing utility conduits and/or service lines, the excavation beneath such lines shall be backfilled the entire length with granular bedding material tamped in place in 6-inch layers to the required density. The granular bedding shall extend outward from the spring line of the conduit a distance of 2 feet on either side and thence downward at its natural slope.

F) Backfilling Under Pavement and Walks

1) Where any pavement, driveway, parking lot, curb and gutter, or walk is to be placed over a backfill area, granular material shall be used. The material

shall be placed and compacted to the required density in accordance with the specification contained herein.

## 3.8 COMPACTION REQUIREMENTS

A) Compaction requirements for Type I, Type II and Type III trench shall be as follows:

1) Compaction of the pipe embedment and pipe zones shall be achieved by mechanical compaction in horizontal lifts or other approved method to ninety percent (90%) of the maximum dry density per AASHTO T99 test method.

2) Compaction of the trench backfill zone shall be achieved by mechanical compaction in horizontal lifts or other approved method to ninety-five percent (95%) of the maximum dry density per AASHTO T99 test method.

B) Compaction requirements for Type IV trench shall be as follows except under gravel roads, driveways, road shoulders or future or current paved areas which shall be compacted in accordance with paragraphs A.1 and A.2 above.

1) Compaction of the pipe embedment and pipe zones shall be achieved by mechanical compaction in horizontal lifts or other approved method to eighty percent (80%) of the maximum dry density per AASHTO T99 test method.

2) Compaction of the trench backfill zone shall be achieved by mechanical compaction in horizontal lifts or other approved method to eighty-five percent (85%) of the maximum dry density per AASHTO T99 test method.

## 3.9 COMPACTION TESTS

A) Trenches shall be backfilled and consolidated in layers, as specified, to the existing ground surface. All backfill shall be frequently tested to insure that the required density is being attained. Contractor shall contact governing agency to determine their requirements for compaction testing, however, the minimum requirements for compaction testing shall be as follows:

1) For every 300 lineal feet of trench and each branch or section of trench less than 300 feet in length, at least one compaction test shall be performed for each two foot vertical lift of backfill material placed. The first test shall be taken approximately two feet above the top of pipe and the last test shall be at the pavement subgrade or 6 inches below the ground surface in unpaved

areas. Compaction tests shall be taken at random locations along the trench and wherever poor compaction is suspected. If any portion of the backfill placed fails to meet the minimum density specified, the area shall be defined by additional tests if necessary and the material in the designated area shall be removed and replaced to the required density at the Contractor's expense.

2) All compaction testing shall be performed by a certified testing laboratory. The cost of the testing shall be borne by the Owner. It shall be the Contractor's responsibility to assist in coordinating the testing and to make necessary excavations in order to accommodate compaction tests at all locations designated.

B) The initial test series for each type of backfill material shall be continued until the method of consolidation employed has proven to attain the required compaction. Any change in the proven method of consolidation will not be permitted unless approved by the Owner's Representative.

C) Subsequent tests or series of tests shall be in locations and at depths ordered by the Engineer.

D) The cost of all retests shall be borne by the Contractor.

3.10 SURFACE RESTORATION AND CLEAN UP

A) Surface restoration shall conform to these Contract Documents where applicable. Restore ground surfaces to original conditions and elevations unless otherwise specified or directed.

B) Clean up and remove all excess materials, construction materials, debris from construction, etc. Replace or repair any fences, mailboxes, signs, landscaping, or other facilities removed or damaged during construction. Replace all lawns, topsoil, shrubbery, flowers, etc., damaged or removed during construction. Contractor to be responsible for seeing that lawns, shrubs, etc. Remain alive. Leave premises in condition equal to or better than original condition before construction.

C) Immediately after any section of a completed pipeline has been tested and approved by the Owner or Engineer, the Contractor shall replace all paved surfaces removed or damaged by his operation. All pavement replacement shall be in accordance with the typical trench detail shown on the standard detail sheets, and in accordance with any permit requirements impose by the City, County or State.

D) Unless otherwise approved, all asphalt pavements removed shall be replaced with hot mixed bituminous pavement and all aggregate base course material shall be Colorado Department of Transportation, Class 6 Aggregate Base Course. Paved surfaces shall be restored to their original line and grade and finished to match adjacent undisturbed surfaces. If Contractor is unable to replace asphalt pavement with hot mixed bituminous pavement, then temporary cold asphalt pavement shall be used. Contractor will be responsible for maintaining the cold asphalt pavement until it can be replaced with hot mixed bituminous pavement. All costs for temporary pavement, maintaining temporary pavement, an replacing asphalt pavement with hot mixed bituminous pavement shall be considered to be included in the bid price for pavement replacement.

E) All curbs, gutters, sidewalks, gutter pans, driveways and other concrete street hardware within the right-of-way shall be replaced by a licensed specialty Contractor with a permit issued by the office of the City Engineer. All concrete shall be Colorado Department of Transportation, Class B unless otherwise noted.

## PART 4: SPECIAL PROVISIONS

### 4.1 MEASUREMENT AND PAYMENT

A) When not listed in the proposal, all trench excavation and backfill costs will be considered incidental work for which no separate payment will be made.

B) When listed in the proposal, payment for work specified under this section will be made at the prices listed in the proposal and as outlined below. Quantities to be computed by the engineer from measurement of actual work completed and accepted.

C) Trench Excavation

1) Paid for on a linear foot basis for each size and classification of trench at the prices named in the proposal. Length will be measured horizontally along pipe actually installed without deducting for fittings and appurtenances.

D) Foundation Stabilization

1) Paid for on a cubic yard basis at the prices named in the proposal. Length and width will be measured horizontally along foundation stabilization material actually installed.

2) Depth measured to be actual depth installed below bottom of bedding. The average depth will be used with measurement intervals of 25 feet along centerline of trench.

3) No payment will be made for unauthorized foundation stabilization.

E) Rock Excavation

1) Payment for unforeseen rock conditions shall be made after negotiations to determine a unit price based on the best and safest method selected and approved by the engineer for the rock removal.

2) Rock excavation will be paid for on a cubic yard basis and or at the prices named in the Proposal. Measurement will be as outlined below.

a) The length will be the entire horizontal distance measured along the centerline of the trench.

b) The width for measurement purposes shall be 12 inches greater than the maximum outside diameter of the pipe.

c) The measurement for depth will be the vertical distance from the top of the rock to the depth shown on the plan. The depth will be measured at intervals of 25 feet along the centerline of the trench and the average depth between measuring points will be the depth used for computing the depth of rock.

F) Measurement and payment for rock excavation will be in addition to the payment for trench excavation and backfill. Payment for rock excavation shall include full compensation for all work necessary to excavate the rock material. Price indicated also includes the cost for embedment and pipe zone materials.

G) Asphalt Cement (AC) Pavement Cuts

1) When not listed in the proposal, all pavement cuts to be considered incidental to work for which no separate payment will be made.

2) When listed in the Proposal, payment for work specified under this section will be made at the prices listed in the Proposal. Quantities to be computed by the Owner's Representative for measurement of actual work completed and accepted.

H) Payment indicated shall include complete compensation for all labor, equipment, materials and incidentals involved in the work specified herein. No additional compensation will be considered unless allowed and submitted in accordance with sections VIII and XIII of the General Conditions.

END OF SECTION

**SECTION 02501**
**TRENCH SURFACE RESTORATION**

## PART 1: GENERAL

1.1 SCOPE

A) This section includes all surface restoration and related work for the construction of the designated pipelines and other work as required for the completion of the project.

B) Surface restoration includes, but is not limited to, the following:

1) Restoration of all surfaces disturbed during construction including asphalt concrete (AC) pavement, concrete, gravel, lawns, topsoil, trees, shrubbery, flowers, fences, mailboxes, signs, landscaping, etc.

2) Surfaces shall be restored in-kind unless otherwise shown on the drawings or directed by the Engineer.

3) Maintenance of all surfaces until final surface restoration is completed. Temporary AC pavement cold patching may be required for all street crossings which are not permanently restored within seven (7) days of excavation depending on the permit requirements of governing agency.

4) Depth, type and compaction of materials shall be equal to original surfaces unless otherwise specified herein or shown on the drawings.

1.2 CLASSIFICATIONS

A) Class A: Asphalt concrete pavement restoration for State Highway, County Roads or City streets, whichever is the governing agency in the area of the work. Also asphalt concrete driveways.

B) Class B: Gravel Road restoration.

C) Class C: Gravel shoulder restoration including graveled driveways.

D) Class D: Concrete driveways, sidewalks, curbs and gutter restoration.

E) Class E: Unimproved or open areas restoration.

## PART 2: PRODUCTS

### 2.1 AGGREGATE BASE COURSE MATERIAL (ROAD BASE)

A) Aggregate Base Course Material or Road Base used for surface restoration shall be material meeting the requirements of the Colorado Department of Transportation (CDOT), Mesa County or the City of Grand Junction, whichever is the governing agency in the area of the work.

### 2.2 TOPSOIL

A) Native topsoil shall be removed and stockpiled to be used for topsoil replacement when possible. Where imported topsoil is required, it shall be clean sandy loam, free from sulfates or alkali.

B) Depth of topsoil shall be determined by actual existing field conditions or as directed by the Engineer.

### 2.3 ASPHALT CONCRETE (AC) PAVEMENT

A) AC pavement shall conform to the requirements of CDOT, Mesa County or the City of Grand Junction, whichever is the governing agency in the area of the work.

### 2.4 PORTLAND CEMENT CONCRETE

A) All concrete shall conform to the requirements of CDOT, Mesa County or the City of Grand Junction, whichever is the governing agency in the area of the work.

### 2.5 GRASS SEED AND MULCH

A) Grass seed and mulch shall conform to the requirements of CDOT, Mesa County or the City of Grand Junction, whichever is the governing agency in the area of the planting, except as modified herein.

B) Seed mixtures shall be compatible with the immediately surrounding vegetation.

C) Seed mix to be approved by the Engineer prior to application.

2.6 GRASS SOD

A) Grass sod shall be certified nursery grade cultivated grass sod with a strong fibrous root system, free of stones and burned or bare spots, and compatible with the immediately surrounding grass.

## PART 3. EXECUTION

3.1 GENERAL

A) The intent of this specification is that cleanup activities and surface restoration work immediately follow the installation of pipe, construction of structures, etc. This is imperative so as to impact activities by the property owner, or other users, as little as possible.

B) Trench backfill and subgrade shall meet compaction requirements as set forth in the applicable sections contained herein prior to proceeding with surface restoration work.

C) All workmanship for AC pavement surface restoration shall conform to the standard requirements of CDOT, Mesa County or the City of Grand Junction, whichever is the governing agency and in accordance with the project permit requirements for Asphalt Concrete Pavement replacement and patching.

D) The Contractor shall notify the Engineer a minimum of 24 hours in advance of performing any AC pavement surface restoration work. No AC pavement surface restoration work shall be performed when weather conditions, in the Engineers opinion, are not suitable for placement of AC pavement.

E) All workmanship for concrete restoration shall conform to the standard requirements of CDOT, Mesa County or the City of Grand Junction.

F) In areas designated for Class E surface restoration, topsoil shall be removed and stored at an approved location prior to excavation.

3.2 PROTECTION

A) No heavy construction vehicle shall operate on any pavement, curbing or walk.

B) Concrete Curbing and Walks:

1) No concrete shall be mixed, transported, placed or finished when the temperature of the base, subgrade or air is below 40°F or whenever, in the opinion of the Engineer, the temperature may fall below 40°F within twenty four (24) hours after the concrete has been placed.

2) The Contractor shall take such precautions as are necessary to protect newly placed concrete from rain.

3) The Contractor shall protect newly placed concrete from freezing for no less than seven (7) days.

3.3 CLASS A SURFACE RESTORATION - Asphalt Concrete Pavement and Driveways

A) Asphalt concrete pavement restoration shall conform to all standards and requirements of the Colorado Department of Highways (CDOT), Mesa County or City, whichever is the governing agency in the area of the work.

B) The wearing course shall match the existing pavement in thickness, line and grade but in no case shall the pavement thickness be less than three (3) inches placed in two (2) lifts.

3.4 CLASS B SURFACE RESTORATION - Gravel Roads

A) Surface restoration shall conform to all standards and requirements of Mesa County or City, whichever is the governing agency in the area of the work.

B) The wearing course shall match the existing road surface in thickness, line and grade, but in no case shall the gravel thickness be less than four (4) inches.

3.5 CLASS C SURFACE RESTORATION - Gravel Shoulders and Driveways

A) Gravel shoulder restoration shall conform to all standards and requirements of the Colorado Department of Highways (CDOT), Mesa County or City, whichever is the governing agency in the area of the work.

B) Gravel driveway restoration shall conform to the same requirements as gravel shoulder restoration or as directed by the Engineer. The gravel thickness shall not be less than six (6) inches.

C) Gravel shoulders and driveways shall be compacted by mechanical means to ninety five percent (95%) of the maximum dry density per AASHTO T-180 unless otherwise directed by the Engineer.

3.6 CLASS D SURFACE RESTORATION - Concrete Driveways, Walks, Curb and Gutter

A) Concrete driveways, sidewalks, curb and gutter restoration shall conform to all standards or requirements of the Colorado Department of Highways (CDOT), Mesa County or City, whichever is the governing agency in the area of the work.

B) Concrete surface restoration shall also conform to drawing details and specifications, Paragraph 3.08, contained herein. Where there is a difference between the agencies requirements and these specifications, the most stringent requirement shall take precedence.

C) The supporting aggregate base course shall be not less than six (6) inches thick and shall be compacted by means of mechanical compaction to ninety five percent (95%) of the maximum dry density per AASHTO T-180.

3.7 CLASS E SURFACE RESTORATION - Unimproved or Open Areas

A) Surface restoration shall conform to all standards and requirements of the governing agency.

B) Surface restoration shall also conform to drawing details and specifications contained herein.

C) Compact to density of existing in place materials by mechanical means unless otherwise directed by the Engineer.

D) Contractor shall replace trees, shrubbery, flowers, ground cover in kind to match existing as approved by the Engineer.

E) Re-Seeding:

1) All areas to be seeded shall be made substantially clear and free of weeds, briars, sticks, loose stones greater than 1-inch, and all other debris detrimental or toxic to the growth of grass.

2) The surface soil in all areas to be seeded shall be in a condition favorable for the germination and growth of grass seed. A minimum of 1/2-inch and maximum of 1-1/2 inches of surface soil shall be in a loose condition.

3) Soil preparation operations shall be directional along the contours of the areas involved.

4) Seed shall be applied at a time approved by the Engineer when conditions are favorable for germination.

F) Re-Sodding:

1) Provide a finish grade such that the top of installed and fresh-cut mature grass will be level with all adjoining sidewalks and curbs. Add or remove topsoil as necessary to achieve proper finish grade.

2) All areas to be sodded shall be made substantially clear and free of weeds, briars, sticks, loose stones greater than 1-inch, and all other debris detrimental or toxic to the growth of grass.

3) The surface soil in all areas to be sodded shall be in a condition favorable for the growth of grass. A minimum of 1/2-inch and maximum of 1-1/2 inches of surface soil shall be in a loose condition.

4) Lay sod perpendicular to direction of slope with alternating joints. Fit sod pieces tightly together: no joints and overlapping; hand tamp firmly and evenly.

5) Top dress lightly with topsoil to fill depressions and joints between strips; leave finished sodding smooth and free of lumps and depressions.

6) Roll sod to ensure the root system is bound to the soil.

7) Sod shall be applied at a time approved by the Engineer when conditions are favorable for growth.

## 3.8 CONCRETE CURBING, WALKS AND DRIVEWAYS

A) All soil subgrade under driveways, curbs, curb and gutter and walks shall be compacted in accordance with the requirements of the applicable sections contained herein.

B) All curbs, sidewalks and driveways shall conform to the lines, grades and thicknesses of existing structures, but in no case shall the thickness be less than sixteen (16) inches for Type "C" curbs, four (4) inches for sidewalks, and six (6) inches for driveways and driveway aprons.

C) A minimum 6-inches of 3/4-inch aggregate base course and granular material leveling course shall be provided under all curbs, sidewalks and driveways.

D) Unless otherwise authorized by the Engineer, sidewalks and/or curbs shall be constructed to match the joint pattern of the existing and surrounding sidewalks and/or curbs.

## PART 4: SPECIAL PROVISIONS

### 4.1 MEASUREMENT AND PAYMENT

A) When not listed in the Proposal, all "SURFACE RESTORATION" costs will be considered incidental work for which no separate payment will be made.

B) When listed in the Proposal, payment for work specified under this section to be made at the units and prices named in the Proposal for each class of surface restoration, complete and acceptable to the Engineer.

C) Length to be measured horizontally along center line of the trench to the nearest foot without deducting for structures, valves, etc.

D) Restoration of concrete curbing and walks shall be considered incidental to the restoration of the street to which it is adjacent unless otherwise listed in the proposal.

E) Cutting of AC pavement costs, when not listed in the Proposal, will be considered incidental work for which no separate payment will be made. However, in no case will payment be made for duplicate cuts where over-excavation, inadequate backfill compaction or less than prompt repaving results in the need for new cuts.

F) Payment indicated to include complete compensation for all labor, equipment, materials and incidentals required for completion of the work. No additional compensation to be allowed.

END OF SECTION

**SECTION 02667**
**WATER DISTRIBUTION SYSTEM**

## PART 1: GENERAL

### 1.1 SCOPE

A) This section includes the construction of water distribution system facilities including: buried pressure piping and fittings; valves; fire hydrants; water services and meters; and appurtenances as shown on the drawings or as required to complete the work.

B) Work under this section shall include, but not be limited to the following:

1) Installation of all buried pipe, fittings, joint restraints, valves, fire hydrant assemblies and service connection assemblies.

2) Installing connections to all existing and/or new facilities and provide temporary services as required.

3) Disinfecting, dechlorinating, flushing, and pressure testing new pipelines and appurtenances for a complete and operable system.

### 1.2 QUALITY CONTROL

A) Laboratory Services: Water quality testing services shall be provided by the Ute Water Conservancy District.

B) Field Inspection:

1) All new water distribution system facility installations shall be inspected by a Representative of the Ute Water Conservancy District. Inspection shall begin at the beginning of construction and continue through the testing, disinfection and flushing operations. Any defective work discovered after installation shall be removed and correctly replaced in a manner satisfactory to the Engineer, or Ute Water Districts Representative at the Contractor's expense.

2) All defective materials shall be suitably marked and removed from the job site before the end of the following day.

C) Final Inspection and Acceptance: The acceptance of all water facilities by the Ute Water Conservancy District will be based on the following:

1) Submittal of satisfactory results of required test (such as pressure test, leakage tests, disinfection tests, compaction tests, etc.) certified by an Engineer or approved by a certified testing laboratory.

2) Passing a final inspection of the work by the Ute Water Conservancy District.

3) Submittal of "As-Built" construction drawings.

4) Restoration of all non-public surface disturbance.

5) Restoration of all surface disturbance within the public right-of-way to the satisfaction of the City, County or State.

6) Contractor shall warrant the work for a period of one year from the date of acceptance against defects in material and workmanship.

1.3 SUBMITTALS

A) Submittals shall be in accordance with the requirements of these Contract Documents and shall include the following:

1) Material, size and pressure class schedule of all pipe, pipe fittings and appurtenances.

2) Special joint details and any special provisions required for assembly.

3) Manufacture's literature for each size and type of pipe, fitting and valve and fire hydrant.

4) A certificate from the pipe, valves and fittings manufacturer stating that the materials have been sampled and tested in accordance with the provisions of and meet the requirements of the designated specification.

## PART 2: PRODUCTS

2.1 PIPE

A) General

1) All pipe shall be intended for use with potable water. Components in contact with potable water shall be certified to comply with NSF/ANSI 61, Drinking Water System Components – Health Effects, and a copy of the NSF/ANSI

61 certification shall be provided to Ute Water Conservancy District and the pipe bear the NSF hallmark.

B) Ductile Iron (DI) Pipe

1) All ductile iron pipe shall be designed, manufactured, tested, inspected, and marked in accordance with AWWA C150, AWWA C151 and Manual M41.

2) Standard pipe outside diameters (ODs) conform to the ductile iron and cast iron sizing system, referred to as cast iron or CIOD.

3) Ductile iron pipe shall be minimum Pressure Class 350 or minimum Special Thickness Class 52, unless otherwise shown or specified.

4) Ductile iron pipe shall have a nominal laying length of 18-feet or 20-feet. Random lengths are not acceptable.

5) Ductile iron pipe shall have standard thickness cement-mortar linings in accordance with AWWA C104.

6) Ductile iron pipe outside coatings shall be asphaltic, shop-applied standard thickness of 1-mil minimum, continuous and smooth, neither brittle when cold or sticky when exposed to the sun, and strongly adherent to the pipe in accordance with AWWA C151.

7) Ductile iron pipe shall be UL listed and a copy shall be provide to Ute Water Conservancy District.

8) Ductile iron pipe shall have cathodic bonding joint assemblies installed by the pipe manufacturer prior to delivery.

9) All ductile iron pipe and ductile iron pipe fittings, including buried fire hydrant sections shall be polyethylene encased conforming to AWWA C105.

10) Push-on joint type ductile iron pipe shall have a single, continuous molded, rubber-ring gasket in an annular recess in the pipe or fitting socket; designed and shaped properly to lock in place against displacement in accordance with AWWA C111. Joint accessories for push-on joint type pipe shall be provided by the manufacturer of the pipe for compatibility.

11) Mechanical joint type ductile iron pipe, only where indicated on the drawings, is a bolted joint of the stuffing-box type that consist of (1) a fabricated or cast bell provided with an exterior flange having bolt holes or slots, a socket with annular recesses for sealing gasket and plain end of pipe

or fitting; (2) a pipe or fitting plain end; (3) a sealing gasket; (4) follower gland with bolt holes; and (5) tee-head bolts and hexagonal nuts.

a) Tee-head bolts and hexagonal nuts shall be made of corrosion-resistant, high-strength low-alloy steel meeting the minimum characteristic values, strength, and dimensions of AWWA C111 such as Cor-Blue or approved equal.

b) Mechanical joint restraints, required for mechanical joint fittings, shall be required for mechanical joint pipe where indicated on the drawings, specified herein.

12) Restrained joint ductile iron pipe where shown on the drawings to be positively restrained push-on joint pipe capable of being deflected after assembly. Joint accessories for restrained joint type pipe shall be provided by the manufacturer of the pipe for compatibility.

a) Acceptable restrained joint ductile iron pipe products include: TR Flex and Flex-Ring pipe as well as Field Lok, Sure Stop, and Fast-Grip gasket systems.

13) Rubber gaskets shall be made of vulcanized styrene butadiene rubber (SBR). Reclaimed or natural rubber shall not be used. Gaskets shall be free from porous areas, foreign material, and other defects that make them unfit for the use intended. Quality control tests shall be available upon request.

14) A thin film of nontoxic, water soluble, NSF/ANSI 61 approved gasket lubricant shall be applied to the inside surface of the gasket and the spigot end of the pipe.

15) Flange joint pipe including flanged spools, only where shown on the drawings, shall meet the additional requirements of AWWA C115 suitable for the pressure specified.

a) Gaskets shall be full face, synthetic rubber, and 1/8-inch thick conforming to flange dimensions, pipe manufacturer's requirements and AWWA C111/C115. For diameters 14-inch and larger 1/8-inch ring type compressed fiber, non-asbestos gaskets are required.

b) Flange bolts, washers, and nuts shall be stainless steel. Flange bolts shall be in accordance with ASTM A193, Grade B8 with heavy hex nuts in accordance with ASTM A194, Grade 8. Strain hardened stainless steel washers type 304.

(1) All stainless steel bolts shall receive a coating of food-grade NSF/ANSI 61, non-conductive, anti-seize on the threads prior to installation.

16) Approved manufacturers of ductile iron pipe:

| **Manufacturers** |
|---|
| American Cast Iron Pipe Company |
| McWane Ductile |
| U.S. Pipe and Foundry Company/Griffin Pipe Products |

17) Ductile iron pipe installed shall be manufactured domestically in the US.

C) Polyvinyl Chloride (PVC) Pressure Pipe

1) 2-inch Through 3-inch PVC Pipe and PVC Fittings

a) PVC pressure pipe 2-inch through 3-inch in diameter shall be Schedule 40 with socket type solvent weld joints meeting the requirements of ASTM D 1785 and NSF/ANSI 61.

b) Nominal pipe lengths shall be 20 feet. Random lengths are not acceptable.

c) PVC Fittings shall be Schedule 40 socket type solvent weld meeting the requirements of ASTM D 2466 and NSF/ANSI 61. Threaded type PVC adapters, caps, and 90° bends shall be Schedule 80.

d) Solvent cement shall be regular- or medium-bodied, high-strength, low VOC as recommended by manufacturer under this specification.

(1) Approved manufacturers of solvent cement:

| **Manufacturer** | **Product** |
|---|---|
| IPS Corporation | 700, 702, 710 (2-inch only), 704, 705, 721 |

e) Primer for all solvent weld joints shall be premium, fast acting, industrial strength, low VOC for wet and/or quick set applications.

(1) Approved manufacturers of primer:

| **Manufacturer** | **Product** |
|---|---|
| IPS Corporation | Weld-On P-75 Wet ‘R Dry |

2) 4-inch Through 24-inch PVC Pipe

a) PVC pressure pipe 4-inch through 24-inch in diameter shall be manufactured in accordance with AWWA C900 and NSF/ANSI 61.

b) Pipe joints shall be made using an integral bell with an elastomeric gasket push-on type joint.

c) Standard pipe outside diameters (ODs) conform to the ductile iron and cast iron sizing system, referred to as cast iron or CIOD.

d) Minimum pressure class or dimension ratio (DR) of PVC pipe shall be DR18 unless otherwise indicated.

e) Pipe shall have a nominal laying length of 20-feet. Random lengths are not acceptable.

f) Restrained joint PVC pipe where shown on the drawings to be positively restrained non-metallic push-on joint pipe shall have coupling and locking splines; or integral bell and locking spline; or fusible type pipe.

g) Approved manufacturers of PVC pipe including restrained joint PVC pipe:

| **Manufacturers** |
|---|
| Diamond Plastics Corporation |
| IPEX |
| JM Eagle |
| North American Pipe Corporation |
| Underground Solutions |
| Vinyltech Corporation |

## 2.2 PIPE FITTINGS

### A) General

1) All fittings shall be intended for use with potable water. Components in contact with potable water shall be certified to comply with NSF/ANSI 61, Drinking Water System Components – Health Effects, and a copy of the NSF/ANSI 61 certification shall be provided to Ute Water Conservancy District and the pipe bear the NSF hallmark.

2) All fittings shall be ductile iron (DI) in accordance with AWWA C110 or AWWA C153 as specified herein except as otherwise specified for PVC fittings for 2- through 3-inch.

3) All DI fittings shall have mechanical joint (MJ) ends as specified herein, except as noted below or shown on the drawings.

   a) DI Tees shall be flanged with a flanged by mechanical joint (FLxMJ) valve bolted directly to the tee or as shown on the drawings.

      (1) If as shown on the drawings, only one of two branches include a FLxMJ valve, an adapter shall be provided as specified herein.

      (2) If size 2- and 3-inch pipe line is installed off a tee, use IP tapped companion flange, stainless steel nipple (4" minimum length) and IP threaded gate valve.

4) Standard coating system shall be asphaltic coating with cement-mortar lining or fusion-bonded epoxy inside and outside as additionally specified herein or except as otherwise shown on the drawings.

   a) Ductile iron fittings outside coatings shall be petroleum-asphaltic coating approximately 1 mil thick, shop-applied, continuous and smooth, neither brittle when cold or sticky when exposed to the sun, and strongly adherent to the fitting.

   b) Ductile iron fittings inside linings shall be cement-mortar linings in accordance with ANSI/AWWA C104/A21.4. At the manufacturer's option, moist cement-mortar linings can be given a seal coat of asphaltic material for curing the cement mortar.

   c) Fusion-bonded epoxy ductile iron fittings shall be in accordance with ANSI/AWWWA C116/A21.16 and shall be applied to the interior and

exterior surfaces. DI caps, plugs, and sleeves not normally cement mortar lined shall have fusion-bonded epoxy interior and exterior.

5) All ductile iron pipe and ductile iron pipe fittings, including buried fire hydrant sections shall be polyethylene encased conforming to AWWA C105.

6) Acceptable manufacturers of DI fittings include:

| **Manufacturers** |
|---|
| American Cast Iron Pipe Company |
| McWane Ductile (TR Flex Restrained Joint DI Fittings) |
| Sigma Corporation |
| Star Pipe Products |
| Tyler Union |
| U.S. Pipe and Foundry Company/Griffin Pipe Products |

7) Ductile iron fittings installed shall be manufactured domestically in the US.

B) Mechanical Joint Fittings

1) All MJ bends, tees, reducers, sleeves, offsets, caps and plugs, adapters, combinations thereof, and other miscellaneous fittings 3-inches through 16-inches in diameter shall be ductile iron compact fittings in conformance with AWWA C153.

2) All MJ bends, tees, reducers, sleeves, offsets, caps and plugs, adapters, combinations thereof, and other miscellaneous fittings greater than 16-inches in diameter shall be ductile iron fittings in conformance with AWWA C110.

3) Unless other specified, the minimum working pressure for all MJ ductile iron fittings 3-inches through 24-inch in diameter shall be 350 psi.

4) Unless otherwise specified, the minimum working pressure for all MJ ductile iron fittings 30-inch through 48-inch in diameter shall be 250 psi.

5) Mechanical joint type DI fittings are a bolted joint of the stuffing-box type that consist of (1) a fabricated or cast bell provided with an exterior flange having bolt holes or slots, a socket with annular recesses for sealing gasket and plain end of pipe or fitting; (2) a pipe or fitting plain end; (3) a sealing gasket; (4) follower gland with bolt holes; and (5) tee-head bolts and hexagonal nuts.

a) Mechanical joint restraints shall be manufactured of DI in accordance with ASTM A 536. MJ restraints are incorporated into the design of the follower gland often known as a retainer gland with dimensions such that it can be used with standardized MJ bell and tee-head bolts in accordance with AWWA C111, C110 and C153.

b) Restraint mechanism shall consist of numerous individually activated gripping surfaces to maximize restraint capability. The gripping surfaces shall be wedges that are designed to spread the bearing surfaces on the pipe. Twist-off nuts, sized the same as tee-head bolts, shall be used to ensure the proper actuating of restraining devices. When the nut is sheared off, a standard hex nut shall remain.

c) MJ restraint device shall have a pressure rating equivalent to the fitting with a safety factor of 2 and are specifically designed for use with PVC pipe or DI pipe.

d) The use of MJ restraint devices in lieu of concrete thrust blocks for restraint is limited to applications specified herein or as shown on the drawings.

e) External coatings shall be shop-applied suitable for direct bury service.

f) Acceptable manufacturers of MJ restraints for PVC Pipe include:

| **Mechanical Joint Restaint – PVC Pipe** | |
|---|---|
| **Manufacturers** | **Models** |
| EBAA Iron, Inc | Megalug Series 2000 PV |
| Ford Meter Box Company | UFR 1500 |
| Romac Industries | PVC RomaGrip |
| Sigma Corporation | One-Lok SLCE |
| Smith-Blair | Cam-Lock for PVC |
| Star Pipe Products | StarGrip Series 4000 |
| Tyler Union | TufGrip Series 2000 |

g) Acceptable manufacturers of MJ restraints for DI Pipe include:

| **Mechanical Joint Restaint – DI Pipe** | |
|---|---|
| **Manufacturers** | **Models** |
| EBAA Iron, Inc | Megalug Series 1100 PV |
| Ford Meter Box Company | UFR 1400 |
| Romac Industries | DI RomaGrip |
| Sigma Corporation | One-Lok SLDE |
| Smith-Blair | Cam-Lock for DI |
| Star Pipe Products | StarGrip Series 3000 |
| Tyler Union | TufGrip Series 1000 |

6) Mechanical joint restraints for PVC Pipe and DI Pipe installed shall be manufactured domestically in the US.

7) Rubber gaskets shall be made of vulcanized styrene butadiene rubber (SBR). Reclaimed or natural rubber shall not be used. Gaskets shall be free from porous areas, foreign material, and other defects that make them unfit for the use intended. Quality control tests shall be available upon request.

8) A thin film of nontoxic, water soluble, NSF/ANSI 61 approved gasket lubricant shall be applied to the inside surface of the gasket and the spigot end of the pipe.

C) Flanged Fittings

1) All flange-joint bends, tees, reducers, adapters, combinations thereof, and other miscellaneous fittings including flange spool pieces 3-inches through 48-inches in diameter shall be ductile iron fittings in conformance with AWWA C110.

a) Gaskets shall be full face, synthetic rubber, and 1/8-inch thick conforming to flange dimensions, pipe manufacturer's requirements and AWWA C111/C115. For diameters 14-inch and larger 1/8-inch ring type compressed fiber, non-asbestos gaskets are required.

b) Flange bolts, washers, and nuts shall be stainless steel. Flange bolts shall be in accordance with ASTM A193, Grade B8 with heavy hex nuts in accordance with ASTM A194, Grade 8. Strain hardened stainless steel washers type 304.

(1) All stainless steel bolts shall receive a coating of food-grade NSF/ANSI 61 anti-seize on the threads prior to installation.

2) Unless otherwise specified, the minimum working pressure for all flanged ductile iron fittings shall be 250 psi.

D) Plain End Fittings

1) Plain end bends, tees, reducers, combinations thereof, and other miscellaneous fittings including spool pieces 3-inches through 48-inches in diameter shall be ductile iron designed to mate with the mechanical joint AWWA C110/C153 and push-on joint connections AWWA C111.

E) Tapping Sleeve

1) Tapping sleeves, in combination with resilient seat wedge gate valves and specialty equipment, are used to install cut-in type connections to existing water facilities with or without interruption performed by Ute Water Conservancy District.

2) Tapping sleeves shall meet the requirements of AWWA C223 with the additional requirements. Tapping sleeves shall be stainless steel meeting or exceeding the requirements of ASTM A 240 type 304 UNS. The stainless steel surface shall be descaled and passivated in accordance with ASTM A967 or ASTM A380.

3) The outlet shall be heavy gauge stainless steel; the outlet flange shall be ASTM A536, Grade 65-45-12 ductile iron with ANSI Class 125 and 150 drilling and recessed to accept tapping valve specified herein.

a) Bolts, nuts and washers shall be 304 stainless steel; heavy hex nuts coated to prevent galling.

b) Flange gasket shall be virgin styrene butadiene rubber (SBR) suitable for potable water meeting the NSF 61 requirements.

4) Tapping sleeves 4- through 8-inch pipe size shall be rated for a working pressure of 250 psi and 10- through 24-inch pipe size shall be rated for a working pressure of 200 psi.

5) Acceptable manufacturers of tapping sleeves are:

| **Manufacturers** | **Model** |
|---|---|
| Ford Meter Box Company | FAST, FTSS DI Flange |
| Mueller Co | H-304 DI Flange |
| Romac Industries | Model SST, SST III DI Flange |
| Smith-Blair | Model 662,664 DI Flange |

## 2.3 COUPLINGS AND ADAPTERS

A) Couplings and adapters shall be limited in their application to connection of proposed pipe facilities to existing and proposed waterline facilities, temporary installations, and where specifically called for in the Contract Documents or approved by Engineer.

B) Couplings to ensure a permanent watertight plain end connection to proposed pipe facilities shall be DI mechanical joint type solid sleeve couplings described in these specifications herein and includes approved manufacturers.

C) Couplings to ensure a permanent watertight plain end connection to existing pipe facilities to accommodate a reasonable OD variance shall be a reducing or transition bolted sleeve-type coupling in accordance with AWWA C219 and in accordance with AWWA Manuals M11 and M41 for design.

1) End rings and center sleeves shall be coated in accordance with AWWA C210 or C213 with a minimum DFT of 12 mils suitable for direct bury.

2) Bolts, heavy hex nuts, and washers (when used) shall be similar materials to minimize the possibility of galvanic corrosion. The manufacturer of the fitting shall supply proper bolts, nuts, and washers along with information as to the recommended torque to which the bolts shall be tightened.

3) Acceptable manufacturers and models of bolted sleeve couplings:

| **Manufactures** | **Models** |
|---|---|
| Dresser | Style 38, Style 138 |
| Ford Meter Box Company | Style FC1, FC2 |
| Hymax | Grip, Hymax 2 |
| Romac Industries | XR501, Macro HP, Style 400 |
| Smith-Blair | 400 Series |

D) Bolted, split sleeve couplings, restrained and nonrestrained, in accordance with AWWA C227 for use on plain end welded steel pipe only as approved by Ute Water Conservancy District.

E) Flanged adapters are a restrained adapter flange coupling device designed to connect plain end pipe to a flanged pipe, valve or fitting. A flange adapter is a ductile iron or steel body with a flanged end and mechanical joint end and shall be used in lieu of threaded or welded flanges on plain end ductile or PVC pipe unless approved in writing by Ute Water Conservancy District. Specification requirements are described herein.

1) Acceptable manufacturers and models of flange adapters:

| **Manufactures** | **Models** |
|---|---|
| EBAA Iron, Inc | Megaflange Series 2100 |
| Ford Meter Box Company | RFAP, RFAD |
| Romac Industries | RFCA, RFCA-PVC |
| Smith-Blair | Flange Lock |

## 2.4 VALVES

A) General

1) All valves and appurtenances shall have the name, monogram, or initials of the manufacturer cast thereon. They shall be built and equipped for the type of operation as specified herein or as shown on the drawings. Valves shall be suitable for frequent operation and for long periods of inactivity. Valves shall be suitable for flows in either direction. Components shall be suitable for exposure to chloraminated water.

2) Where requested by the Contractor and approved by the Engineer, additional valves may be installed by the Contractor to facilitate installation, testing, or connection to existing pipe work. Unless otherwise specified in writing by the Engineer, such valves requested by the Contractor shall be provided at no additional cost to the Owner.

3) All buried valves shall be supplied with a 2-inch square operating nut. Operating nut shall be 1-5/16 -inch square at the top, 2-inch square at the base and 1-3/4 - inches high. Extension stems shall be provided for buried valves when the operating nut is four (4) feet or more below finished grade. Extension stem shall extend to within twelve (12) inches of the ground surface and shall be provided with spacers which will center the stem in the valve box.

4) At the minimum, joint restraints will be required at the valve; additional joint restraints maybe required at adjacent joints depending on proximity to the valve, test pressure and line size, with the approval of the Engineer.

5) Unless otherwise specified, all valves shall have a minimum pressure rating that will accommodate maximum pressure which will be experienced during hydrostatic leakage testing.

B) Valve Boxes (VB)

1) A cast iron valve box and lid shall be provided for each underground valve. Valve boxes shall be 2-piece, slip type sized for the type of valve and depth of bury. The use of extensions in preparation of final grade shall not be acceptable.

2) The valve box lid shall have the word "water" permanently cast on the top.

3) Valve box parts shall be made of gray cost iron in accordance with ASTM A 48, Class 35B. Aluminum alloy as a casting material is not acceptable.

4) Valve boxes shall be heavy duty 564A, with formed top to receive insert type traffic-rated cover.

5) All parts of valve boxes, bases, and covers shall be coated by dipping in black bituminous paint.

C) Gate Valves (GV)

1) Gate valves shall be resilient seated wedge gate valves designed and manufactured in accordance with AWWA C509 or AWWA C515, as applicable, with the following additional requirements.

2) Gate valves shall be iron body, resilient seated gate valves, fully bronze-mounted with non-rising stems. Valve bodies shall be designed to allow for the lifting of the valves by the bonnet flange, gland flanges, or other appurtenances.

3) Valve stems shall be made of bronze in accordance with ASTM B 763, Copper Alloy No.C99500 or stainless steel in accordance with ASTM A 276, Type 304, Type 316, or AISI 420. The stems shall consist of two O-rings.

4) Valves shall be suitable for frequent operation and for long periods of inactivity. Operating pressure for 3-inch through 12-inch shall be 200 psi and 14-inch through 16-inch shall be 150 psi; valves shall be drip-tight, zero leakage past the seat under rated pressure differential.

5) The bonnet gland bolts and nuts shall be in accordance with ASTM F 593, Type 304 stainless steel. The hot-dip galvanized process is not acceptable.

6) Flanged and mechanical joint end connections as indicated on the drawings. Flanges shall be sized and drilled in accordance with ANSI B16.1, Class 125; machined and finished in accordance with AWWA C207. Mechanical joint ends shall be as described in these specifications and AWWA C111.

7) Ferrous surfaces, except machined or bearing surfaces, shall be prepared in accordance with SSPC SP10. These interior and exterior surfaces shall be epoxy coated in accordance with AWWA C550.

8) Each valve shall be successfully operated and hydrostatic tested in accordance with AWWA C509 or AWWA C515 at the manufacture's plant.

9) The manufacturer shall provide affidavit of compliance in accordance with the AWWA Standard.

10) Acceptable manufacturers of resilient seated gate valves are:

| **Manufacturers** |
|---|
| American AVK |
| Clow Valve Co. |
| Kennedy Valve |
| Mueller Co |
| US Pipe Valve & Hydrant |

D) Tapping Valves

1) Tapping valves shall be resilient seated wedge gate valves specified herein and in accordance with AWWA C509 or AWWA C515 furnished with a tapping sleeve flanged end connection on one end of the valve.

2) The tapping sleeve flanged end connection on the fitting side shall have a machined projection on the flange to mate with a machined recess on the outlet flange of the tapping sleeve fitting.

3) The outlet end shall conform in dimensions to the AWWA Standards for hub or mechanical joint end, except that the outside of the hub shall have a large flange for attaching a drilling machine. The seat opening of the valves shall be larger than normal size to permit full diameter cuts.

4) Acceptable manufacturers of resilient seated gate valves are:

| **Manufacturers** |
|---|
| American AVK |
| Clow Valve Co. |
| Kennedy Valve |
| Mueller Co |
| US Pipe Valve & Hydrant |

E) Butterfly Valves (BFV)

1) Butterfly valves shall be rubber seated butterfly valves designed and manufactured in accordance with AWWA C504 except as herein modified.

2) Valves shall be suitable for throttling service, frequent operation, and long periods of inactivity. Valves shall operate with flows in either direction. Components shall be suitable for exposure to chloraminated water.

3) Butterfly valves shall be iron body rubber seated, rated for a differential pressure of 250 psi and a flow velocity of 16 ft/sec. Class 250B valves shall be ductile iron bodies. Valves shall be short-body. Unless specified otherwise, valves shall be intended for direct-bury use.

4) Butterfly valves shall be supplied with 2-inch square operating nut and open standard counter-clockwise. The type and class of valves shall be specified.

5) Unless otherwise specified or shown on the drawings, valves shall have flanged end or mechanical end as specified herein. Flanges shall be Class 125, flat faced, dimensions and drilling per ANSI B16.1 with full-sized bolt holes through the flange except where the shaft passes through the body. Flange gaskets and hardware as specified herein.

6) Butterfly valves shall be furnished with manual actuators designed and sized per AWWA M49 to meet torque requirements for the maximum differential pressure rating; actuators shall be sufficient to seat, unseat, and rigidly hold the disc in any position. The gearing of the actuator shall be totally enclosed and sealed with lubricant for a temperature range of -10°F to 150°F.

7) Interior and exterior surfaces except stainless steel, machined or bearing surfaces, and flange faces shall be shop-coated with an epoxy coating conforming to the requirements of ANSI/AWWA C550 to a minimum dft of 8 mil with NSF/ANSI 61 certification provided.

8) Acceptable manufacturers of resilient seated butterfly valves are:

| **Manufacturers** |
|---|
| DeZurik |
| Kennedy Valve |
| M&H Valve Co |
| Mueller Co |
| Pratt |
| Val-Matic |

F) Air Release Valves (ARV)

1) Air release valves shall be combination air-release and air vacuum valves designed and manufactured in accordance with AWWA M51 and AWWA C512.

2) Valves shall be capable of venting large quantities of air while filling pipeline systems; automatically releasing small pockets of air that accumulate during system operation; and admitting large quantities of air into pipeline system when internal system pressure drops below atmospheric pressure. Valves shall be suitable for frequent operation and long periods of inactivity. Components shall be suitable for exposure to chloraminated water.

3) Valves shall be a single body design capable of 300 psi maximum working pressure. Materials for valve construction shall comply with the requirements of the Safe Drinking Water Act for potable water.

4) Valve sizes, locations, and details shall be in accordance with the drawings. Valves shall be installed in a vertical position in an underground concrete manhole or concrete vault as applicable.

5) Valves, 1-inch and 2-inch shall be furnished with NPT inlets and 3-inch through 6-inch shall be furnished with flanged inlets that conform to the dimensions and drilling of ANSI B16.1, Class 125. A ¼-inch minimum NPT in the bottom of the valve body shall be provided.

6) Internal and external ferrous surfaces, except machined or bearing surfaces shall be prepared in accordance with SSPC SP10. These surfaces shall then be epoxy coated in accordance with AWWA C550 and NSF 61 compliant.

7) Acceptable manufacturers of combination air-release and air vacuum valves are:

| **Manufacturers** |
|---|
| APCO |
| GA Industries |
| Val-Matic |

## 2.5 SERVICE LINE PIPE, VALVES, FITTINGS AND TAPPING SADDLES

### A) General

1) All service brass and bronze goods in contact with potable water shall be manufactured in accordance with AWWA C800 using lead-free copper alloy.

2) Components in contact with potable water must comply with the latest requirements of the Federal Safe Drinking Water Act, NSF/ANSI 61 and a copy of the certification shall be provided if requested.

### B) Service Line Pipe

1) Water service line pipe shall be seamless copper water tube in accordance with ASTM B 88, furnished in coils, annealed, Type K Copper UNS No.12200, in accordance with AWWA C800.

2) Water service line pipe sizes include: ¾-inch, 1-inch, 1 ¼-inch, 1 ½-inch, and 2-inch nominal diameters. Unless otherwise shown on the drawings, service line pipe shall be 3/4-inch.

3) Acceptable manufacturers of water service line pipe are:

| **Manufacturers** |
|---|
| Cambridge-Lee Industries |
| Cerro Flow Products |
| CMC Howell Metal |
| Mueller Industries |
| Wieland Copper |

4) Water service line pipe shall be manufactured domestically.

C) Corporation Stops

1) Corporation (corp) stops are valves attached to all service saddles at the main. Corp stops shall be brass fittings with full-way bore with inlets for AWWA iron pipe threads and compression outlets to adapt to copper pipe.

2) Acceptable manufacturers of corporation stops are:

| **Manufacturers** | **Models** |
|---|---|
| A.Y. McDonald | Ball Model 74704BQ |
| Ford Meter Box Co | Ball FB1100-x-Q-NL |
| Mueller Co. | Type300 Ball Model B-25028N |

D) Service Saddles

1) Service saddles (tapping saddles) are fittings that attach circumferentially to the water main to provide for attachment of a corporation stop.

2) DI and AC pipe service saddles shall be double bronze strapped tapping saddles with AWWA iron pipe threads.

a) Acceptable manufacturers of DI and AC pipe service saddles are:

| **Manufacturers** | **Models** |
|---|---|
| A.Y. McDonald | 3826 |
| Ford Meter Box Co | 202B-xxx-TAP IP Thread<br>202BS-xxx-TAP IP Thread<br>202BSD-xxx-TAP IP Thread |
| Mueller Co | BR2B IP Thread<br>BR1S IP Thread<br>BR2S IP Thread |

3) PVC pipe service saddles shall be stainless steel strapped bronze tapping saddles with AWWA iron pipe threads; saddles shall provide full support around the circumference of the pipe, have a bearing area of sufficient width along the pipe axis so that the pipe will not be distorted when the saddle is tightened.

a) Acceptable manufacturers of C900 PVC pipe (4-inch through 24-inch) service saddles are:

| **Manufacturers** | **Models** |
|---|---|
| A.Y. McDonald | 3846, 3856 |
| Ford Meter Box Co | 202BS-xxx-TAP IP Thread<br>202BSD-xxx-TAP IP Thread |
| Mueller Co | BR2S IP Thread<br>BR2W IP Thread |
| Romac Industries | 202BS IP Thread |

b) Acceptable manufacturers PVC pipe saddles (2-inch through 3-inch)

| **Manufacturers** | **Models** |
|---|---|
| A.Y. McDonald | |
| Ford Meter Box Co | FS300W-xxx-Tap IP Thread<br>F1-xxx-xxx-IPx |
| Mueller Co | 500/510 Series IP Servi-Seal |
| Romac Industries | SS1 IP Tap Repair Clamp |
| Smith-Blair | Full Circle Repair Clamp w/IP Tap Service |

E) <u>Brass and Bronze Goods</u>

1) Where connecting to existing water service lines, Contractor shall supply all required fittings to make connections, plug services and blow offs.

2) Fittings are generally no-lead (no more than 0.25% total lead content) brass; typically with compression style ends.

3) Couplings

| **Manufacturers** | **Types** | **Models** |
|---|---|---|
| A.Y. McDonald | Coupling CTS | 74758-22 |
| Ford Meter Box Co | | |
| Mueller Co | Coupling 3 part union | H-15403N |

4) Branch wye fittings for gang services shall be brass MIP x CTS manufactured by A.Y. McDonald, Ford Meter Box, and Mueller Co.

5) Threaded pipe nipples shall be brass or stainless steel with IP thread.

6) Plugs and caps shall be brass with IP thread.

## 2.6 WATER METERS

A) All meter pit assemblies, including cones and lids, yokes and water meters, shall be provided by the Ute Water Conservancy District.

1) Meter pits generally include concrete pit rings; CI cone, CI frost lid and CI top lid drilled to accept radio read meters. Cast iron goods shall be thoroughly cleaned and coated with a black bituminous paint.

2) Yokes are copper with brass valves and goods; ends will have a CTS compression inlet with a FIP outlet.

## 2.7 FIRE HYDRANTS

A) General

1) All fire hydrants shall conform to local fire district requirements unless otherwise required.

2) Dry-barrel fire hydrants shall be designed and manufactured in accordance with AWWA M17 and AWWA C502 with the following additional requirements or exceptions.

B) Fire hydrants shall be designed for a minimum working pressure of 150 psi.

C) Fire hydrants shall be the three-way type with one pumper nozzle and two hose nozzles located on the same horizontal plane at least 18-inches above the ground line.

1) Hose nozzles (2) shall be 2 ½-inch nominal diameter ports with 7 ½-inch threads per inch (2.5-7.5 NH), National Standard in accordance with NFPA Standard 1963. Hose nozzle caps shall be furnished with security chains; the end shall be securely attached to the upper barrel section of the fire hydrant.

2) Pumper nozzle (1) shall be 4 ½-inch nominal diameter port; nozzle dimensions as specified herein. Pumper nozzle caps shall be furnished with security chains; the end shall be securely attached to the upper barrel section of the fire hydrant.

a) Grand Junction Fire District and Grand Junction Rural Fire District:

(1) Threads per inch (tpi) shall be 4.

(2) Outside (major) diameter of male thread is 5.282 inches.

(3) Diameter of root (minor) male thread is 4.932 inches.

(4) Pitch diameter is 5.12 inches.

b) Lower Valley Fire District:

(1) An integral 5-inch quick, universal ¼ turn hose to hydrant connection (commonly referred to as a Storz Nozzle) and metal cap which can be opened by a standard hex nut hydrant wrench shall be factory-installed from the manufacturer.

3) Hydrants shall have a main valve opening of 5 ¼-inches, compression type that closes with water pressure. The components of the main valve assembly shall be designed so that removal of the assembly from the barrel may be accomplished without excavation.

4) Hydrant base shall be provided with a mechanical joint inlet to accommodate 6-inch DI or C900 PVC pipe complete as specified herein.

5) Hydrants shall be equipped with traffic features that include a breakaway flange or lug system with a shaft coupling that prevents damage to the barrel section upon impact.

6) The upper and lower operating rods shall be stainless steel. The operating nut shall be bronze or DI, pentagon shaped with a finished height of 1 1/8-inch. The dimensions from point-to-flat shall be between 1 ¼-inch and 1 3/8-inch, top to the bottom of the nut, respectively.

7) A stop nut located in the hydrant bonnet on the operating shaft shall prevent the over travel of the main valve when it is being opened.

8) The hydrant shall open by turning the operating nut left or counter-clockwise and shall have an arrow on the top of the bonnet to designate the direction of opening.

9) The upper exposed section of the fire hydrant shall be thoroughly cleaned and painted with a prime coat of a rust inhibitive primer followed by a 10 mil DFT shop coat of heavy duty enamel paint. The paint color:

a) Grand Junction Fire District and Grand Junction Rural Fire District:
Bonnet shall be “OSHA Safety Yellow”
Body shall be “OSHA Safety Green”

b) All other Fire Districts fire hydrants shall be painted "OSHA Safety Red"

10) Exposed exterior surfaces below the bury line shall be coated with asphalt varnish in accordance with AWWA C502. Interior of the hydrant shall be coated with an epoxy coating in accordance with AWWA C502 and NSF 61. The hydrant shoe and connecting gland shall be lined and coated with fusion-bonded epoxy in accordance with AWWA C502.

11) Fire hydrants shall be oriented so as to optimize access to nozzles; pumper nozzle shall generally face the street, or as directed by the Engineer.

12) Ute Water standard detail for fire hydrant assemblies require concrete thrust blocks as shown regardless of the use of joint restraints.

13) Acceptable manufacturers of fire hydrants:

| **Manufacturers** | **Model** |
|---|---|
| Kennedy Valve | Guardian K81-D |
| Mueller Co | Super Centurion |

## 2.8 BACKFILL AND BEDDING MATERIAL

A) Unless otherwise shown on the drawings or specified herein, all pipe bedding materials shall be in conformance with the applicable trench excavation and backfill specifications contained herein.

## 2.9 CONCRETE

A) Concrete for thrust blocks or pipe anchorage shall be Portland Cement concrete with minimum compressive strength at 28 days of 3000 psi.

B) High early concrete specified in the Contract Documents shall achieve compressive strength of 2,500 psi in 24 hours minimum.

C) Reinforcing steel shall be deformed bars conforming to ASTM A615, Grade 60; hooked epoxy-coated rebar shall be used for concrete overbends. A fiber mesh additive, in lieu of reinforcing steel, to concrete is acceptable for most thrust block installations with approval from Ute Water's Engineer.

2.10 TRACER WIRE

A) A continuous insulated minimum 10 gauge solid copper tracer wire shall be supplied with all pipe with 2-inch wide PVC tape.

B) Tracer wire shall have blue 0.03-inch thick high molecular weight polyethylene (HMWPE) insulation suitable for direct burial applications.

C) Additional wire shall be installed as necessary to allow the tracer wire to be looped up at all fire hydrants and air vents at underground vaults.

2.11 BLOWOFF ASSEMBLY

A) A Blowoff Assembly is required for evacuating air and flushing water facilities. Blowoff assemblies generally include: service saddles, valves, and pipe according to the Standard Details and sized according to the schedule provided in specifications herein.

1) A Type B Blowoff Assembly for installations where the main is to be permanently dead-ended, such as a cul-de-sac.

2) A Type A Blowoff Assembly for installations where the main is to be temporarily dead-ended, such as the boundary of a subdivision filing, a Type A Blowoff shall be installed unless a fire hydrant, which can serve additionally as a blowoff, is located at the main's temporary end.

## PART 3: EXECUTION

3.1 PRODUCT HANDLING, UNLOADING, AND STORAGE

A) Care shall be taken during transporting and all handling to avoid damaging pipe and appurtenances. Loading and unloading shall be accomplished with the material under control at all times and under no circumstances shall the material be dropped. Material shall be securely wedged and restrained during transportation and supported on blocks when stored in the shop or field. Manufacturer's recommendations shall be carefully followed during material handling and storage.

B) The Contractor shall be responsible for unloading and loading materials at the jobsite. Slings (other than nylon straps), hooks, or pipe tongs shall be padded and used to properly prevent damage to pipe and appurtenances.

C) Store all pipe on a flat surface so that the blocking will support the barrel evenly; if possible, pipe and appurtenances shall be handled in unit packages with proper

supports. When unit packages are stacked, care shall be exercised to ensure the height of the stack does not result in instability that could cause stack collapse, pipe damage, or personal injury. Generally, stack height should not exceed eight (8) feet.

D) Plastic pipe, if stored outside for long periods of time shall be covered with an opaque material to protect it from sunlight. Gaskets shall be protected from excessive exposure to heat, direct sunlight, oil, grease or other contaminants.

E) Lower all pipe and fittings into trench in a manner to prevent damage to pipe or fittings. Heavy impact may cause a slight longitudinal indentation in the outside of PVC pipe and a crack on the inside. This may result in a split as soon as the pipe is placed under pressure. Any pipe that has been impacted shall be examined closely for this type of damage. Any observed gouges or scratches that extend 10 percent or more into the pipe wall shall justify rejection of that pipe.

F) All pipe and appurtenances are subject to inspection on delivery. Neither inspection nor failure to provide inspection shall relieve the Contractor of the responsibility to provide materials meeting the requirements of the Contract Documents. Materials not conforming to the requirements of these specifications and AWWA Standards shall be made satisfactory or replaced.

## 3.2 SURVEYING

A) Water facilities, including pipe, fittings, valves, meter services, hydrants, and other appurtenances shall not be installed without line and grade stakes approved by Ute Water Inspector. Line and grade for water mains shall be established under the direct supervision of a PLS.

B) The correct alignment and elevation of water mains, as shown on the approved drawings, is the responsibility of the PE. Approval by Ute Water Inspector does not relieve the PLS of responsibility of field errors.

C) If a water main is to be extended in an existing street and if the PE that prepared the plans can show the ground line is to remain unchanged, grade stakes shall not be required. The water main shall be installed with 54-inch of cover.

## 3.3 INSPECTION

A) The installation of new facilities shall be inspected and approved by Ute Water.

B) Ute Water personnel are not responsible for Contractor jobsite safety compliance or the enforcement of applicable safety regulations and standards.

C) Ute Water requires compliance with these specifications, especially with regard to the quality of workmanship and approved materials.

D) The Contractor shall give at least 2 days' notice to Ute Water's Engineer (970-242-7491) prior to the start of construction. Construction is not allowed within the 2-day notification period.

## 3.4 TRENCHING

A) Comply with federal regulations for the protection of workers and the safety of the general public according to AWWA M3.

B) Trench excavation shall proceed in advance of pipe installation only so far as can be backfilled the same day, or as permitted by the Contract Documents.

C) The discharge from any trench dewatering pumps or directional drilling operations shall be discharge to natural drainage channels, storm sewers, or containment reservoirs as approved by regulatory authorities having jurisdiction and in a manner that prevents property damage, erosion, or siltation.

D) Where necessary to prevent caving or trench instability, trench excavations in unstable soils shall be adequately supported with steel sheeting or trench boxes. Before sheeting is withdrawn, or trench boxes moved forward, they shall be raised, in place, just above the pipe crown to safely allow the Contractor to completely fill any voids left in the pipe zone.

E) Unless otherwise specified herein or shown on the drawings, the width of the trench at the top of the pipe shall permit the pipe to be laid and joined properly and to allow the backfill to be placed in accordance with the Contract Documents. Trench widths are based on the nominal pipe diameter plus the distance from each side of the pipe to the face of the trench (or the back of the sheeting or trench box, if used). As a guide:

1) For pipe twenty-four (24)-inches in diameter or less, trench width shall not exceed width of the pipe plus nine (9) inches on each side.

2) For pipe greater than twenty-four (24)-inches in diameter, trench width shall not exceed width of the pipe plus fifteen (15) inches on each side.

F) Unless otherwise directed or called for on the drawings, all pipe trenches shall be excavated below the proposed pipe invert as required to accommodate the depths of pipe bedding material as scheduled on the drawings.

G) When excavation in rock, meeting the definition of rock as defined in Section 02226, is necessary, said rock shall be removed to provide additional clearance below the pipe zone as shown in the Contract Documents.

H) Blasting for excavation shall be permitted with approval by the Engineer and only after securing approval(s) from federal, state, and other authorities having jurisdiction.

I) Trees, shrubs, fences, and all other property and surface structures shall be protected during construction, unless their removal is shown in the Contract Documents. All properties that have been disturbed shall be restored as completely as practical to their original condition.

J) When material is found to include ashes, cinders, refuse, organic material, or other unsuitable material, this material shall be removed with approval from the Engineer according to the Contract Documents.

K) When the bottom of the trench consists of material that is unstable as determined by Ute Water's Engineer to such a degree that removal is impractical, a foundation for the pipe or appurtenance shall be constructed according to the Contract Documents

## 3.5 ALIGNMENT AND GRADE

A) Waterlines shall be laid and maintained on lines and grades established in the Contract Documents. Fittings, valves, hydrants, and appurtenances shall be installed at the required locations, unless field conditions warrant otherwise and these changes are approved in accordance with the Contract Documents.

B) Prior to excavation, an investigation shall be conducted to determine the location of existing underground utilities, structures, conflicts, and potential for corrosive soil conditions. Special precautions shall be taken when the water main being installed crosses or is adjacent to a facility that is cathodically protected.

C) Generally, waterlines shall be installed at a depth of bury of 54-inches measured from the top of pipe to finish grade unless specifically approved by the Engineer.

D) When waterlines are designed to be laid in a straight line and/or at a specific grade, the deviation from line and grade shall not be in excess of 0.2 feet horizontally for line and 0.1 feet vertically for grade.

E) Variations from the bury depth may be necessary to avoid underground obstructions. A minimum of six (6) inches of clearance shall be maintained

between the pipe and obstructions unless federal, state, and other local regulations require otherwise or as deemed necessary to prevent future damage.

## 3.6 UTILITY CONFLICTS

A) The Contractor shall be responsible for exposing potential utility conflicts far enough ahead of pipeline construction to make necessary adjustments in grade and alignment of the new work within the recommended limits of pipe and fitting deflection and/or the lines and grades stated in the Contract Documents.

B) The Contractor shall be responsible for informing the Engineer of the need for a grade and/or alignment adjustment.

C) The Contractor shall not deviate from the design line and grade stated in these Contract Documents without the approval of the Engineer.

## 3.7 SANITARY SEWER CROSSINGS

A) The physical relationship between water lines and sanitary sewers shall conform to requirements of the Colorado Department of Public Health and Environment (CDPHE). The minimum horizontal spacing between sewer lines and water lines shall be ten (10) feet measured center line to center line.

B) Where sewer lines and water lines cross, the sewer pipe shall be a minimum of eighteen (18) inches clear distance vertically below the water line. If this clear distance is not feasible, the crossing must be constructed so as to protect the water line. Minimum protection shall be as follows:

1) When sewer crosses over water pipe, no matter what the separation distance, the sewer line shall be concrete encased with reinforced concrete to a distance of 10-feet on each side of the waterline as shown on the Standard Detail Drawing.

2) When the sewer crosses under the water pipe with less than 18-inches separation the sewer line shall be concrete capped to springline a distance of 10-feet on each side of the waterline as shown on the Standard Detail Drawing.

C) In all cases, suitable backfill or other structural protection shall be provided to preclude settling and/or failure of the sewer or water piping, especially the higher pipe.

D) Contractor shall contact Engineer when sewer lines are found within the above described zone. Engineer may field verify the need for concrete encasement of

sewer lines. Contractor shall install ductile iron sewer lines only after direction from the Engineer.

## 3.8 OPERATION OF EXISTING VALVES

A) The Owner will operate or supervise the operation of all existing valves during the course of the work. The Contractor shall not operate any existing valve unless specifically instructed to do so by the Engineer or the Owner.

B) The Contractor shall be responsible for coordination of the work with the Owner to provide for the timely operation of existing valves. Owner will require advance notice necessary to coordinate service outage notifications to customers.

C) The Contractor shall coordinate and perform the work so as not to require the Owner's personnel to operate any valves outside of the Owner's normal work hours.

## 3.9 SANITARY PRACTICES DURING INSTALLATION

A) Pipe shall not be laid in standing water. Precautions shall be taken to prevent dirt, debris, or other foreign materials from entering the pipe during all phases of construction. Tools, rags, and other materials shall be kept out of the pipe at all times.

B) At the end of each day, or at other times when the trench site is left unattended, the open ends of the pipe shall be sealed with a water tight plug to prevent trench water and foreign materials from entering the pipe. If water is in the trench, the seal shall remain in place as long as water is able to enter the pipe.

## 3.10 PIPE INSTALLATION

A) Pipe shall be laid and joined one length at a time to the required line and grade. Pipe shall be placed with the bell end facing the direction of laying unless otherwise specified.

B) Where pipe is laid on grades in excess of fifteen percent (15%), the bells shall face upgrade. Where pipe is laid on grades in excess of twenty percent (20%), pipe anchorage systems shall be required.

C) The outside of the spigot and the inside of the bell shall be cleaned immediately before the pipe or fittings are installed. If the pipe contains dirt or other foreign matter, the interior of the pipe shall be cleaned as necessary to remove the material prior to installation.

D) As the pipe is placed in the trench, bell holes shall be dug and the pipe supported on bedding materials the full length of the barrel.

E) Where required, lubricate the outer surface of the rubber gaskets and the spigot end of the pipe using approved lubricant meeting the requirements of the Federal Safe Drinking Water Act, NSF/ANSI 61.

F) Assemble the pipe in accordance with the manufacturer's recommendations. Regardless of the method used to assemble the pipe, the pipe shall be kept in alignment during installation of the spigot into the bell end or the fitting.

G) The spigot and the bell shall be aligned and pushed until the reference line on the spigot is flush with the end of the bell. Pushing shall be done in a smooth, steady motion. Pipe that is not furnished with a depth mark shall be marked prior to the assembly to ensure the spigot end is inserted to the full depth of the joint.

H) When it is necessary to deflect pipe from a straight line in either horizontal or vertical plane, the amount of deflection listed by the manufacturer shall be limited to 75% of those values.

I) After each length of pipe is installed in the trench, the pipe shall be secured in place with approved backfill material tamped under and along sides to prevent movement. Additional backfill material shall be placed and compacted in suitable lift layers to the height shown on the plans and details or as directed. The remainder of the trench shall be backfilled as specified and called for in the Contract Documents.

J) Pipe ends shall be kept clear of backfill at all times.

K) Wherever piping passes through walls, a wall casting pipe or sleeve shall be installed unless otherwise shown on the drawings.

## 3.11 FITTING INSTALLATION

A) All connections shall be made in strict accordance with manufacturer's recommendations.

B) The connection of pipe with plain ends of the same diameter in new construction shall be accomplished with ductile iron, mechanical joint solid sleeve couplings unless otherwise approved by the Engineer.

C) Contractor shall use the correct rubber gaskets with the ductile iron bell or fitting, and specifically designed for the pipe OD equivalent used.

D) Mechanical Joint Fittings

1) The outside of the spigot, the inside of the bell, and the rubber gasket shall be thoroughly cleaned to remove oil, grit, excess coating, and other foreign matter.

2) Lubrication and additional cleaning shall be provided by brushing both the gasket and plain end with soapy water or a thin film of nontoxic, water soluble, NSF/ANSI 61 approved lubricant just prior to slipping the gasket on the plain end.

3) The gland shall be slipped on the spigot end of the pipe with the lip extension of the gland toward the socket or bell end. The rubber gasket shall be placed on the spigot end with the thick edge toward the gland.

4) Pipe shall be pushed in until the spigot end fully penetrates the bell. The gasket shall then be pressed into place evenly within the bell around the entire joint. The DI gland shall be moved along the pipe into position for bolting. Bolts shall be inserted and nuts shall first be screwed finger tight with the final tightening to be done to the Manufacturer's specifications with a torque-limiting wrench.

5) Pipe equipped with locking gaskets providing mechanical joint restraint shall be installed according to the Manufacturer's recommendation. The bell end of the locking gasket pipe shall be spray-painted safety red.

6) Nuts spaced 180 degrees apart shall be tightened alternately to produce equal pressure on the gland.

E) Flanged Fittings

1) When installing flanged fittings, care shall be taken to ensure flanged mating faces and gaskets are clean and free of dirt and foreign matter.

2) Flanged faces should bear uniformly on the gasket, and the bolts should be tightened according to the manufacturer's requirements for torque and generally in a progressively crisscrossed pattern.

3) The flange shall be assembled and installed in accordance with the recommendations and instructions of the Coupling Manufacturer.

4) Stainless steel bolts shall receive a coating of food-grade NSF/ANSI 61 anti-seize on the threads prior to installation.

F) Couplings

1) When installing bolted sleeve-type couplings, care shall be taken to ensure connecting pipe ends, couplings, and gaskets are clean and free of dirt and foreign matter with special attention given to the contact surfaces of pipe, gaskets, and couplings.

2) The couplings shall be assembled and installed in accordance with the recommendations and instructions of the Coupling Manufacturer.

3) Coupling bolts shall be tightened to secure a uniform annular space between the end rings. The body of the pipe and the bolts shall be tightened approximately the same amount. Diametrically opposite nuts shall be tightened progressively and evenly. Final tightening shall be done to the Coupling Manufacturer's specifications with a torque-limiting wrench.

3.12 CUTTING PIPE

A) General

1) Cutting pipe for insertion of valves, fittings, or closure pieces shall conform to all safety recommendations of the manufacturer of the cutting equipment. Cutting shall be done in a safe, professional manner to prevent damage to the pipe.

2) Where new or existing pipe requires cutting in the field it shall be done in a manner to leave a smooth end at right angles to the pipe centerline. The pipe shall be marked around its entire circumference prior to cutting.

3) After cutting and dressing or beveling, the reference mark on the spigot shall be accurately relocated and marked at the proper distance from the end as recommended by the manufacturer. The reference mark may be located by using a factory marked end of the same size as a guide.

B) Ductile Iron Pipe

1) Ductile iron pipe selected for cutting should be field-gauged. A mechanical joint gland inserted over the barrel might serve as a convenient indicator for this purpose. Pipe can be selected by measuring with a tape in accordance with the manufacturer's recommendations.

2) Ductile iron pipe may be cut using an abrasive pipe saw, rotary wheelcutter, guillotine pipe saw, milling wheel saw, or oxyacetylene torch only if recommended by the pipe manufacturer.

3) Existing gray-iron pipe may be cut using a hydraulic squeeze cutter, abrasive pipe saw, rotary wheelcutter, guillotine pipe saw, milling wheel saw.

4) Cut ends and rough edges of the pipe shall be ground smooth as required. For push-on joint connections, the cut end shall be beveled by methods recommended by the manufacturer. The width and general appearance of the bevel shall closely resemble the bevel on an original pipe end.

5) Any lining or coating damaged during the cutting process, as determined by the Engineer, shall be cause for removing the damaged section by recutting the pipe or for rejecting the pipe altogether.

C) PVC Pipe

1) Circular saws, handsaws, or similar equipment may be used for cutting PVC pipe.

2) For push-on joint connections, the cut end shall be beveled. Factory finished beveled end may be used as a guide to determine the angle and length of taper. The end may be beveled using a plastic pipe beveling tools which will cut the correct taper automatically. A portable type sander or abrasive disc may also be used to bevel the pipe end.

3) For PVC pipe connection commonly found to ductile iron fittings, valves, hydrants, or other appurtenances, the insertion depth of these joints are significantly less than those of PVC pipe. Before assembly or insertion, the spigot end shall be squarely cut, deburred, and given only a slight outer bevel. If the pipe spigot end has the factory bevel, the factory bevel shall be removed or shortened to ensure that the gasket will be in full contact with the nonbeveled portion of the pipe.

D) Asbestos Cement (AC) Pipe

1) Methods of AC pipe cutting that produce a smooth square-cut end, without damage to the pipe, and that do not produce airborne particles, shall be employed. Abrasive discs are prohibited unless they are equipped with local exhaust ventilation and a high-efficiency particulate air (HEPA) filter dust collection system.

2) Contractor shall dispose of demolished materials off-site in accordance with applicable laws, ordinances, rules, and regulations. Upon request, provide the original disposal manifest to the Ute Water Conservancy District.

## 3.13 POLYETHYLENE ENCASEMENT

A) All ductile iron pipe, ductile iron pipe fittings, valves, appurtenances including buried fire hydrant sections shall be polyethylene encased conforming to AWWA C105.

B) Polyethylene film shall be fitted to the contour of the ductile iron pipe, fittings and appurtenances creating a snug, but not tight encasement, preventing contact between the pipe, fitting and the surrounding backfill. Lumps of clay, mud, cinders, etc., on the pipe surface shall be removed prior to installation of the polyethylene encasement.

C) Repair cuts, tears, punctures, or damage to polyethylene with adhesive tape or with a short length of polyethylene sheet, or with a tube cut open, wrapped around the pipe to cover the damaged area and secured in place.

D) Provide openings in encasement for service connections, blowoffs, air valves, and similar appurtenances by cutting an 'X' in the polyethylene and temporarily folding back the film. After the appurtenance is installed, tape the slack securely to the appurtenance and repair the cut and any other damage areas with tape.

E) Exercise care to prevent damage to the polyethylene encasement when placing backfill. Backfill material shall be free from cinders, refuse, boulders, rocks, and stones that could damage the polyethylene.

## 3.14 CATHODIC PROTECTION

A) Cathodic protection and electrical insulation shall be installed as required by Contract Documents. Care shall be taken to electrically insulate between dissimilar materials and at service line connections to metallic water mains.

B) Contractor shall install the cathodic bonding joint assemblies provided by the ductile iron pipe manufacturer across ductile iron pipe joints. Additional protection and care to ensure these assemblies don't damage the polyethylene encasement shall be provided; may include overlaying several layers of PVC tape to the bonding joint assemblies.

C) After the assembly of cathodic protection and electrical insulation joints are complete, Ute Water will test the assembly. The Contractor shall make necessary repairs until the joint passes the test.

## 3.15 CONNECTION TO EXISTING, IN-SERVICE MAINS

A) The Contractor must provide at least 2 business days' notice to the District prior to connecting to existing mains so that the District can notify customers of a planned outage. The fire department having jurisdiction for the affected area shall be notified 2 days in advance of service interruptions.

B) A normal outage shall be a maximum of 8 hours. If an outage is to be longer than 8 hours, the work shall be done in a manner that minimizes the inconvenience to customers, such as working at night in a continuous operation until service is restored.

C) Immediately prior to installation, all fittings, valves and appurtenances, including tool surfaces which will come in contact with potable water, shall be thoroughly cleaned by washing with potable water and then swabbed or sprayed with a minimum one percent (1%) solution of chlorine in accordance with the requirements of AWWA C651.

D) Cut-In Connections

1) All valves shall be operated by or under the supervision of a Ute Water District Representative.

2) Prior to taking any waterline out of service, the Contractor shall assemble all personnel, equipment, and materials necessary to complete the work, completely assemble all fitting assemblies and check components for compatibility with the existing waterline, and accomplish all excavation that is required to make the connection in as short of time possible or within a time period approved by the Ute Water District Representative.

3) Ute Water does not guarantee the water tightness of its valves on existing facilities. If existing valves leak, Ute Water will assist in reducing the leakage; however, the Contractor shall use appropriate methods to work with the resulting leakage.

4) In situations where an existing pipe joint is found adjacent to a proposed connection and the Engineer determines that construction operations may compromise the joint, the Contractor shall remove the existing pipe between the joint and the new work as directed by the Engineer, and replace that section with new materials.

E) Tapping Sleeves

1) Tapping sleeves or tees shall be spaced to provide clearance between the completed services lines and meter pits/vaults, fire hydrants, and similar underground structures. Minimum manufacturer spacing requirements between tapping sleeves and pipe or fitting joints shall be provided.

2) Contractor shall fully support the weight of the tapping tee, associated valve and the existing pipeline. Under no circumstances shall the weight of the tapping unit be supported by the existing pipe. Pipe which is damaged due to failure of the Contractor to follow this requirement shall be replaced at no additional cost to the Owner.

## 3.16 BLOWOFF ASSEMBLY

A) Install a Type B Blowoff Assembly for installations where the main is to be permanently dead-ended, such as a cul-de-sac according to Standard Details and sized according to the schedule provided in specifications herein.

B) Install a Type A Blowoff Assembly for installations where the main is to be temporarily dead-ended, such as the boundary of a subdivision filing; unless a fire hydrant, which can serve additionally as a blowoff, is located at the main's temporary end. Construct blowoff according to Standard Details and sized according to the schedule provided in specifications herein.

## 3.17 PIPE ANCHORAGE

A) Pipe anchorage systems shall be installed as shown on the drawings or as specified herein.

B) All plugs, caps, tees, and bends of 11-1/4° or more on waterlines that are 4-inches in diameter or larger shall be securely anchored by concrete thrust blocking or restrained joints as approved by the Engineer. The use of threaded tie back rods for thrust restraint shall not be used unless specifically shown on the drawings or directed by the Engineer.

C) Thrust blocks shall be installed where specified herein, shown on the drawings, or as directed by the Engineer. Installation shall be in conformance with drawing details and the following:

1) All concrete thrust blocks shall be placed using forms as necessary to allow access to the bolt circles after the placement of the thrust blocking concrete. The bearing surface shall be placed so that the pipe and fitting joints will be accessible for repair. Concrete shall in no case extend around more than one-half the circumference of the fitting at any point.

2) A plastic sheet or other similar protection shall be placed between the concrete and any portions of the valve, fitting, or nuts and bolts with which the concrete comes in contact. Do not encase pipe joints or cover bolt circles with concrete.

3) Concrete thrust blocking shall be placed between undisturbed earth and the fittings to be anchored. If, in the opinion of the Engineer, the undisturbed earth against which the bearing surface will be established is compromised by adjacent trenches or excavations, the Contractor shall excavate additional material as required to establish a new bearing surface that is consistent with the size, configuration, and location of the piping.

4) Newly installed water mains and fire service lines shall not be hydrostatically tested until field-placed concrete has been allowed to set undisturbed for a minimum of 24 hours.

## 3.18 SERVICE TAPS

A) Service pipe and fittings shall conform to plan details. Installation shall be in accordance with pipe manufacturer's recommendations.

B) All service connections for DI and PVC pipe shall be saddle tapped. Direct tap type services shall not be allowed.

C) Strictly adhere to the Manufacturer’s requirements to field cut or bore to maximize the opening through the service tap and corporation stop.

## 3.19 WATER METERS

A) All meter pit assemblies, including cones and lids, yokes and water meters, shall be provided by the Ute Water Conservancy District and installed by Contractor according to the Standard Details.

B) All meter pit assemblies shall be as indicated on plans, field staked for location, and on the property serviced. All meter pit assemblies shall be constructed so that the cast iron lid is at an elevation 0.1-feet above final grade without unnecessary grade ring risers.

## 3.20 FIRE HYDRANTS

A) Installation shall be in accordance with AWWA C600 and constructed where indicated on plans, field staked for location and grade or directed by the Engineer.

B) Hydrants shall be set a minimum of three (3) feet behind the curb/sidewalk or within the utility corridor right-of-way unless otherwise shown or directed. Hydrants shall stand true and plumb with a minim horizontal clearance of 3-feet.

C) Fire hydrants shall be set so that the elevation of the bury line is within ± 2-inches of final grade; doing so should locate the center of the safety breakaway flange a minimum of 2 inches and a maximum of 6 inches above finished curb, sidewalk or finished grade.

D) Where utility conflicts may require changes in grade, Contractor shall pothole existing utilities far enough in advance to allow the proper height hydrants to be planned and installed.

E) Hydrants set too high or too low shall be removed and replaced with an appropriate hydrant by the Contractor at no additional cost. The use of extension kits manufactured specifically for the fire hydrant make and model to raise low hydrants must be approved by the Engineer in advance.

## 3.21 VALVE AND VALVE BOX INSTALLATION

A) Valve installation shall be in accordance with AWWA C600 and applicable sections contained herein. A valve box shall be supplied for each valve, conforming to plan requirements and at locations shown on plans or staked in field.

B) Valve boxes shall be centered over the valve and installed plumb, with the cover flush with the finished grade. Valve boxes shall be set so they do not transmit shock or stress to the valves.

C) Backfill shall be placed around the valve boxes and thoroughly compacted in conformance with the compaction requirements for the adjacent backfill, and in a manner that will not damage or displace the valve box from proper alignment or grade. Misaligned valve boxes shall be excavated, plumbed and backfilled at Contractor's expense.

D) Valve boxes shall be kept free of rocks and debris at all times.

E) Tracer wire, only as indicated on the Contract Documents or as required by the Ute Water Inspector, shall be looped up at valve boxes.

## 3.22 AIR RELEASE VALVES (ARV)

A) By design, the location of ARVs is along the highpoint of the pipeline. The ARV should be installed as close as possible to the pipeline; as practical, minimize lay length of appurtenances to maximize the clearance between the ARV and the vault.

B) The concrete manhole or vault shall be founded firmly on grade beams of adequate surface bearing area to support the structure. Field modify as necessary to maintain clearance between the vault and pipeline to accommodate possible settlement without potentially bearing on the pipeline.

C) Construct manhole or vault to ensure manhole cover is flush with final grade without unnecessary manhole risers.

## 3.23 INSTALLATION OF TRACER WIRE

A) Tracer wire shall be installed with all pipe and secured with 2-inch wide PVC tape to the top of the pipe at about 8 foot intervals.

B) When splicing tracer wire to connect a new roll of wire or to connect wire from lateral water lines, the wire shall be tied together in an overhand knot, the end of the insulation strip off to expose at least 3/4" of bare wire, the wire twisted together and then a silicone-filled wire nut screwed over the end to completely cover and seal the exposed wire.

C) Tracer wire shall be brought up at all fire hydrants, vent pipe and, as directed, looped up into at least one valve box at valve clusters

D) Contractor, at his expense, will be responsible for testing the tracer wire to ensure that there is complete continuity of signal. The continuity of the tracer wire shall be tested in each direction from a valve box or fire hydrant with an electronic locator. Any areas that do not show continuity will be fixed at the Contractor's expense.

## 3.24 CLEANING POTABLE WATER MAINS

A) All water mains shall be cleaned in accordance with AWWA C651 and as specified herein.

B) Minimum Blowoff Assembly size for water mains shall be as shown in the following table:

| Water Line Size | Minimum Blowoff Size |
|---|---|
| 2- to 3-inch | 1-inch |

| | |
|---|---|
| 4- to 8-inch | 2-inch |
| 10- to 16-inch | 4-inch |
| 18- to 20-inch | 6-inch |
| Larger than 20-inch | 8-inch (or as directed) |

C) Prior to completion of pressure and leakage testing and prior to being placed into service, all new water mains and repaired portions or extensions of existing mains shall be disinfected by chlorination by the Contractor in accordance with AWWA C651 except as may be modified herein.

## 3.25 DISINFECTING POTABLE WATER MAINS

A) All water mains shall be disinfected in accordance with the requirements of AWWA C651 except as modified herein.

B) All new water lines shall be disinfected by introducing chlorinated water from a water truck or other means, approved by the Engineer, into the new line. Initial (high) chlorine residual shall not be less than 50 ppm. The use of chlorine tablets glued into the pipe with permatex will not be allowed.

1) Dry chlorine powder, that has 68% Calcium Hypochlorite as the active ingredient, or liquid chlorine bleach, that has 5% by weight chlorine, shall be used at the rate as set forth:

a) Dry chlorine powder shall be mixed at the rate of 0.62 pounds of powder per 1000 gallons of water.

b) Liquid chlorine bleach shall be mixed at the rate of one gallon per 1000 gallons.

c) The amount of chlorinated water required for various sizes of water lines is shown in the following table:

| Pipe Diameter (inch) | Cross-Sectional Pipe Area ($ft^2$) | Volume per 100 feet of Pipe (gallons) |
|---|---|---|
| 2 | 0.02 | 16 |
| 3 | 0.05 | 37 |
| 4 | 0.09 | 66 |
| 6 | 0.20 | 147 |
| 8 | 0.35 | 261 |
| 10 | 0.55 | 408 |
| 12 | 0.79 | 588 |

| | | |
|---|---|---|
| 18 | 1.77 | 1322 |
| 24 | 3.14 | 2350 |
| 30 | 4.91 | 3672 |

2) Powdered chlorine or liquid chlorine bleach shall be thoroughly mixed with clean water in a water truck or other storage container. After mixing the solution shall be tested to insure that it is at least a 50ppm chlorine residual. If there is not at least a 50ppm residual more powdered chlorine or liquid chlorine bleach shall be added to bring the residual up to 50ppm. The chlorine residual shall be tested using a commercially available chlorine residual tester that measures concentrations above 10ppm.

3) After the water line has been completed and before making connections to services or other water mains, except those shown on the drawings, water line shall be slowly loaded with chlorinated water from a potable or disinfected water truck or tank until all air has been expelled. Air shall be bled from all service lines and fire hydrant laterals to ensure adequate disinfection of all lines, valves, fittings and appurtenances.

C) The dosage of chlorinating agent shall be of the amount to produce a minimum chlorine residual of 50 mg/L of free chlorine at all points in the line. Tests with the DPD method shall be made at selected points to determine the residual.

D) Where the Contractor chooses to use other methods for disinfecting the water line he shall submit a detailed plan to the Engineer, for Engineer's approval, indicating methods of introducing chlorine to the water line, methods for flushing the line and the means by which heavily chlorinated water will be disposed of.

E) Chlorinated water shall be retained in the lines for sufficient time to accomplish the desired disinfection but not less than 24 hours. All valves and hydrants in the line shall be operated during the retention period. At the end of this 24 hour period, the treated water in all portions of the main shall have a residual of not less than 25 mg/L free chlorine.

F) Valves shall be manipulated so that the strong chlorine solution in the line being treated will not flow back into lines adjoining the new line. Check valves may be used if desired.

G) Water mains taken out of service for inspection, repair, or other activities may or may not require disinfection and sampling, depending on the risk as determined by the Engineer and Inspector.

H) The Contractor shall furnish required materials and apparatus and perform the work of disinfection. If additional taps and open trenches at points of connection are required, the Contractor shall bear the responsibility of making taps and maintaining open trenches until a satisfactory analysis has been obtained.

## 3.26 CLEARING THE MAIN OF HEAVILY CHLORINATED WATER

A) Following chlorination, all heavily chlorinated water shall be flushed into a water truck from the lines at their extremities until the replacement water throughout the lines shall, upon test, have a chlorine residual of no more than that of the existing system to which the new line is connected.

B) Heavily chlorinated water that is in the water truck shall be disposed of in accordance with all Federal, State and Local laws and regulations. The environment into which the chlorinated is to be discharged shall be inspected. If there is any possibility that the chlorinated discharge will enter any stream, storm drain, or any drainage feature, then a neutralizing chemical shall be applied to the chlorinated water prior to discharge from the water truck.

C) The table below shows the neutralizing chemicals that can be used and their respective dosages, in pounds, per 1000 gallons of water:

| Residual Chlorine (ppm) | Sulfur Dioxide ($SO_2$) | Sodium Bisulfite ($NaHSO_3$) | Sodium Sulfite ($Na_2SO_3$) | Sodium Thiosulfate ($Na_2S_2O_3$-$5H_2O$) |
|---|---|---|---|---|
| 1 | 0.008 | 0.012 | 0.014 | 0.012 |
| 2 | 0.017 | 0.025 | 0.029 | 0.024 |
| 5 | 0.042 | 0.063 | 0.073 | 0.060 |
| 10 | 0.083 | 0.125 | 0.146 | 0.120 |
| 25 | 0.21 | 0.313 | 0.365 | 0.30 |
| 50 | 0.42 | 0.625 | 0.73 | 0.60 |

## 3.27 FLUSHING AND CLEANING

A) After all of the heavily chlorinated water has been removed from the new water line, fire hydrants and service lines, the main shall be flushed to remove all dirt and debris that may be in the line. Contractor shall flush the line to obtain a minimum velocity of at least 2.5 fps in the line.

B) Upon completion of flushing Ute Water Conservancy District will obtain water samples for laboratory analysis to test for the presence of coliform bacteria. Should the initial treatment prove ineffective, the chlorination shall be repeated as

set forth in Paragraph 3.25 at no additional cost to the Ute Water District until confirmed tests show acceptable results.

## 3.28 PRESSURE AND LEAKAGE TESTS

A) The Contractor shall furnish the pump, pipe connections, taps, gauges, auxiliary water container, bulkheads, plugs and other necessary equipment and perform pressure and leakage tests on all lines unless otherwise directed by the Engineer. All equipment and material that will come in contact with water entering the distribution system shall be clean and disinfected prior to use. Water shall be potable water that has only been stored in clean disinfected containers.

B) Tests shall be conducted on all pipelines or valved sections thereof. Tests on lines anchored or blocked by concrete shall not be conducted until the concrete has taken permanent set.

C) Hydrostatic leakage testing shall be performed in conformance to the applicable sections of AWWA C600 or local jurisdiction requirements, whichever is more stringent, except as modified below. Unless otherwise authorized by the Ute Water District, all hydrostatic leakage tests shall be witnessed by the Engineer or the Districts field Representative.

D) The test pressure shall be 150 lbs./sq. in., or 50 percent (50%) above the normal operating pressure, whichever is greater. Hydrostatic pressure shall be applied by pumping water from an auxiliary supply. The Contractor shall accurately determine the amount of water required to reach the initial test pressure and the amount of makeup water required to maintain the test pressure during the test period.

E) The test pressure shall be maintained for a minimum of four (4) hours and additional time as required for thorough inspection to find any leaks or defects in the water main and appurtenances. Should the pipe section fail to pass the tests, the Contractor shall find and correct failures and repeat the tests until satisfactory results are obtained at no additional cost to the Owner.

F) Where test pressure is 250 psi or less, the hydrostatic test shall be performed with the hydrant line valves open.

G) Before applying the specified test pressure, air shall be expelled completely from the pipe, valves, and hydrants. If permanent air vents are not located at all high points, the Contractor shall install corporation stops at such points so that the air can be expelled as the line is filled with water. After all the air has been expelled, the corporation stops shall be closed and the test pressure applied. At the

conclusion of the pressure test, the corporation cocks shall be removed and plugged or left in place at the discretion of the Owner.

H) Allowable Leakage

1) No pipe installation will be accepted if the leakage or makeup water is greater than that determined by the formula outlined below or local jurisdiction requirements, whichever is more stringent.

$$L = \frac{SD\sqrt{P}}{148{,}000}$$

Where:

| | | |
|---|---|---|
| L | = | allowable leakage, in gallons per hour |
| S | = | length of pipe tested, in feet |
| D | = | nominal diameter of the pipe, in inches |
| P | = | average test pressure during the leakage test, in pounds per square inch (gauge) |

This formula is based on an allowable leakage of 10.49 gpd/mi./in. of nominal diameter at a pressure of 150 psi.

2) The allowable leakage in gallons per hour per 1,000 feet at various pressures and pipe sizes is shown below. In the event of discrepancies between formulas and table values, the more stringent shall apply.

| Average Test Pressure (psi) | Nominal Pipe Diameter (inch) | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 3 | 4 | 6 | 8 | 10 | 12 | 18 | 24 |
| 250 | 0.32 | 0.43 | 0.64 | 0.85 | 1.07 | 1.28 | 1.92 | 2.56 |
| 225 | 0.30 | 0.41 | 0.61 | 0.81 | 1.01 | 1.22 | 1.82 | 2.43 |
| 200 | 0.29 | 0.38 | 0.57 | 0.76 | 0.96 | 1.15 | 1.72 | 2.29 |
| 175 | 0.27 | 0.36 | 0.54 | 0.72 | 0.89 | 1.07 | 1.61 | 2.15 |
| 150 | 0.25 | 0.33 | 0.50 | 0.66 | 0.83 | 0.99 | 1.49 | 1.99 |
| 125 | 0.23 | 0.30 | 0.45 | 0.60 | 0.76 | 0.91 | 1.36 | 1.81 |
| 100 | 0.20 | 0.27 | 0.41 | 0.54 | 0.68 | 0.81 | 1.22 | 1.62 |

3) If the pipe structure under test contains sections of various diameters, the allowable leakage shall be the sum of the computed leakage for each size. No additional leakage allowance will be given for fire hydrant assemblies.

3.29 CLEANUP

A) Cleanup and surface restoration area shall conform to the requirements contained herein and shall closely follow pipe-laying activities.

B) Contractor shall remove all excess materials, broken pavement, construction equipment, etc., within three (3) days after pipe is laid in any area.

C) Contractor shall level and resod lawn areas, grade and gravel shoulder or parking areas, and replace any signs, mailboxes, etc. which were removed or damaged.

## PART 4: SPECIAL PROVISIONS

### 4.1 MEASUREMENT AND PAYMENT

A) When not listed in the Proposal, all "WATER DISTRIBUTION SYSTEM" costs will be considered incidental work for which no separate payment will be made.

B) When listed in the Proposal, payment for work specified under this section will be made at the prices named in the Proposal for the following items installed, tested, disinfected and acceptable to the Engineer.

1) Mainline pipe to be paid for at the unit prices named in the Proposal for each size and type of pipe. Length to be measured horizontally along centerline of pipe without deducting for valves and fittings. Unless otherwise listed in the Proposal, cost of mainline pipe, fittings and appurtenances shall be included in the unit price for mainline pipe.

2) Unless otherwise listed in the Proposal, valves are to be paid for at the unit price named in the Proposal for each size and type of valve complete with valve box and cover.

3) Each fire hydrant assembly to be paid for at the unit price named in the Proposal. Payment for each fire hydrant assembly shall include hydrant, lateral pipe or spool piece, gate valve and valve box and cover, fittings, mainline tee, thrust blocking, support block and all appurtenances (including Storz Adapter as necessary), as well as excavation, backfill, compaction and surface restoration.

4) All mainline connections named in the Proposal to be paid for at the lump sum prices named in the Proposal. Unless otherwise listed in the Proposal, payment for each mainline connection shall include fittings, pipe thrust restraint and all appurtenances inclusive of valves, as well as excavation, backfill, compaction and surface restoration outside of the specified trench pay limits.

5) Each air release valve assembly to be paid for at the unit prices named in the Proposal. Unless otherwise listed in the Proposal, payment for each air release valve assembly to include service saddle or mainline tee and companion flange (as required), pipe, valves, fittings, manhole (or vault) and grade beams, manhole cover and frost lid, air vent, drain line and all appurtenances, as well as excavation, backfill, compaction and surface restoration.

6) All near and far side water service to be paid for at the unit prices named in the Proposal. Payment for each service to include fittings, pipe and all appurtenances, as well as surface preparation (saw cutting or other), excavation, backfill, compaction and surface restoration.

C) No payment to be made for pipe or valves which have not passed a hydrostatic leakage test.

D) Quantities to be computed by the Engineer from measurement of actual work completed and accepted.

E) Unless otherwise listed in the Proposal, pipe anchorage and thrust restraint systems to be considered incidental work for which no separate payment will be made.

F) Unless otherwise listed in the Proposal, blowoff assemblies for line terminations to be considered incidental work for which no separate payment will be made.

G) Unless otherwise listed in the Proposal, sanitary sewer concrete caps or encasements to be considered incidental work for which no separate payment will be made.

H) Unless otherwise listed in the Proposal, polyethylene encasement as required to be considered incidental work for which no separate payment will be made.

I) Payment indicated to include complete compensation for all labor, equipment, materials and incidentals involved in the work as listed in the Proposal and as specified under this section. No additional compensation to be allowed.

END OF SECTION

# Structural Specifications (by SGM)

1
# REVISION OF SECTION 202
# REMOVAL OF BRIDGE

Revise Section 202 of the Standard Specifications as follows:

Subsection 202.01 shall include the following:

This work consists of removal of the existing bridge(s) at the locations shown in the plans. Bridge removal shall consist of the complete removal of all superstructure and substructure elements including caissons and piling to a depth of at least two (2) feet below finished grade unless otherwise shown on the plans. Time limitations for the work shall be as shown in the contract and/or plans.

Subsection 202.02 shall include the following:

Perform the removal of the existing bridges in accordance with the requirements in this specification and Standard Specification 107.06. The Construction Plan requirements shown in Revision of Section 107-Performance of Safety Critical Work shall be included in the Bridge Removal Plan.

When removal operations are located over or in proximity to a railroad or any live water way, additional coordination including potential incident emergency/risk management notifications with the railroad or other agency (United States Army Corps of Engineers (USACE), US Fish and Wildlife Service, US Forest Service, etc.) shall be required.

The Contractor shall submit a Bridge Removal Plan to the Engineer for review and acceptance at least 2 weeks prior to the Pre-removal Conference. This Plan shall detail procedures, sequences, and all features required to perform the removal in a safe and controlled manner**.** The Bridge Removal Plan shall be prepared by the Contractor's Engineer and contain the Seal of a Professional Engineer registered in the State of Colorado. The Contractor's Engineer shall stamp and sign the Bridge Removal Plan "Approved for Construction". Submit the Bridge Removal Plan to the Engineer of Record, the corresponding CDOT Region Bridge Unit Leader and the Engineer for review and concurrence with general specification compliance, but it will not be approved. Submit comments from the referenced reviewers of the Bridge Removal Plan in writing to the Contractor within seven calendar days from receipt of the plan and prior to the Pre-removal Conference**.** Acceptance of the Bridge Removal Plan will be contingent upon the Contractor adequately addressing all written comments to the satisfaction of the Engineer.

The Bridge Removal Plan shall provide complete details of the bridge removal process, including:

(1) The removal sequence corresponding to the construction phasing shown on the plans, including calculations and analysis of the Contractor's removal equipment as related to loading capacity and any crane bearing during the removal operations. Sequence of operation shall include a detailed schedule that complies with the working hour limitations.

(2) Equipment descriptions including size, number, type, capacity, backup/standby need, and location of equipment during removal operations.

(3) Roles, responsibilities, and positioning of all CDOT project management, construction supervision, and critical workers during removal activities. Include instructions for communicating and managing a 'safe-all stop' scenario in this section, if unexpected hazards are discovered during the activity.

(4) Shoring that exceeds 5 feet in height, all falsework and bracing. Shoring design shall follow the AASHTO Guide Design Specifications for Bridge Temporary Works, or other design standard as approved by the Engineer.

(5) Shoring construction, including verification and proof testing shall be in accordance with Section 206. Shoring will not be measured and paid for separately, but shall be included in the cost of item 202 – Removal of Bridge, unless otherwise provided on the plans or as directed by the Engineer.

(6) Details, locations, and types of protective coverings to be used. The protective covering shall prevent materials, equipment, and debris from falling onto the property below. When removal operations are located over or in proximity to a live waterway, railroad, or pedestrian/bicycle path, additional width of protective covering sufficient to protect these facilities shall be required. Include detailed methods of protection of the existing roadway facilities, including measures to assure that people, property, utilities, and improvements will not be endangered. Consider a catastrophic, unplanned failure of the structure during demolition as worst-case scenario.

(7) Detailed methods for protection of live waterways including minimization of turbidity and sedimentation, and protection of existing wetlands.

(8) Detailed methods for mitigation of fugitive dust resulting from the demolition.

(9) Details for dismantling, removing, loading, and hauling steel elements.

(10) Locations of railroad tracks, roadways, utilities (overhead and underground), structures or facilities located within the area of the bridge removal operations.

(11) Detailed methods of fire suppression.

(12) Methods of Handling Traffic, including bicycles and pedestrians, in a safe and controlled manner.

(13) Details for managing project communications, media, and on-looking public during demolition as needed.

(14) Contingency planning for unexpected weather.

(15) Details for emergency and post-incident management in a catastrophic failure or other serious incident or worker injury.

The Contractor's Engineer shall be responsible for the stability of the existing "in service" structure for any deviation from the bridge removal limits shown on the construction phasing plans. The Contractor is also responsible for the protection of any portion of the structure to remain in place for later phases, including protection from the Contractor's construction activities.

Use the more stringent criteria of the design guidelines, when a temporary works or demolition guideline is provided by a railroad or local agency

Hold a Pre-removal Conference at least seven days prior to the beginning of removal of the bridge. The Engineer, Staff Bridge, the Contractor, the subcontractor performing the removal(s), the Contractor's Engineer, the Traffic Control Supervisor (TCS), and CDOT/Project Communications Staff shall attend the Pre-removal Conference. Finalize the Bridge Removal Plan at this Conference. Record meeting minutes and the attendance list.

The Contractor's Engineer shall seal items (1) and (4) listed above in the final Bridge Removal Plan. Demonstrate with adequate calculations that the loads and impact of the Contractor's demolition equipment do not impose detrimental effects on the stability of the structure remaining after the end of each phase of removal. Review these calculations before traffic is allowed to resume in its normal configuration.

March 30, 2021

# 3
# REVISION OF SECTION 202
# REMOVAL OF BRIDGE

The final Bridge Removal Plan shall be stamped "Approved for Construction" and sealed by the Contractor's Engineer. The Contractor shall address all written comments from the Engineer and submit a final Bridge Removal Plan to the Engineer. The Contractor shall not begin the removal operations without the Engineer's written acceptance of the final Bridge Removal Plan.

Submittal of the final Bridge Removal Plan to the Engineer, and field inspection performed by the Engineer, will in no way relieve the Contractor and the Contractor's Engineer of full responsibility for the removal plan and procedures.

Work within Railroad right-of-way shall be in accordance with Section 107. For bridge removal over railroads, including overhead wires, tunnels and underground facilities, approval of the bridge removal plans will be contingent upon the drawings being satisfactory to the railroad company involved.

The Contractor's Engineer shall be onsite during safety critical removal operations considered to have a high degree of safety risk. At or before the Pre-removal Conference, the Contractor and the Engineer shall agree if the Bridge removal operations are of high safety risk. Document said agreement in writing. The Contractor's Engineer shall inspect and provide written approval of each phase of the removal operations corresponding to the construction phasing shown on the plans prior to allowing vehicles or pedestrians on, below, or adjacent to the structure. The Contractor's Engineer shall certify in writing that the falsework, bracing, and shoring conform to the details of the final Bridge Removal Plan. Submit a copy of the certification to the Engineer. If any part of the adjacent structure designated to remain in place is damaged during removal operations, the Contractor's Engineer shall perform a full and complete engineering evaluation of the structure and submit a written report to the Engineer. This evaluation, as well as any additional costs to stabilize the structure due to or resulting from the Contractor's actions or inactions, shall be borne solely by the Contractor. Do not permit further work involving the bridge until the report and any subsequent remedial stability measures are complete and satisfactory to the Engineer and Staff Bridge.

The Contractor shall have all necessary workers, materials, and equipment at the site prior to closing any lanes to traffic to accommodate bridge removal operations. Pursue work promptly and without interruption until reopening the roadway to traffic.

Removal of hazardous material shall be in accordance with Section 250.

The Contractor shall take all necessary steps to avoid contaminating state waters, in accordance with subsection 107.25.

If an unplanned event occurs or the bridge removal operation deviate from the submitted Bridge Removal Plan, the bridge removal operations shall immediately cease. Perform all necessary work to ensure worksite safety. The Contractor shall submit to the Engineer the procedure or operation proposed by the Contractor's Engineer to correct or remedy the occurrence of this unplanned event or to revise the final Bridge Removal Plan. The Contractor's Engineer shall submit a written report to the Engineer within 24 hours of the event summarizing the details of the event and the procedure for correction. The Engineer shall review the information submitted regarding the unplanned event and provide written acceptance of the corrective action or remedy procedure prior to resuming operations.

Before removal of the protective covering, the Contractor shall clean the protective covering of all debris and fine material.

# 4
# REVISION OF SECTION 202
# REMOVAL OF BRIDGE

The Engineer may be suspend bridge removal for the following reasons:

(1) Final Bridge Removal Plan has not been submitted, or written acceptance has not been provided by the Engineer to begin the removal.

(2) The Contractor is not proceeding in accordance with the final Bridge Removal Plan, procedures, or sequence.

(3) The Contractor's Engineer is not onsite to conduct inspection for the written approval of the work.

(4) Safety precautions are deemed to be inadequate.

(5) Existing neighboring facilities are damaged because of bridge removal.

Suspension of bridge removal operations shall in no way relieve the Contractor of their responsibility under the terms of the Contract. A suspension ordered as a direct result of (1) through (5) above, shall be considered a non-excusable delay. Bridge removal operations shall not resume until modifications have been made to correct the conditions that resulted in the suspension, as approved in writing by the Engineer.

The Contractor shall notify all emergency response agencies of the proposed removal work and any detours a minimum of three days in advance of the work. This shall include the Colorado State Patrol, local Police Department, local Fire Department, all local ambulance services, and the Sheriff's Department, as appropriate.

All required traffic control devices, nighttime flagging stations, barricades and VMS signs shall be in place, with detours in operation, prior to the beginning of removal operations each day. Night work shall conform to the requirements of the MUTCD, Parts 1, 5, and 6.

Prior to reopening the roadway to public traffic, remove all debris, protective pads, materials, and devices and sweep the roadways clean. The Contractor shall install any restriping necessary to achieve full compliance pavement markings prior to reopening. All costs related to pavement marking replacement shall be included in the work.

Do not use explosives for removal work without the written approval of the Engineer.

Removal shall include the superstructure, the substructure, which includes the piers, abutments and wingwalls, the bridge rail, and any approach slabs and sleeper slabs.

During removal of the substructure, take it down to at least 2 feet below the natural existing or future ground surface at the lowest point of interface with the abutment, unless otherwise approved by the Engineer. Holes resulting from substructure removal shall be backfilled with Structure Backfill (Class 2) to the adjacent existing grades.

All other materials removed from the existing structure shall become the property of the Contractor and shall be properly disposed of offsite at the Contractor's expense, unless otherwise stated on the plans.

The Contractor shall not damage the existing structures, facilities, and surrounding roadways during the removal operations. Repair damage that occurs immediately, at the Contractor's expense.

# 5
# REVISION OF SECTION 202
# REMOVAL OF BRIDGE

Subsection 202.03 shall include the following:

Protect and remove all brass bridge plaques prior to demolition of the bridge. Deliver plaques to the Region Environmental group or Staff Bridge.

In Subsection 202.08: Replace the first paragraph with:

Unless otherwise directed, remove the substructures of removed structures to 2 feet below the natural stream bottom and remove those parts outside of the stream down 2 feet below natural ground or finished surface. Remove such portions of existing structures, which lie wholly or in part within the limits of a new structure, as necessary to accommodate the construction of the proposed structure.

In Subsection 202.12 include the following:

Make payment under:

| **Pay Item** | **Unit** |
|---|---|
| Removal of Bridge | Each |

Payment for Removal of Bridge will be full compensation for all labor and materials required to complete the work, including, preparation and implementation of the Bridge Removal Plan, Engineering work, inspection, equipment, debris handling and disposal, salvaging, handling and storage of salvable materials, handling and disposal of all hazardous materials and disposal of non-salvable materials.

Lighting required for nighttime operations will not be measured and paid for separately, but shall be included in the work.

# REVISION OF SECTION 206
# EXCAVATION AND BACKFILL
# FOR STRUCTURES

Section 206 of the Standard Specifications is hereby revised for this project as follows:

Delete the 2nd paragraph in Subsection 206.09 and replace with the following:

When the height of shoring exceeds five feet above the base of the excavation, the Contractor shall submit working drawings in accordance with subsection 105.02. The drawings shall be submitted to the Engineer for information only. The drawings shall be electronically sealed by the Contractor's Engineer. The Contractor shall design for internal and external stability of temporary shoring such as but not limited to bearing capacity, settlement, sliding, overturning, internal compound stability, and global stability. All proof and verification testing of the shoring elements shall be the responsibility of the Contractor and results shall be reported to the Engineer the day after the testing was performed.

Delete the 5th paragraph in Subsection 206.09 and replace with the following:

The Contractor shall have performed and documented an independent review of their shoring design and drawings at designated areas prior to submittal. The Contractor’s Engineer shall electronically seal the independent review shoring design and drawings.

Delete the 11th paragraph in Subsection 206.09 and replace with the following:

The Contractor's Engineer may assign an on-site representative, to perform construction field oversight, by submitting documentation of experience to the Engineer ten days prior to starting shoring construction for review and the Engineer's acceptance. Prior to placing construction or traffic loads on or immediately adjacent to the supported earth, the Contractor's Engineer for the shoring shall certify in an electronically sealed letter that shoring materials and construction have been inspected and that all shoring, materials, and construction are in conformity with the shoring drawings. A copy of this certification shall be submitted to the Engineer.

Section 207 of the Standard Specifications is hereby deleted for this project and replaced with the following:

## DESCRIPTION

**207.01** This work consists of salvaging topsoil from onsite locations, stockpiling, maintaining, and preparing the subsoils for the placement of the topsoil at locations shown on the plans. It also includes creating seeding media by amending subsoils, and importing offsite topsoil when shown on the plans.

Substitutions from this specification will not be allowed unless submitted in writing to the Engineer and approved by the Region or Headquarters Landscape Architect.

## MATERIALS

**207.02 General.** Topsoil shall be salvaged onsite, imported, or produced as shown on the plans. Topsoil shall be free of refuse and litter along with noxious weed seed and reproductive plant parts, as listed in current State of Colorado A and B Noxious Weed List and local agency weed lists. Topsoil shall not include heavy clay, hard clods, toxic substances, pathogens, or other material, which would be detrimental to growing native vegetation. All required amendments shall be thoroughly incorporated to parent material, onsite. All amendments shall conform to Section 212. Topsoil and parent material shall be free of clods, sticks, stones, debris, concrete, and asphalt in excess of 4 inches in any dimension for all material used within the designed clear zone for the project. Topsoil outside of the clear zone may contain rock larger than 4 inches in any dimension. For slopes with no structures being used to protect areas from falling rocks the Contractor shall remove or secure any rocks deemed unstable and could pose a safety hazard.

Topsoil shall be generated from one or more of the following as shown on the plans:

(a) *Topsoil (Onsite).* Topsoil shall consist of the upper 6-inch layer of the A horizon, as defined by the Soil Science Society of America, or at the depths and locations shown on the Stormwater Management Plan (SWMP). It shall consist of loose friable soil, salvaged from onsite and stockpiled or windrowed. Litter and duff (layer of partially decomposed plant material) shall be collected as part of the salvaging of topsoil unless specified to be removed and hauled offsite on the plans.

(b) *Topsoil (Wetland).* Wetland topsoil shall consist of moist, organic soil obtained from delineated wetlands, including any existing wetland vegetation and seeds. Wetland topsoil shall be extracted from the project site at locations shown on the plans or as directed, to a minimum depth of 12 inches or at the depths as shown on the plans.

(c) *Seeding Media.* Seeding Media shall consist of one or all of the following approved materials: sub-soil, overburden, or material generated from rock. Contractor shall select onsite or offsite locations to generate material that meet the requirements of Table 207-1. The Contractor shall provide a Certified Test Report (CTR) in accordance with subsection 106.13, excluding lot, heat, and batch confirming that the excavated material conforms to Table 207-1.

(d) *Topsoil (Offsite).* The Contractor shall submit a CTR for Topsoil (Offsite) for approval a minimum of 60 days prior to import in accordance with subsection 106.13. The Contractor shall include with the CTR a complete Soil Nutrient Analysis for the properties listed in Table 207-2 from an independent laboratory that participates in the National Association for Proficiency Testing (NAPT). If topsoil nutrient analysis is deficient, an Amendment Protocol shall be submitted by the Contractor for approval. The Amendment

Protocol shall contain a complete list of amendments and associated quantities to produce topsoil that conforms to Table 207-2.

The Contractor shall submit a Certificate of Compliance (COC) for Topsoil (Offsite) for approval a minimum of 60 days prior to import that the source has controlled noxious weeds in accordance with the State of Colorado Noxious Weed Act 35-5.5-115.

**Table 207-1**
**PHYSICAL PROPERTIES OF SEEDING MEDIA**

| Property | Range | Test |
|---|---|---|
| Soil pH (s.u.) | 5.6 – 7.5 | ASA Mono. #9, Part 2, Method 10-3.2 or TMECC 04.11-A |
| Soil Electrical Conductivity (EC) (mmhos/cm or ds/m) | < 5.0 | ASA Mono. #9, Part 2, Method 10-3.3 |
| Soil SAR (s.u.) | 0 - 10 | ASA Mono. #9, Part 2, Method 10-3.4 |
| Rock Content (%) | ≤ 25 | USDA NRCS Rock Fragment Modifier Usage |
| Trace Contaminants (Arsenic, Cadmium, Copper, Mercury, Selenium, Zinc, Nickel, and Lead) | Meets US EPA, 40 CFR 503 Regulations | TMECC 04.06 or EPA6020/ASA (American Society of Agronomy) |
| Rock Content (%) greater than 3” diameter | ≤ 25 | USDA NRCS Rock Fragment Modifier Usage |
| USDA Soil Texture | No more than 70% clay, silt, and sand by percentage volume of topsoil. | ASA Monograph #9, Part 1, Method 15-4 or ASA 1 43-5 |
| All Particle Sizes | < 6 Inches | |
| Physical contaminants (man-made inerts) (%) | < 1 | TMECC 03.08-C |
| C:N ratio | <20 | TMECC 05.02-A |
| * Fines % when manufacturing material from rock | >25% material passing through #4 sieve | ASTM D6913 |

Amendments to the base imported material shall have the quantities of material verified onsite prior to incorporation into parent material, either at the stockpiles or after placement of parent material. Topsoil amended at the stockpiles shall be distributed to the site within seven days. * Substitute this requirement for USDA Soil Texture requirement when project are approved to use material manufactured from native rock material on site.

**Table 207-2**
**TOPSOIL (OFFSITE) PROPERTIES**

| Property | Range | Test Methods |
|---|---|---|
| Soil pH (s.u) | 5.6 – 7.5 | ASA Mono. #9, Part 2, Method 10-3.2 or TMECC 04.11-A |
| Salt by Electrical Conductivity (EC) (mmhos/cm or ds/m) | < 2.0 | ASA Mono. #9, Part 2, Method 10-3.3 |
| Soil SAR (s.u.) | 0 – 10 | ASA Mono. #9, Part 2, Method 10-3.4 |
| Soil OM (%) | 3 – 5 | Methods of Soil Analysis, Part 3, Method 34 |
| Soil N ($NO_3$-n, ppm) | ≥ 20.0 | Methods of Soil Analysis, Part 3. Chemical Methods. Ch. 38 Nitrogen – Inorganic Forms |
| Soil P (ppm) | ≥ 13.0 | ASA Mono. #9, Part 2, Method 24-5.4 or others as required based on soil pH |
| Soil K (ppm) | ≥ 80 | ASA Mono. #9, Part 2, Method 13-3.5 |
| Rock Content (%) greater than 3" diameter | ≤ 25 | USDA NRCS Rock Fragment Modifier Usage |
| Bioassay (seedling emergence and relative vigor) | > 80% of control | TMECC 05.05-A or Approved Germination Test |
| Soil Texture | No more than 70% clay, silt and sand by percentage volume of topsoil | ASA Mono. #9, Part 1, Method 15-4 |
| Physical contaminants (man-made inerts) (%) | < 1 | TMECC 03.08-C |
| Trace Contaminants (Arsenic, Cadmium, Copper, Mercury, Selenium, Zinc, Nickel, and Lead) | Meets US EPA, 40 CFR 503 Regulations | TMECC 04.06 or EPA6020/ASA (American Society of Agronomy) |
| All Particle Sizes | < 6 Inches | |
| C:N ratio | <20 | TMECC 05.02-A |

The Contractor shall utilize a rod penetrometer for determining subgrade soil preparation and determining looseness of soil after ripping. The penetrometer shall have a psi pressure gage, and shall meet the following requirements:

(1) Steel rod with a minimum diameter of ½ inch with graduations (tick marks) every 6 inches.

(2) The rod shall be made of stainless steel or other metal that will not bend when weight is applied.

(3) The end of the rod shall have a 30-degree cone tip.

(4) The diameter of the cone at its tip shall be no more than 0.1 inch.

(5) The top of the rod shall be a T-handled configuration.

## CONSTRUCTION REQUIREMENTS

**207.03 Site Pre-vegetation Conference.** Prior to the start of the initial Subgrade Soil Preparation for the project, the Contractor shall request a Site Pre-vegetation Conference. The Engineer will set up the conference and will include: the Engineer or designated representative, the Superintendent or designated representative, the sub-contractor(s) performing the subgrade soil preparation and soil amendments, and the CDOT Landscape Architect representing the Region. Only one meeting is required for the project unless a new sub-contractor is brought on that did not attend the previous meeting.

The Agenda of the Pre-vegetation Conference can be found in Appendix A of the Construction Manual and includes the following:

(1) Final review of the Topsoil (Offsite) Amendment Protocol

(2) Review of the Method Statement detailing the equipment which will be used for the subgrade soil preparation operations

(3) Review of rod penetrometer which will be used to determine subgrade soil preparation of topsoil

(4) Permanent Stabilization Phasing Plan (identify strategies and site management measures to protect de-compacted, topsoil amended, seeded, and blanketed areas from foot, vehicle loads, and other disturbances).

(5) Seeding. See subsection 212.03 for submittal requirements.

(6) Meeting attendee sign-in log

**207.04 Topsoil Stockpiling.** Stockpiles of topsoil shall be created as shown on the plans or as approved by the Engineer. All Stockpiles of topsoil which are scheduled to remain in place for 14 days or more shall receive interim stabilization in accordance with subsection 208.04. All topsoil stockpiles shall be identified using white pin flags with “TOPSOIL” printed in black letters and shall have their locations shown on the SWMP Plans. Each individual stockpile shall require at least one flag, and one additional flag for each 10 cubic yards of salvaged topsoil. The contractor shall provide only perimeter flags for stockpile larger than 100 cubic yards with a minimum spacing of 25 feet.

Topsoil may be placed in stockpiles or windrowed at the edge of the disturbance. Windrowed topsoil shall not be used as perimeter erosion control or extensively compacted. When topsoil is windrowed, all stockpile requirements still apply.

(1) Upland Topsoil. If included on the plans, stockpiles shall be treated with herbicide, in accordance with Section 217, or as directed.

(2) Wetland Topsoil. Wetland stockpiles shall not be treated with herbicide. Weeds shall be hand pulled. Wetland topsoil shall be placed within 24 hours from excavation, unless otherwise approved by the Engineer. Wetland topsoil shall not be stockpiled for more than six months.

**207.05 Subgrade Soil Preparation.** Before placement of topsoil, the subgrade shall be ripped to a minimum depth of 14 inches. Subgrade shall be mostly dry and friable. Subgrade shall crumble without sticking together, yet not be so dry and hard that it does not break apart easily.

Underground utilities shall be located prior to soil preparation.

Subgrade soil preparation equipment shall meet the requirements for either winged tip or parabolic shanks. Operation shall be performed to fracture the soil uniformly without lifting or furrowing the surface excessively. The Contractor shall submit a method statement for subgrade soil preparation other equipment will be considered.

1. Winged tip shanks (dozer equipment) shall be a minimum of 6 inches wide and have 2 inches of vertical profile change on the blade with a 40 – 60-degree sweep angle.

The Contractor shall calibrate the subgrade soil preparation equipment using a minimum 30 linear feet of the initial pass. The Contractor shall utilize the rod penetrometer to verify that that de-compaction was successfully done. The Contractor shall take penetration measurements every 6 inches across a transect perpendicular to the direction of the tractor and spanning the width of the subgrade soil preparation. Depths of penetration shall confirm that a minimum of 12 inches can be achieved without reaching 300 psi on the rod penetrometer pressure gage (approximately 30 pounds of pressure on the T-handle).

Existing subgrade shall be de-compacted to a depth of 14 inches. If multiple passes are needed, the subsequent passes shall be positioned so that the ripping equipment (subsoilers) from the previous pass are split by the subsequent pass. Following ripping, the Contractor shall remove all sticks, stones, debris, clods, and all other substances greater than 6 inches in diameter. The Contractor shall restrict motorized vehicle and foot traffic from passing over the ripped area since this would recompact the areas that received subgrade soil preparation.

The first 4 feet from the edge of pavement shall be ripped to a depth of 6 inches. If the project is going to use aggregate base course or recycled asphalt as a shouldering technique, those areas will not require subgrade soil preparation. Depth of soil ripping for the subgrade soil preparation shall be checked with the rod penetrometer.

The Contractor shall verify adequate de-compaction of the entire area to have topsoil placed using a rod penetrometer in the presence of the Engineer. Tests shall be performed at a minimum of ten random locations per each acre as selected by the Engineer. The Test shall verify that a depth of 12 inches of penetration into the soil can be achieved without reaching 300 psi on the rod penetrometer pressure gage (approximately 30 pounds of pressure on the T-handle). If this depth cannot be achieved for 80 percent of the penetrations, the Contractor shall re-rip the area at no additional cost to the Department.

**207.06 Placement of Topsoil and Seeding Media.** Topsoil and Seeding Media shall be hauled and placed at the locations disturbed and will be re-vegetated or as shown on the plans. The contractor shall place a minimum thickness of 6 inches and should only be handled when it is dry enough to work without damaging soil structure. Topsoil and Seeding Media shall be placed a minimum depth of twelve (12) inches when placed over riprap as required on the plans. No Topsoil or Seeding Media shall be placed below ordinary high water mark except as otherwise specified in bio-stabilization bank treatments.

Salvaged topsoil placement deeper than 6 inches is allowed if additional approved material is on-site.

Contractor shall place topsoil in a method that does not re-compact subgrade material using low ground-contact pressure equipment, or by excavators and/or backhoes operating adjacent to it.

The final grade shall be free of all materials greater than 4 inches in diameter within the designed clear zone for the project. Equipment not required for revegetation work will not be permitted in the areas of placed topsoil.

Soil amendments, seedbed preparation, and permanent stabilization mulching shall be accomplished within four working days of placing the topsoil on the de-compacted civil subgrades. If placed topsoil is not mulched with permanent stabilization mulch within four working days, the Contractor shall complete interim stabilization methods in accordance with subsection 208.04(e), at no additional cost to the Department. Time to perform the work may be extended for delays due to weather.

## METHOD OF MEASUREMENT

**207.07** Topsoil material will be measured by the actual number of cubic yards of topsoil placed and accepted. Subgrade soil preparation will be measured by the square yards of subgrade which is ripped and accepted for adequate de-compaction.

## BASIS OF PAYMENT

**207.08** The accepted quantities measured will be paid for at the Contract unit price for each of the pay items listed below that appear in the bid schedule.

Payment will be made under:

| **Pay Item** | **Pay Unit** |
|---|---|
| Topsoil (Onsite) | Cubic Yard |
| Seeding Media | Cubic Yard |
| Topsoil (Offsite) | Cubic Yard |
| Topsoil (Wetland) | Cubic Yard |
| Subgrade Soil Preparation | Square Yard |

Amendments for Topsoil (Onsite) and Seeding Media will be measured and paid for in accordance with Section 212.

Amendments for Topsoil (Offsite) will not be measured and paid for separately, but shall be included in the work.

Noxious Weed Management will be measured and paid for in accordance with Section 217.

Stockpiling or windrowing of topsoil will not be measured and paid for separately, but shall be included in the work.

Testing of Seeding Medial and Topsoil (Offsite) will not be measured and paid for separately but shall be included in the work.

Rod penetrometer and associated verification testing of random locations will not be measured and paid for separately, but shall be included in the work.

The Site Pre-vegetation Conference will not be paid for separately, but shall be included in the work.

Additional passes with the ripping equipment to achieve the desired de-compaction will not be measured and paid for separately, but shall be included in the work.

Removing of clods, sticks, stones, debris, concrete, and asphalt in excess of 4 inches in any dimension for all topsoil and Seeding Media used within the designed clear zone for the project will not be measured and paid for separely, but shall be included in the work.

1
REVISION OF SECTION 502
PILING

Section 502 of the Standard Specifications is hereby revised for this project as follows:

In the 8th paragraph in Subsection 502.09 (b), revise as follows:

Once the dynamic monitoring is complete, the Contractor's Engineer conducting the PDA shall run Case Pile Wave Analysis Program (CAPWAP) analyses and shall provide the final driving criteria the same day of the test to the Engineer. Production piles driven prior to receipt of the final driving criteria shall be done at the Contractor's risk. Final driving criteria for additional structures shall be provided within two business days of the test or when multiple test piles are dynamically tested the same day. A detailed report electronically sealed by the Contractor's Engineer conducting the PDA shall include the pile driving criteria with the PDA and CAPWAP results and shall be submitted to the Engineer for acceptance within two business days after the dynamic monitoring.

**REVISION OF SECTION 517**
**WATERPROOFING**

Section 517 of the Standard Specifications is hereby revised for this project as follows:

Subsection 517.02 shall include the following:

Protection course shall be a multi-ply, semi-rigid core composed of a mineral-fortified asphalt core formed between two outside layers of Class B asphalt-impregnated reinforced mats, manufactured in accordance with ASTM D 6506. Protection course shall have the following characteristics in accordance with ASTM D 6506:

Type 3

(1) Puncture Strength, Class A & B: 365 N (82 lbf) minimum.
(2) Thickness, Class A & B: 5.6 mm to 7.1 mm (0.220 to 0.280 inches).
(3) Water Absorption, Class A & B: 10 % maximum.
(4) Asphalt % by weight, Class A: 65 % minimum.
(5) Asphalt % by weight, Class B: 40 % minimum.
(6) Resistance to decay, Class A & B: Meets puncture requirements after completion of test.

Subsection 517.03 shall include the following:

Protection course shall be applied at the end of each day's waterproofing to both horizontal and vertical surfaces. Protection course sheets should be butted together and cut to fit all intersecting surfaces and protrusions. For vertical surfaces, protection course may require temporary support while backfilling. Backfill material should not be dropped against vertically applied protection course in such a manner that it could drag the sheet down as the backfill drops.

**1**

# REVISION OF SECTION 518
# WATERSTOPS AND EXPANSION JOINTS

Section 518 of the Standard Specifications is hereby revised for this project to include the following:

Section 518.03 is replaced with the following:

**518.03 Swelling Rubber Waterstops.** Swelling rubber waterstop shall have the minimum performance standards as follows:

| Property | ASTM | Values |
|---|---|---|
| Tensile Strength (psi) | D412 | 142 |
| Elongation (%) | D412 | 550 |
| Hardness (Hs) | D2240 Duror Type A | 30 |

The material for swelling rubber waterstop may be used either in strip form or gun grade as shown on the plans. The gun grade product's physical properties shall conform to the following:

| Property | Gun Grade |
|---|---|
| Hardness (Hs) | 28 |
| Tensile Strength (psi) | 356 |

The Contractor shall submit a certificate of compliance for each type of swelling rubber waterstop proposed for use on the project to the engineer.

Section 518.08 is replaced with the following:

**518.08 Swelling Rubber Waterstops.** Swelling rubber waterstop shall be provided where shown on the plans for sealing permanent cold and construction joints between structural elements against the penetrations of water from wet-face of structure under high hydrostatic pressure. Also for the protection of migratory water between horizontal floor and deck slabs, or loose laid waterproofing membranes under high hydrostatic pressure.

The Contractor shall submit working drawings for swelling rubber waterstop in conformance with the provisions in Section 105.02, "Plans, Shop Drawings, Working Drawings, Other submittals, and Construction Drawings," of the Standard Specifications and the requirements specified herein. The working drawings shall include all procedures, sequences, and details of fabrication, installation, anchorage, and interface with bar reinforcing steel and other structural elements, and all other operations that are required to construct swelling rubber waterstop.

Prior to installation of the swelling rubber waterstop, the surface shall be evened, dry, clean and free of oil, dust and laitance. Joint may be glued to surface using gun grade cartridges or nailed with nails. The glue shall be applied both on the concrete and the swelling rubber waterstop joint surface. Allow the glue to become tacky to the touch in order to obtain maximum adhesion and ease in application.
The swelling rubber waterstop shall be applied with the even side towards the existing concrete surface and shall be then pressed into the tacky glue. The minimum concrete coverage over the swelling rubber waterstop shall be 6". The swelling rubber waterstop shall be placed no closer than 2 inches from the edge of the concrete pour to prevent the concrete edge from spalling. The swelling rubber waterstop ends shall be butted together tightly. Pipe penetrations shall be sealed by the use of swelling rubber waterstop gun grade cartridges by placing two beads of the material around the entire circumference of the pipe penetration as shown on the plans.

Section 518.09 is replaced with the following:

# REVISION OF SECTION 518
# WATERSTOPS AND EXPANSION JOINTS

Section 518.12 shall include the following:

Swelling Rubber Waterstop will be measured by the number of lineal feet of joint installed and accepted.

Section 518.13 shall include the following:

The accepted quantities of Swelling Rubber Waterstop will be paid for at the contract unit price per lineal foot.

Payment will be made under:

| **Pay Item** | **Pay Unit** |
|---|---|
| Waterstop (Special) | Linear Foot |

**1**
**REVISION OF SECTION 601**
**STRUCTURAL CONCRETE**

Section 601 of the Standard Specifications is hereby revised for this project to include the following:

Delete Paragraph 4 (Class D concrete) of Section 601.02 and replace with the following:

**Class D** concrete is a denser general use concrete. Class G may be substituted for Class D concrete. Additional requirements are:

(1) The mix shall either have a permeability not exceeding 2,500 coulombs at an age of not more than 56 days when tested in accordance with ASTM C1202, or have a surface resistivity of at least 12 kΩ-cm at 28 days using AASHTO T358.
(2) The unrestrained shrinkage shall not exceed 0.050 percent at 28 days when tested by CP-L 4103.
(3) The mix may use an optimized gradation (OG) with a nominal maximum aggregate size of at least ¾ inch.
(4) The mix shall have a nominal maximum aggregate size of at least ¾ inch if an OG is not used.
(5) When used in slip forming, an edge slump less than 6 mm (0.25 in.) and less than 30 percent surface voids (ranking of 2 or less) is required. The box test is described in CP 63.
(6) Class D Concrete for sidewalks on bridge decks and headwall shall be macro-fiber reinforced.

Section 601.03 shall include the following:

Where indicated in the plans, Xypex C-500 or Engineer Approved Waterproofing Admixture shall be added. Product data sheets for the Waterproofing Admixture shall be submitted to the Engineer for approval. Waterproofing Admixture shall be used in accordance with the manufacturer's recommendations.

Section 601.20 shall include the following:

Payment for Class D concrete with Engineer Approved Waterproofing Admixture will be made under:

| **Pay Item** | **Pay Unit** |
|---|---|
| Concrete Class D (Special) | Cubic Yards |

REVISION OF SECTION 601
STRUCTURAL CONCRETE

Section 601 of the Standard Specifications is hereby revised for this project as follows:

Delete subsections 601.01 thru 601.07 and replace with the following:

**601.01** This work consists of furnishing and placing hydraulic cement concrete in accordance with these specifications and in conformity with the lines, grades and dimensions as shown on the plans or established.

This work includes preparing concrete surfaces designated in the Contract and applying an approved colored Structural Concrete Coating to them.

**601.02 Classification.** The classes of concrete shown in Table 601-1 shall be used when specified in the Contract.

**Table 601-1**
**CONCRETE FIELD REQUIRMENTS**

| Concrete Class | Required Field Compressive Strength (psi) | Air Content: % Range (Total) | Slump[2] | Maximum Water/Cementitious Material Ratio: |
|---|---|---|---|---|
| **B** | 4500 at 28 days | 5 - 8 | +/- 2” of Form 1373 Slump | w/cm on Form 1373 |
| **BZ** | 4000 at 28 days | N/A[1] | 6” – 9” | w/cm on Form 1373 |
| **D** | 4500 at 28 days | 5 – 8 | +/- 2” of Form 1373 Slump | w/cm on Form 1373 |
| **DT** | 4500 at 28 days | 5 – 8 | +/- 2” of Form 1373 Slump | w/cm on Form 1373 |
| **G** | 4500 at 28 days | 5 – 8 | +/- 2” of Form 1373 Slump | w/cm on Form 1373 |
| **PS (Girders)** | 8500 at 28 days | N/A[1] | 9” maximum | 0.45 |
| **PS (Deck Panels)** | 6000 at 28 days | N/A[1] | 9” maximum | 0.45 |
| **P** | 4500 at 28 days | 4 – 8 | +/- 2” of Form 1373 Slump | w/cm on Form 1373 |
| **S35** | 5000 at 28 days | 5 – 8 | +/- 2” of Form 1373 Slump | w/cm on Form 1373 |
| **S40** | 5800 at 28 days | 5 – 8 | +/- 2” of Form 1373 Slump | w/cm on Form 1373 |
| **S50** | 7250 at 28 days | 5 – 8 | +/- 2” of Form 1373 Slump | w/cm on Form 1373 |
| **Shotcrete** | 4500 at 28 days | 7-10[3] | N/A | 0.45 |

[1] 5 - 8% when specified
[2] Slump shall be a maximum of 9.0 inches for all classes of concrete. Concrete may have a slump above 9.0 inches when designed as Self Consolidating Concrete (SCC). The requirements for slump flow, blocking assessment, and segregation shall apply.

[3] Prior to pumping for wet process.

**Class B** concrete is an air entrained concrete for general use. Class D, G or P concrete may be substituted for Class B concrete. Additional requirements are:

(1) The coarse aggregate shall have a nominal maximum size of 1½ inches or smaller.

(2) Class B Concrete for Slope and Ditch Paving shall be macro-fiber reinforced.

**Class BZ** concrete is concrete for drilled shafts. Additional requirements are:

(1) Entrained air is not required unless specified in the Contract. When entrained air is specified in the Contract, the air content shall be 5 to 8 percent.

(2) Slump shall be a minimum of 6 inches and a maximum of 9 inches. A minimum slump of 6 inches shall be maintained during the anticipated pour period. The use of retarders and hydration stabilizers are allowed to extend the slump life of the concrete. When the Contractor elects to use SCC, the slump requirement for Class BZ Concrete does not apply.

(3) The coarse aggregate size shall be AASHTO M43 size #8 unless otherwise approved by the Engineer.

(4) The mix shall either have a permeability not exceeding 2,500 coulombs at an age of not more than 56 days when tested in accordance with ASTM C1202, or have a surface resistivity of at least 12 kΩ-cm at 28 days using AASHTO T358.

(5) The unrestrained shrinkage shall not exceed 0.050 percent at 28 days when tested by CP-L 4103.

**Class D** concrete is a denser general use concrete. Class G may be substituted for Class D concrete. Additional requirements are:

(1) The mix shall either have a permeability not exceeding 2,500 coulombs at an age of not more than 56 days when tested in accordance with ASTM C1202, or have a surface resistivity of at least 12 kΩ-cm at 28 days using AASHTO T358.

(2) The unrestrained shrinkage shall not exceed 0.050 percent at 28 days when tested by CP-L 4103.

(3) The mix may use an optimized gradation (OG) with a nominal maximum aggregate size of at least ¾ inch.

(4) The mix shall have a nominal maximum aggregate size of at least ¾ inch if an OG is not used.

(5) When used in slip forming, an edge slump less than 6 mm (0.25 in.) and less than 30 percent surface voids (ranking of 2 or less) is required. The box test is described in CP 63.

(6) Class D Concrete for sidewalks on bridge decks and bridge rail shall be macro-fiber reinforced.

**Class DT** concrete is used for bridge deck resurfacing. Additional requirements are:

(1) The concrete mix shall consist of a minimum 50 percent AASHTO M 43 size No. 7 or No. 8 coarse aggregate by weight of total aggregate.

(2) The mix shall either have a permeability not exceeding 2,500 coulombs at an age of not more than 56 days when tested in accordance with ASTM C1202, or have a surface resistivity of at least 12 kΩ-cm at 28 days using AASHTO T358.

(3) The unrestrained shrinkage shall not exceed 0.050 percent at 28 days when tested by CP-L 4103.

**Class G** concrete is a low shrinkage macro fiber-reinforced concrete. Additional requirements are:

(1) The concrete mix shall include approved macro or hybrid polyolefin fibers at a minimum dosage of 4 lbs/cy or the minimum dosage specified on the Department's Approved Product List (APL), whichever is greater.

(2) Shrinkage reducing admixtures may be incorporated into the mix.

(3) The unrestrained shrinkage shall not exceed 0.030 percent at 28 days when tested by CP-L 4103.

(4) The mix shall either have a permeability not exceeding 2,500 coulombs at an age of not more than 56 days when tested in accordance with ASTM C1202, or have a surface resistivity of at least 12 kΩ-cm at 28 days using AASHTO T358.

(5) The mix may use an OG with a nominal maximum aggregate size of at least ¾ inch. The mix shall have a nominal maximum aggregate size of ¾ inch if an OG is not used.

(6) An expansive cement additive may be added to an ASTM C150 Type I/II cement and fly ash to produce an ASTM C845 Type K cement. The proportion of the expansive cement additive will be determined by testing the cementitious material blend in accordance with ASTM C806. The blended material shall have an expansion of 0.04 to 0.10 percent at 7 days when tested in accordance with ASTM C806. When an expansive cement is used, the w/cm ratio shall be 0.45 to 0.55 and the expansion of the laboratory trial mix shall be 0.05 to 0.09 percent at 7 days when tested in accordance with ASTM C878.

**Class P** concrete is used in pavements. Additional requirements are:

(1) The Required Field Flexural Strength shall be 650 psi.

(2) The concrete mix shall consist of a minimum 55 percent AASHTO M 43 sizes No. 57, No. 6, No. 67, No. 357, or No. 467 coarse aggregate by weight of total aggregate.

(3) The mix may use an OG with a nominal maximum aggregate size of at least ¾ inch.

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~~(4) ASTM C150 Type III and ASTM C1157 Type HE cements may be used for early opening.~~

(5) The mix shall either have a permeability not exceeding 2,500 coulombs at an age of not more than 56 days when tested in accordance with ASTM C1202, or have a surface resistivity of at least 12 kΩ-cm at 28 days using AASHTO T358.

(6) The unrestrained shrinkage shall not exceed 0.050 percent at 28 days when tested by CP-L 4103.

(7) When concrete is to be placed using a paver, an edge slump less than 6 mm (0.25 in.) and less than 30 percent surface voids (ranking of 2 or less) is required. The box test is described in CP 63.

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~~(8) A minimum of 20 percent Class F fly ash or 30 percent Slag cement by weight shall be used to replace any ASTM C150 cement, any ASTM C1157 cement, or ASTM C595 Type IL cement. ASTM C595 Type IT(MS), IT(HS), IP(MS) or IP(HS) cements may be used without cement substitutions. Class C fly ash may be used if the calcium oxychloride is determined to be less than 15 g CaOXY/100 g cementitious paste as determined in accordance with AASHTO T 365 for Class 0 Sulfate Exposure.~~

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~~**Class PS** Class PS concrete is used for prestressed concrete members. Requirements for Class PS concrete are specified in subsection 618.11. ASTM C150 Type III and ASTM C1157 Type HE cements may be used.~~

**Class S35, S40, and S50** concretes are dense high strength concretes. Additional requirements are:

(1) The concrete mix shall be made with AASHTO M 43 sizes No. 57, No. 6, No. 67, No. 7 or No. 8 coarse aggregate.

(2) When placed in a bridge deck, the mix shall have a nominal maximum aggregate size of at least ¾ inch.

(3) The mixes may use an OG with a nominal maximum aggregate size of at least ¾ inch.

(4) For S35 and S40 concretes, the unrestrained shrinkage shall not exceed 0.050 percent at 28 days when tested by CP-L 4103.

(5) For S50 concretes, the unrestrained shrinkage shall not exceed 0.040 percent at 28 days when tested by CP-L 4103.

(6) For S35 and S40 concretes, the mix shall either have a permeability not exceeding 2,000 coulombs at an age of not more than 56 days when tested in accordance with ASTM C1202, or have a surface resistivity of at least 14 kΩ-cm at 28 days using AASHTO T358.

(7) For S50 concrete, the mix shall either have a permeability not exceeding 1,500 coulombs at an age of not more than 56 days when tested in accordance with ASTM C1202, or have a surface resistivity of at least 18 kΩ-cm at 28 days using AASHTO T358.

**Class Shotcrete** concrete is used for shotcrete applications. Additional requirements are:

(1) The required air content prior to the pump for wet process applications shall be 7–10 percent.

(2) Additional requirements are listed in subsection 641.02.

The Contractor may design Class B, Class BZ, Class D, Class G, Class PS, Class S35, Class S40, and Class S50 concrete to be Self Consolidating Concrete (SCC) with the following requirements:

(1) SCC shall have a slump flow of 20 to 26 inches when tested in accordance with ASTM C1611 using an inverted slump cone.

(2) SCC shall have a maximum blocking assessment of 2.0 inches when tested in accordance with ASTM C1621.

(3) SCC shall have a maximum static segregation of 10 percent when tested in accordance with ASTM C1610.

## MATERIALS

**601.03** Materials shall meet the requirements specified in the following subsections:

| | |
|---|---|
| Fine Aggregate | 703.01 |
| Coarse Aggregate | 703.02 |
| Portland Cement | 701.01 |
| Fly Ash | 701.02 |
| Silica Fume | 701.03 |
| Water | 712.01 |
| Air Entraining Admixtures | 711.02 |
| Pigments and Admixtures | 711.03 |
| Curing Materials | 711.01 |
| Preformed Joint Material | 705.01 |
| Reinforcing Steel | 709.01 |
| Bearing Materials | 705.06 |
| Epoxy | 712.10 |
| Structural Concrete Coating | 708.08 |
| High-reactivity Pozzolans | 701.04 |
| Slag Cement | 701.05 |

Pozzolans shall consist of fly ash, silica fume, and high-reactivity pozzolan.

Prestressing steel shall meet the requirements of subsection 714.01 except as noted on the plans.

Calcium Chloride shall not be used in reinforced concrete. Calcium Chloride shall be used in non-reinforced concrete only when specified.

Where Fiber-Reinforced Concrete is specified or designated on the plans, the concrete mix shall include approved polyolefin fibers. Unless otherwise specified, a minimum of 1.5 pounds or the manufacturer's recommended dose per cubic yard of polyolefin fiber reinforcement shall be evenly distributed into the mix. Mixing shall be as recommended by the manufacturer such that the fibers do not ball up. Polyolefin fibers shall meet the requirements of ASTM C1116 and ASTM D7508.

Where Macro Fiber-Reinforced Concrete is specified or designated on the plans, the concrete mix shall include approved macro or hybrid polyolefin fibers at a minimum dosage of 4 lb/cy or the minimum dosage specified on the APL, whichever is greater. The dosage of the fiber may be reduced if trial mix data shows a minimum residual strength of 150 psi as determined in accordance with ASTM C1609 using a load support apparatus compliant with the requirements of ASTM C1812, "Standard Practice for Design of Journal Bearing Supports to be Used in Fiber Reinforced Concrete Beam Tests." Mixing shall be as recommended by the manufacturer such that the fibers are evenly distributed in the mix and do not ball up. Macro or hybrid polyolefin fibers shall meet the requirements of ASTM C1116 and ASTM D7508.

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**601.04 Sulfate Resistance.** The Contractor shall provide protection against sulfate attack on concrete structures and pavements by providing concrete manufactured according to the requirements of the specified Sulfate Exposure Class. The sulfate exposure class for all concrete except Class PS shall be Class 2 unless otherwise specified on the plans. The sulfate exposure class for Class PS shall be Class 0. The requirements for a higher sulfate exposure class may be used for lower sulfate exposure classes.

The Contractor may request to test the soil and water at a structure location to change the sulfate exposure class. Testing and sampling of the location shall be at a frequency approved by the Engineer, in consultation with the Region Materials Engineer. If the Contractor provided test reports that show another class of exposure exists at a structure location, the Engineer may accept a concrete mix for that location at the changed sulfate exposure class.

Cementitious material requirements for each Sulfate Exposure Class are as follows:

Class 0 requires that the concrete have a maximum Water/Cementitious Material Ratio of 0.45 and one of the following:

(1) ASTM C150 Type I, II, III or V

(2) ASTM C595 Type IL, IP, IP(MS), IP(HS) or IT

(3) ASTM C1157 Type GU, HE, MS or HS

Class 1 requires that the concrete have a maximum Water/Cementitious Material Ratio of 0.45 and one of the following:

(1) ASTM C150 Type II or V

(2) ASTM C595 Type IP(MS) or IP(HS)

(3) ASTM C1157 Type MS or HS

(4) ASTM C150 Type III. Type III shall have no more than 8 percent C3A.

(5) ASTM C595 Type IL(MS), IL(HS), IT(MS) or (HS)

Class 2 requires that the concrete have a maximum Water/Cementitious Material Ratio of 0.45 and one of the following:

(1) ASTM C150 Type V with a minimum of a 20 percent substitution of Class F fly ash or slag cement by weight

(2) ASTM C150 Type II or III with a minimum of a 20 percent substitution of Class F fly ash or slag cement by weight. The Type II or III cement shall have no more than 0.040 percent expansion at 14 days when tested according ASTM C452.

(3) ASTM C1157 Type HS

(4) ASTM C150 Type II, III, or V plus High-Reactivity Pozzolan where the blend has less than 0.05 percent expansion at 6 months or 0.10 percent expansion at 12 months when tested according to ASTM C1012

(5) ASTM C1157 Type HE or MS plus Class F fly ash, slag cement, or High-Reactivity Pozzolan where the blend has less than 0.05 percent expansion at 6 months or 0.10 percent expansion at 12 months when tested according to ASTM C1012

(6) A blend of portland cement meeting ASTM C150 Type II or III with a minimum of 20 percent Class F fly ash or slag cement by weight, where the blend has less than 0.05 percent expansion at 6 months or 0.10 percent expansion at 12 months when tested according to ASTM C1012

(7) ASTM C595 Type IP(HS), IL(HS) or IT(HS). Class F fly ash, slag cement, or High-Reactivity Pozzolan may be substituted for Type IL cement.

(8) ASTM C595 Type IL(MS) or IT(MS) plus Class F fly ash, slag cement, or High-Reactivity Pozzolan where the blend has less than 0.05 percent expansion at 6 months or 0.10 percent expansion at 12 months when tested according to ASTM C1012

Class 3 requires that the concrete have a maximum Water/Cementitious Material Ratio of 0.40 and one of the following:

(1) A blend of portland cement meeting ASTM C150 Type II, III, or V with a minimum of a 20 percent substitution of Class F fly ash or slag cement by weight, where the blend has less than 0.10 percent expansion at 18 months when tested according to ASTM C1012

(2) ASTM C 1157 Type HS having less than 0.10 percent expansion at 18 months when tested according to ASTM C1012. Class F fly ash, slag cement, or High-Reactivity Pozzolan may be substituted for cement.

(3) ASTM C1157 Type HE, MS or HS plus Class F fly ash, slag cement, or High-Reactivity Pozzolan where the blend has less than 0.10 percent expansion at 18 months when tested according to ASTM C1012

(4) ASTM C150 Type II, III, or V plus High-Reactivity Pozzolan where the blend has less than 0.10 percent expansion at 18 months when tested according to ASTM C1012

(5) ASTM C595 Type IL(MS) or IT(MS) plus High-Reactivity Pozzolan where the blend has less than 0.10 percent expansion at 18 months when tested according to ASTM C1012

(6) ASTM C595 Type IP(HS), IL(HS), or IT(HS) having less than 0.10 percent expansion at 18 months when tested according to ASTM C1012. Class F fly ash, slag cement, or High-Reactivity Pozzolan may be substituted for Type IL cement.

(7) ASTM C595 Type IL with a minimum of a 20 percent substitution of Class F fly ash or slag cement by weight, where the blend has less than 0.10 percent expansion at 18 months when tested according to ASTM C1012

(8) ASTM C150 Type I, II, III, or V plus a minimum of 20 percent Class F fly ash when the R factor of the fly ash is less than 0.75. R factor is determined using the following from the chemical composition of the fly ash:

$$R = \frac{CaO - 5}{Fe_2O_3}$$

ASTM C150 Type III and ASTM C1157 Type HE cements may only be used in Class P or PS Concrete when approved by the Engineer.

Class C fly ash shall not be substituted for cement when Class 1, 2, or 3 sulfate resistance/exposure class is specified.

The maximum Water/Cementitious Material Ratio may be exceeded when an expansive cement additive is used.

When fly ash or high-reactivity pozzolan is used to enhance sulfate resistance, it shall be used in a proportion greater than or equal to the proportion tested in accordance to ASTM C1012, shall be the same source, and shall have a calcium oxide content no more than 2.0 percent greater than the fly ash or high-reactivity pozzolan tested according to ASTM C1012. ASTM C1012 test results are acceptable for up to two years from the completion date of the test.

**Table 601-2**

| Water-Soluble Sulfate ($SO_4$) in Dry Soil, (%) | Sulfate ($SO_4$) in Water, ppm | Sulfate Exposure Class |
|---|---|---|
| 0.00 to 0.10 | 0 to 150 | Class 0 |
| 0.11 to 0.20 | 151 to 1,500 | Class 1 |
| 0.21 to 2.00 | 1,501 to 10,000 | Class 2 |
| 2.01 or greater | 10,001 or greater | Class 3 |

## CONSTRUCTION REQUIREMENTS

**601.05 Mix Design Submittal Requirements.** The Contractor shall submit a Concrete mix design for each class of concrete being placed on the project. Concrete shall not be placed on the project before the Concrete mix design has been approved by the Engineer. The Concrete mix design will be reviewed following the procedures of CP 62. The Concrete mix design will not be approved when the laboratory trial mix data or aggregate data are the results from tests performed more than two years in the past. The concrete mix design shall show the weights and sources of all ingredients including cements, pozzolans, aggregates, fibers, pigments, water, additives and the water to cementitious material ratio (w/cm). When determining the w/cm, the weight of cementitious material (cm) shall be the sum of the weights of the cement, slag cement, fly ash, silica fume, and high-reactivity pozzolan. Water from dosages of admixtures greater than 10 ounces per 100 pounds of cementitious materials shall be included in the calculation of w/cm.

The laboratory trial mix data shall include results of the following:

(1) AASHTO T 119 (ASTM C143) Slump of Hydraulic Cement Concrete, except when the concrete is SCC

(2) AASHTO T 121 (ASTM C138) Weight per Cubic Foot, Yield, and Air Content (Gravimetric) of Concrete

(3) AASHTO T 152 (ASTM C231) Air Content of Freshly Mixed Concrete by the Pressure Method

(4) ASTM C39 Compressive Strength of Cylindrical Concrete Specimens shall be performed with at least two specimens at 7 days and three specimens at 28 days.

(5) Class P concrete shall include AASHTO T97 (ASTM C78) Flexural Strength of Concrete (Using Simple Beam with Third-Point Loading). At least two specimens will be tested at 7 days and four specimens at 28 days. The lab trial mix shall produce a flexural strength at 28 days of at least 650 psi.

(6) Concrete with an OG shall indicate the gradation of the blended aggregates. Optimized gradations shall be developed by an approved mix design technique such as Tarantula Curve, Shilstone, or KU mix.

(7) SCC concrete shall include ASTM C1611 Standard Test Method for Slump Flow of Self-Consolidating Concrete. Slump flow shall be measured using an inverted slump cone.

(8) SCC concrete shall include ASTM C1621 Standard Test Method for Passing Ability of Self-Consolidating Concrete by J-Ring.

(9) SCC concrete shall include ASTM C1610 Standard Test Method for Static Segregation of Self-Consolidating Concrete Using Column Technique.

(10) When concrete is to be placed using a paver, the edge slump and surface voids shall be reported in accordance with CP 63.

Prior to placement of accelerated Class P Concrete, the Contractor shall provide the Engineer a report of maturity relationships in accordance with CP 69.

Except for Class PS concrete, the laboratory trial mix must produce an average compressive strength of at least the required field compressive strength specified in Table 601-1. For Class PS concrete, the laboratory trial mix must produce an average compressive strength at least 115 percent of the required field compressive strength specified in Table 601-1.

When entrained air is specified in the Contract for Class BZ concrete, the trial mix shall be run with the required air content.

The laboratory trial mix shall have a relative yield of 0.99 to 1.02.

Aggregate data shall include the results of the following:

(1) AASHTO T 11 (ASTM C117) Materials Finer Than 75 um (No. 200) Sieve in Mineral Aggregates by Washing

(2) AASHTO T 19 (ASTM C29) Unit Weight and Voids in Aggregate

(3) AASHTO T 21 (ASTM C40) Organic Impurities in Fine Aggregate for Concrete

(4) AASHTO T 27 (ASTM C136) Sieve Analysis of Fine and Coarse Aggregates

(5) AASHTO T 84 (ASTM C128) Specific Gravity and Absorption of Fine Aggregate

(6) AASHTO T 85 (ASTM C127) Specific Gravity and Absorption of Coarse Aggregate

(7) AASHTO T 96 (ASTM C131) Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine

(8) AASHTO T 104 (ASTM C88) Soundness of Aggregate by Use of Sodium Sulfate or Magnesium Sulfate

(9) CP 37 Plastic Fines in Graded Aggregates and Soils by use of the Sand Equivalent Test

(10) ASTM C535 Resistance to Degradation of Large-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine

(11) ASTM C1260 Determining the Potential Alkali Reactivity of Aggregates (Accelerated Mortar-Bar Method). When an aggregate source is known to be reactive, ASTM C1567 results may be submitted in lieu of ASTM C1260 results.

Aggregate tested by ASTM C1260 with an expansion of 0.10 percent or more, or that is known to be reactive, shall not be used unless mitigative measures are included in the mix design.

Mitigative measures shall be tested using ASTM C1567 and exhibit an expansion less than 0.10 percent by one of the following methods:

(1) Combined Aggregates. The mix design sources of aggregates, cement and mitigative measures shall be tested. The proportions of aggregates, cement and mitigative measures shall be those used in the mix design.

(2) Individual Aggregates. Each source and size of individual aggregates shall be tested. The source of cement and mitigative measures shall be those used in the mix design. The highest level of mitigative measures for any individual aggregate shall be the minimum used in the mix design.

For all concrete mix designs with ASTM C150 and ASTM C595 Type IL cements, the total substitution of cement shall not exceed 50 percent by weight of total cementitious material.

For all concrete mix designs with ASTM C595 Type IP, IP(MS), IP(HS), or IT cements: fly ash or high-reactivity pozzolan shall not be substituted for cement.

For all concrete mix designs with ASTM C595 IT cements, slag cement shall not be substituted for cement.

For all concrete mix designs with ASTM C595 Type IP, IP(MS), IP(HS) cements, when slag cement is substituted for cement, the total substitution of cement shall not exceed 50 percent by weight of total cementitious material.

For all concrete mix designs with ASTM C1157 cements, the total pozzolan content including pozzolan in cement shall not exceed 30 percent by weight of the cementitious material content. Up to a maximum of 30 percent slag cement by weight of total cementitious material may be substituted for cement.

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The Contractor shall submit a new Concrete Mix Design Report meeting the above requirements when a change occurs in the source, type, or proportions of cement, slag cement, fly ash, high-reactivity pozzolan, silica fume, or aggregate. Adjustments to aggregate weights may be made to adjust yield if the combined gradation remains constant (+/-1 percent) or within the optimized band.

When a change occurs in the source or type of approved admixtures or the addition of approved accelerating, retarding or hydration stabilizing admixtures to existing mix designs, the Contractor shall submit a letter stamped by the Concrete Mix Design Engineer approving the changes to the existing mix design. The change shall be approved by the Engineer prior to use.

Unless otherwise permitted by the Engineer, the product of only one type of hydraulic cement from one source of any one brand shall be used in a concrete mix design.

Approval of the concrete mix design by the Engineer does not constitute acceptance of the concrete. Acceptance will be based solely on the test results of concrete placed on the project.

Once approved for a project, the mix design may be used for the duration of the project.

**601.06 Batching** Measuring and batching of materials shall be done in accordance with AASHTO M 157 (ASTM C94).

The Contractor shall furnish a batch ticket (delivery ticket) with each load for all classes of concrete. Concrete delivered without a batch ticket containing complete information as specified shall be rejected. The Contractor shall collect and complete the batch ticket at the placement site and deliver all batch tickets to the Engineer on a daily basis. The Engineer shall have access to the batch tickets at any time during the placement. The following information shall be provided on each batch ticket:

(1) Supplier's name and date

(2) Truck number

(3) CDOT Project number and location

(4) Concrete class designation and item number

(5) Cubic yards batched

(6) Time batched

(7) CDOT mix design number

(8) Type, brand, and amount of each admixture and pigment

(9) Type, brand, and amount of cement, slag cement, fly ash, and high-reactivity pozzolan

(10) Weights of fine and coarse aggregates or combined weight when an OG is pre-blended

(11) Moisture of fine and coarse aggregates or combined moisture when an OG is pre-blended

(12) Gallons (Pounds) of batch water (including ice)

(13) Weight of polyolefin fiber reinforcement

The Contractor shall add the following information to the batch ticket at the placement site:

(14) Gallons of water added by truck operator, the time the water was added, and the quantity of concrete in the truck each time water is added

(15) Number of revolutions of drum at mixing speed (for truck mixed concrete)

(16) Discharge time

(17) Location of batch in placement

(18) Water to cementitious material ratio

Electronic tickets are allowed as long as CDOT has access to the batch ticket and the batch ticket can be downloaded and saved by the Engineer in PDF format before placement, at any time during placement, and until the project is accepted.

(a) *Hydraulic Cement, Fly Ash, High-Reactivity Pozzolan, Slag Cement and Silica Fume.* All cementitious material shall be measured by mass. Supplementary cementitious materials may be weighed cumulatively with cement. Cement and other cementitious material shall be weighed on a scale and in a weigh hopper, which is separate and distinct from those used for other materials. When the quantity of cementitious material exceeds 30 percent of the full capacity of the scale, the quantity of cement and the cumulative quantity of cement plus supplementary cementitious material shall be within ±1 percent of the required mass. For small batches to a minimum of 1 cubic yard, the quantity of cement and the quantity of cement plus supplementary cementitious material used shall not be less than the required amount or more than 4 percent in excess. A fraction of a bag of cement shall not be used unless weighed.

(b) *Water.* Mixing water shall consist of water added to the batch, ice added to the batch, water occurring as surface moisture on the aggregates, and water introduced in the form of admixtures. The added water shall be measured by mass or volume to an accuracy of 1 percent of the required total mixing water. Added ice shall be measured by weight. In the case of truck mixers, wash water retained in the drum for use in the next batch of concrete shall be accurately measured or shall be discharged prior to loading the next batch of concrete. Total water (including any wash water) shall be measured or weighed to an accuracy of ±3 percent.

(c) *Aggregates.* Aggregates from different sources and of different gradings shall not be stockpiled together.

Aggregate shall be handled from stockpiles or other sources to the batching plant in such manner as to secure a uniform grading of the material. Aggregates that have become segregated, or mixed with earth or foreign material, shall not be used. All aggregates produced or handled by hydraulic methods, and washed aggregates, shall be stockpiled or binned for draining at least 12 hours before being batched. Rail shipment requiring more than 12 hours will be accepted as adequate binning only if the car bodies permit free drainage. In case the aggregates contain high or non-uniform moisture content, storage or stockpile period in excess of 12 hours may be required.

Aggregate shall be measured by mass. The quantity of aggregate used in any batch of concrete as indicated by the scale shall be within ±2 percent of the required mass when weighed in individual weigh batchers. In a cumulative aggregate weigh batcher, the cumulative mass after each successive weighing shall be within ±1 percent of the required cumulative amount when the scale is used in excess of 30 percent of its capacity. For cumulative mass for less than 30 percent of scale capacity, the tolerance shall be ±0.3 percent of scale capacity or ±3 percent of the required cumulative mass, whichever is less.

(d) *Bins and Scales.* The batching plant may include bins, weighing hoppers, and scales for the fine aggregate and for each size of coarse aggregate. A bin, hopper, and scale for cementitious material shall be included. A single weighing hopper with an accumulative scale will be permitted, provided a separate scale is used for weighing cementitious material.

Scales shall meet the requirements of subsection 109.01.

**601.07 Mixing.** Mixing of materials shall be done in accordance with AASHTO M 157 (ASTM C94). Concrete shall be mixed in stationary mixers, in a central-mix plant, in truck mixers, or in self-contained mobile mixers. Mixing time shall be measured from the time all materials, except water, are in the drum.

Admixtures listed in the mix design, or admixtures approved in accordance with subsection 601.04, and water may be added at the project.

(a) *Mixing General.* Concrete shall be deposited in place within 90 minutes after batching when concrete is delivered in truck mixers or agitating trucks, and within 60 minutes when delivered in non-agitating trucks.

The 90 minute time limit for mixer or agitating trucks may be extended to 120 minutes if:

(1) No water is added after 90 minutes.

(2) The concrete temperature prior to placement is less than 90 °F.

The 90 minute time limit for mixer or agitating trucks may be extended to 180 minutes if:

(1) No water is added after 90 minutes.

(2) The concrete temperature prior to placement is less than 90 °F.

(3) The approved concrete mix contains an approved retarding admixture.

The 90 minute time limit for mixer or agitating trucks may be extended longer than 180 minutes if:

(1) An Extended Set Control Admixture (ESCA) is added at the time of batching. Procedures and doses shall be in accordance with manufacturer’s recommendations. The ESCA shall be on the approved products list.

(2) The concrete temperature prior to placement is less than 90 °F.

(3) Each load of concrete shall be sampled and tested by the Contractor for air content according to CP 61.

(4) The Department will cast three additional acceptance cylinders. If the acceptance cylinders tested at 28 days do not meet design strength, the additional cylinders will be tested at 56 days for acceptance.

(b) *Central-Mixed Concrete.* Concrete that is mixed completely in a stationary mixer and transported to the point of delivery either in a truck agitator or a truck mixer operating at agitating speed, or in non-agitating equipment approved by the Engineer, shall conform to the following:

(1) The mixing time shall be counted from the time all the solid materials are in the drum.

(2) The batch shall be so charged into the mixer so that some water will enter in advance of the cement and aggregate.

(3) All water shall be in the drum by the end of the first one fourth of the specified mixing time.

(4) The volume of concrete mixed per batch may exceed the mixer's nominal capacity, as shown on the manufacturer’s standard rating plate on the mixer, by up to 10 percent provided concrete test data for

strength, segregation, and uniform consistency are satisfactory, and provided spillage of concrete does not occur.

(5) Where no mixer uniformity tests are made, the acceptable mixing time for mixers having capacities of 1 cubic yard or less shall be not less than 1 minute. For mixers of greater capacity, this minimum shall be increased 15 seconds for each cubic yard or fraction thereof of additional capacity. Uniformity testing shall be in accordance with AASHTO M157 (ASTM C94).

(c) *Truck Mixing*. Truck mixed concrete shall conform with one of the following:

(1) Concrete that is completely mixed in a truck mixer shall be mixed 70 to 100 revolutions at the mixing speed to produce uniform concrete. Concrete uniformity tests shall be made in accordance with AASHTO M157 (ASTM C94). Additional revolutions of the mixer beyond the number found to produce the required uniformity of concrete shall be at a designated agitating speed.

(2) For concrete that is partially mixed in a stationary mixer, and then mixed completely in a truck mixer (shrink mixed concrete), the time of partial mixing shall be the minimum required to intermingle the ingredients. After transfer to a truck mixer, it shall be mixed at a speed to produce uniform concrete. Concrete uniformity tests shall be made in accordance with AASHTO M157 (ASTM C94). Additional revolutions of the mixer beyond the number found to produce the required uniformity of concrete shall be at a designated agitating speed.

(3) Concrete mixed entirely in a stationary mixer and delivered to the job in a truck mixer shall be remixed for a minimum of 20 revolutions of the mixing drum at mixing speed at the job site prior to discharge.

When water is added at the delivery site to control the consistency of the concrete, the concrete shall be mixed for at least 30 revolutions of the mixer drum at mixing speed for each addition of water before discharge. These revolutions are in addition to the minimum revolutions required for mixing at the delivery site. The added water shall not cause the w/cm ratio to exceed the approved mix design w/cm ratio. Water from all sources shall be documented by the Contractor on the delivery slip for each load of concrete.

The Contractor shall provide a Concrete Truck Mixer Certification. This certification shall show the various pick-up and throw-over configurations and wear marks so that the wear on the blades can be checked. Blades shall be replaced when any part or section is worn 1 inch or more below the original height of the manufacturer's design. A copy of the manufacturer's design, showing the dimensions and arrangement of blades, shall be available to the Engineer at all times.

The Contractor shall furnish a water-measuring device in good working condition, mounted on each transit mix truck, for measuring the water added to the mix after the truck has left the charging plant. Each measuring device shall be equipped with an easy-to-read gauge. Water shall be measured to an accuracy of ±3 percent.

(d) *Self Contained Mobile Mixer.* Proportioning and mixing equipment shall be of the self-contained, mobile, continuous mixing type in accordance with ASTM C685 and subject to the following:

(1) The mixer shall be self-propelled and capable of carrying sufficient unmixed dry, bulk cementitious materials, fine aggregate, coarse aggregate, admixtures, and water to produce on the site at least 6 cubic yards of concrete. The mixer shall have one bin for each size aggregate.

(2) The mixer shall be capable of positive measurement of cementitious materials being introduced into the mix. A recording meter visible at all times and equipped with a ticket printout shall indicate the quantity of total concrete mix.

(3) The mixer shall provide positive control of the flow of water into the mixing chamber. Water flow shall be indicated by flow meter and be readily adjustable to provide for minor variations in the aggregate moisture.

(4) The mixer shall be capable of calibration to automatically proportion and blend all components of indicated composition on a continuous or intermittent basis as required by the finishing operation, and shall discharge mixed material through a conventional chute directly in front of the finishing machine.

(5) The Contractor shall perform calibration tests according to the equipment manufacturer's recommendations at the beginning of each project, and when there is a change in the mix design proportions or source of materials. The Engineer may require a calibration test or yield check when a change in the characteristics of the mixture is observed. The tolerances in proportioning the various ingredients shall be according to ASTM C685.

Subsection 601.09(h) shall include the following:

When ESCAs are used, the removal of forms, supports and housing, and the discontinuance of heating and curing may begin when the concrete is found to have the required compressive strength.

In subsection 601.12(g) delete the fifth paragraph and replace with the following:

When concrete is placed by pumping, the pumping equipment shall be thoroughly cleaned prior to concrete placement. Excess form release agent shall be removed from the hopper. The pump shall be primed at the Contractor’s expense by pumping and discarding enough concrete to produce a uniform mix exiting the pump. At least 0.25 cubic yards of concrete shall be pumped and discarded to prime the pump. Water or admixtures shall not be added directly into the concrete pump hopper after placement has commenced. If water or admixtures are added to the concrete pump hopper, all concrete in the concrete pump hopper and the line shall be discarded and the pump shall be re-primed at the Contractor’s expense.

In subsection 601.15 delete the second paragraph and replace with the following:

A Pre-placement Conference shall be held at a time mutually agreed upon before the initial placement of bridge deck concrete. Representatives of the ready mix producer and the Contractor shall meet with the Engineer to discuss the following topics:

Delete subsection 601.15(a) and replace with the following:

(a) *Surface Preparation*. Tops of girders, precast deck panels, pier caps, and abutments that will come into contact with bridge deck concrete shall be heated to raise the temperature above 35 °F prior to concrete placement. The proposed preheating method is subject to approval by the Engineer.

Delete subsection 601.15(b).

In subsection 601.15(c) delete paragraphs 3 through 8.

In subsection 601.16 delete paragraphs 1 to 3 and replace with the following:

The minimum curing period shall be 120 hours.

The concrete surface shall be kept moist at all times by fogging with an approved atomizing nozzle or applying a monomolecular film coating to retard evaporation until the curing material is in place.

Concrete bridge decks, including bridge curbs and bridge sidewalks, shall be cured as follows:

Delete subsection 601.16(e).

Delete subsection 601.17 and replace with the following:

**601.17 Acceptance and Pay Factors.** These provisions apply to all concrete. The Contractor shall sample concrete for both Process Control (PC) and Owner Acceptance (OA) in accordance with CP 61. The Engineer will

witness the sampling and take possession of the OA samples at a mutually agreed upon location. The Contractor shall be responsible for Process Control (PC) testing for concrete. PC testing shall be performed at least once per day and then once per 50 cubic yards for concrete slump, unit weight, and concrete temperature.

If the produced concrete does not have a relative yield of 0.99 to 1.02 for two consecutive yield determinations, concrete production shall cease and the Contractor shall present a plan to correct the relative yield to the Engineer.

When SCC is used, the Contractor shall test the first load of SCC prior to placement for Slump Flow (ASTM C1611) and Blocking Assessment (ASTM C1621). The Contractor shall take a sample from the first portion of the load and complete the slump flow and blocking assessment prior to depositing any portion of the load. The tests shall not be performed more than 15 minutes prior to placement. The slump flow shall be 20 to 26 inches. The blocking assessment shall be less than or equal to 2.0 inches. The Contractor will be allowed to make adjustments to the load with admixtures. After adjustments have been made, the slump flow and blocking assessment shall be retested. Each subsequent load of SCC shall be tested for Slump Flow. If the slump flow differs from the first load by more than 2.0 inches, the load shall be adjusted to have a slump flow within 2.0 inches of the first load, or the load may be tested for Blocking Assessment (ASTM C1621). If the load is tested for and meets the requirements for Blocking Assessment (ASTM C1621), the load's slump flow will be used for the acceptance of the following loads. When concrete placement is halted for more than 15 minutes, the slump flow and blocking assessment shall be retested prior to resuming placement. When the slump flow exceeds 26 inches, the concrete may be placed if the depth of penetration is less than 11 millimeters when tested using ASTM C1712 Test Method for Static Segregation Resistance of Self-Consolidating Concrete. If a load of concrete has a slump flow greater than 26 inches and a depth of penetration less than 11 millimeters, the next load shall be tested for slump flow and blocking assessment to establish a new slump flow target.

When SCC is used, subsection 601.17(b) does not apply.

When SCC is used, the test methods for fabricating specimens in accordance with subsections 601.17(a) and 601.17(c) acceptance shall be modified to use ASTM C1758, Practice for Fabricating Test Specimens with SCC, for filling the test specimens with concrete.

(a) *Air Content.* The first three batches at the beginning of each day's production shall be tested by the Contractor's PC and CDOT's OA for air content. When the PC and OA air content measurements differ by more than 0.5 percent, both the PC and OA air meters shall be checked in accordance with ASTM C231. When air content is below the specified limit, it may be adjusted in accordance with subsection 601.08. Successive batches shall be tested by the Contractor's PC and witnessed by the Engineer until three consecutive batches are within specified limits. After the first three batches, CDOT will follow the random minimum testing schedule. After the first three batches, the Contractor shall perform PC testing at a frequency of one random sample per 50 cubic yards. Air content shall not be adjusted after a CDOT OA test.

    At any time during the placement of the concrete, when an OA test on a batch deviates from the minimum or maximum percent of total air content specified, the batch that deviates from the specified air content by 1 percent or less may be accepted at a reduced price using Table 601-3.

    Portions of loads incorporated into structures prior to determining test results which indicate rejection as the correct course of action shall be subject to acceptance at reduced price, no payment, or removal as determined by the Engineer.

(b) *Slump*. Except for Class BZ concrete, the slump of the delivered concrete shall be the slump of the approved concrete mix design plus or minus 2.0 inches. The maximum slump shall be 9.0 inches. Slump acceptance, but not rejection, may be visually determined by the Engineer. Any batch that exceeds the slump of the approved concrete mix design by more than 2.0 inches will be retested. If the mix design slump is exceeded by more than 2.0 inches a second time, that load will be rejected. If the slump is greater than 2 inches lower than the approved concrete mix design, the load may be adjusted by adding a water reducer or by adding water (if the w/cm allows) and retested.

Portions of loads incorporated into structures prior to determining test results which indicate rejection as the correct course of action shall be subject to reduced payment or removal as determined by the Engineer.

(c) *Strength (When Specified).* The concrete will be considered acceptable when the running average of three consecutive strength tests per mix design for an individual structure is equal to or greater than the specified strength and no single test falls below the specified strength by more than 500 psi. A test is defined as the average strength of three test cylinders cast in plastic molds from a single sample of concrete and cured under standard laboratory conditions prior to testing. If the compressive strength of any one test cylinder differs from the average by more than 10 percent that compressive strength will be deleted and the average strength will be determined using the compressive strength of the remaining two test cylinders.

When the average of three consecutive strength tests is below the specified strength, the individual low tests will be used to determine the pay factor in accordance with Table 601-3. If less than three strength tests are available the individual low tests, if any, will be used to determine the pay factor in accordance with Table 601-3. The pay factor will be applied to the quantity of concrete represented by the individual low test. For concrete having a specified strength of less than 4500 psi, when the compressive strength test is below the specified strength by more than 500 psi, the concrete represented will be rejected. For concrete having specified strength of 4500 psi or greater, when the compressive strength test is below the specified strength by more than 500 psi but not more than 1000 psi, the concrete represented will be evaluated by the Department for removal, corrective action, or acceptance at a reduced price. All costs of the evaluation shall be at the Contractor's expense. When the compressive strength test is below the specified strength by more than 1000 psi, the concrete represented will be rejected.

The Contractor may take cores at its own expense and in accordance with Colorado Procedure 65 within 10 working days of being notified of a price reduction or up to 45 days after placement, whichever is later, to provide an alternative determination of strength. Price reduction for strength will be based on the 28 day compressive strength of acceptance cylinders or corresponding cores strength, whichever is greater. If the core compressive strength is at least 90 percent of the specified field compressive strength, the concrete represented by the cores will be accepted with no price reduction.

The Engineer may use cores to determine acceptance or rejection of a part of the structure instead of acceptance cylinders. The Engineer will notify the Contractor in writing that CDOT will core the structure. The location of the coring will be directed by the Engineer. Coring and testing will be performed at the expense of the Department regardless of the result. Cores will be taken and tested in accordance with AASHTO T24 between 28 days and 45 days after concrete placement. Cores will be a minimum of 4 inches in diameter, unless otherwise approved by the Engineer. A minimum of three cores in a two square foot area will be obtained for locations of the structure that are suspect. If the compressive strength of any one core differs from the average by more than 10 percent that compressive strength will be deleted and the average strength will be determined using the compressive strength of the remaining two cores. If the compressive strength of more than one core differs from the average by more than 10 percent, the average strength will be determined using all three compressive strengths of the cores. If the average core compressive strength is greater than or equal to 85 percent of the specified 28 day compressive strength, the concrete represented by the cores will be accepted. If the average core compressive strength is less than 85 percent of the specified 28 day compressive strength, the structure will be evaluated by the Department according to subsection 105.03 for removal and replacement. Pay factors will not be based on cores taken by the Engineer. If the concrete represented by the cores is accepted, all costs associated with the repair of the core holes, including preparation and submittal of the repair method, will be measured and paid for separately.

After the Department performs additional core testing as described above, the Contractor may make one request that the structure be cored by the Contractor, tested and re-evaluated by the Department within 45 days after concrete placement. Coring and testing costs will be at the expense of the Contractor regardless of the result. Cores shall be taken at the same area of the structure as those obtained by the Engineer. The Engineer will approve the location of the cores prior to the Contractor coring the structure. All costs associated with the repair of these core holes, including preparation and submittal of the repair method, will not be measured and paid for separately, but shall be included in the work.

If the concrete in the structure is found to be sufficient resulting time delays will be considered excusable. If the concrete in the structure is still found to be deficient, resulting time delays will be considered non-excusable for this evaluation. Compensation for time delays will be evaluated by the Engineer in accordance with subsection 108.08.

The Contractor shall submit a proposed repair method for the core holes for approval prior to coring. The method shall use an approved non-shrink concrete patching material with a minimum compressive strength of 4500 psi. The Contractor shall submit the manufacturer's recommendations along with the repair method. The Engineer will review and approve the proposed methodology prior to patching.

The Engineer will distribute electronically to the concrete supplier all compressive strength Owner Acceptance (OA) data for the concrete supplied to the project. The Engineer will distribute the OA compressive strength data within two business days of the 7 day and 28 day compressive strength testing. The data will include the compressive strength and batch ticket number at a minimum. The Contractor shall not have a valid dispute or claim as a result of any action or inaction by the Department related to the distribution of test results.

(d) *Pay Factors.* The pay factor for concrete which is allowed to remain in place at a reduced price shall be determined according to Table 601-3 and shall be applied to the unit price bid for the Item.

If deviations occur in air content and strength within the same batch, the pay factor for the batch shall be the product of the individual pay factors.

**Table 601-3**
**PAY FACTORS**

| **Percent Total Air** | | **Strength** | | |
|---|---|---|---|---|
| **Deviations From Specified Air (Percent)** | **Pay Factor (Percent)** | **Below Specified Strength (psi) [ < 4500 psi Concrete]** | **Pay Factor (Percent)** | **Below Specified Strength (psi) [ ≥ 4500 psi Concrete]** |
| 0.0 – 0.2 | 98 | 1 – 100 | 98 | 1 – 100 |
| 0.3 – 0.4 | 96 | 101 – 200 | 96 | 101 – 200 |
| 0.5 – 0.6 | 92 | 201 – 300 | 92 | 201 – 300 |
| 0.7 – 0.8 | 84 | 301 – 400 | 84 | 301 – 400 |
| 0.9 – 1.0 | 75 | 401 – 500 | 75 | 401 – 500 |
| Over 1.0 | Reject | Over 500 | Reject | |
| Concrete represented by out-of-spec tests will only be priced reduced with the lowest pay factor, not for each pay factor. | | | 65 | 501 – 600 |
| | | | 54 | 601 – 700 |
| | | | 42 | 701 – 800 |
| | | | 29 | 801 – 900 |
| | | | 15 | 901 – 1000 |
| | | | Reject | Over 1000 |

(e) *Bonding of Bridge Deck Overlay.* After the curing period for Class DT concrete has elapsed, the overlay shall be "sounded" by the Contractor in accordance with ASTM D4580 Standard Practice for Measuring Delamination in Concrete Bridge Decks by Sounding to determine if the Class DT concrete has bonded to the bridge deck. In areas where the Class DT concrete has not bonded to the bridge deck, it shall be removed and replaced at the Contractor's expense.

(f) *Maturity Meter Strength.* When maturity meters are specified for determining strength for removing forms, removing false work, backfilling against structures, or loading the structure, the Contractor shall provide the Engineer a report of maturity relationships in accordance with CP 69 prior to placement of concrete.

If a maturity meter fails, is tampered with, destroyed, or was not placed, the following shall apply:

The minimum curing time or waiting time for removing forms, removing false work, backfilling against structures, or loading the structure shall be 28 days.

The Contractor may choose at his own expense to core the structure represented by the maturity meter. Cores shall be obtained and tested according to CP 65. Cores shall be a minimum of 4 inches in diameter. A minimum of three cores in a two square foot area shall be obtained. If the compressive strength of any one core differs from the average by more than 10 percent that compressive strength will be deleted and the average strength will be determined using the compressive strength of the remaining two cores. If the compressive strength of more than one core differs from the average by more than 10 percent, the average strength will be determined using all three compressive strengths of the cores. The average compressive strength of the cores shall achieve the specified compressive strength of the structure. A structure may be cored only once.

(g) *Water to Cementitious Material Content (w/cm) Ratio.* The maximum w/cm ratio is the ratio that was used in the laboratory trial mix for the Concrete mix design. The w/cm ratio shall be determined for each batch of concrete by the Contractor and provided to the Engineer for approval prior to placement. If an adjustment to the mix is made after the Engineer's approval, the w/cm ratio shall be determined and submitted to the Engineer prior to the continuation of placement. Concrete that is placed without the Engineer's approval shall be removed and replaced at the Contractor's expense.

# REVISION OF SECTIONS 601 & 701
# STRUCTURAL CONCRETE

The Standard Special Provision issued October 4, 2019 is revised as follows:

Delete subsection 601.02 Class P Items (4) & (8) and replace with the following:

(4) ASTM C150 Type III cement may be used for early opening.

(8) A minimum of 20 percent Class F fly ash or High Reactivity Pozzolan or 30 percent Slag cement by weight shall be used to replace any ASTM C150 cement, or ASTM C595 Type IL cement. ASTM C595 Type IT(MS), IT(HS), IP(MS) or IP(HS) cements may be used without cement substitutions. Class C fly ash may be used if the calcium oxychloride is determined to be less than 15 g CaOXY/100 g cementitious paste as determined in accordance with AASHTO T 365 for Class 0 Sulfate Exposure.

Delete subsection 601.02 Class PS and replace with the following:

**Class PS** Class PS concrete is used for prestressed concrete members. Requirements for Class PS concrete are specified in subsection 618.11. ASTM C150 Type III cement may be used.

Delete subsection 601.04 and replace with the following:

**601.04 Sulfate Resistance.** The Contractor shall provide protection against sulfate attack on concrete structures and pavements by providing concrete manufactured according to the requirements of the specified Sulfate Exposure Class. The sulfate exposure class for all concrete except Class PS shall be Class 2 unless otherwise specified on the plans. The sulfate exposure class for Class PS shall be Class 0. The requirements for a higher sulfate exposure class may be used for lower sulfate exposure classes.

The Contractor may request to test the soil and water at a structure location to change the sulfate exposure class. Testing and sampling of the location shall be at a frequency approved by the Engineer, in consultation with the Region Materials Engineer. If the Contractor provided test reports that show another class of exposure exists at a structure location, the Engineer may accept a concrete mix for that location at the changed sulfate exposure class.

Cementitious material requirements for each Sulfate Exposure Class are as follows:

Class 0 requires that the concrete have a maximum Water/Cementitious Material Ratio of 0.45 and one of the following:

(1) ASTM C150 Type I, II, III or V

(2) ASTM C595 Type IL, IP, IP(MS), IP(HS) or IT

(3)

Class 1 requires that the concrete have a maximum Water/Cementitious Material Ratio of 0.45 and one of the following:

(1) ASTM C150 Type II or V

(2) ASTM C595 Type IP(MS) or IP(HS)

(3) ASTM C150 Type III. Type III shall have no more than 8 percent C3A.

(4) ASTM C595 Type IL(MS), IL(HS), IT(MS) or (HS)

# REVISION OF SECTIONS 601 & 701
# STRUCTURAL CONCRETE

Class 2 requires that the concrete have a maximum Water/Cementitious Material Ratio of 0.45 and one of the following:

(1) ASTM C150 Type V with a minimum of a 20 percent substitution of Class F fly ash or slag cement by weight

(2) ASTM C150 Type II or III with a minimum of a 20 percent substitution of Class F fly ash or slag cement by weight. The Type II or III cement shall have no more than 0.040 percent expansion at 14 days when tested according ASTM C452.

(3) ASTM C150 Type II, III, or V plus High-Reactivity Pozzolan where the blend has less than 0.05 percent expansion at 6 months or 0.10 percent expansion at 12 months when tested according to ASTM C1012

(4) A blend of portland cement meeting ASTM C150 Type II or III with a minimum of 20 percent Class F fly ash or slag cement by weight, where the blend has less than 0.05 percent expansion at 6 months or 0.10 percent expansion at 12 months when tested according to ASTM C1012

(5) ASTM C595 Type IP(HS), IL(HS) or IT(HS). Class F fly ash, slag cement, or High-Reactivity Pozzolan may be substituted for Type IL cement.

(6) ASTM C595 Type IL(MS) or IT(MS) plus Class F fly ash, slag cement, or High-Reactivity Pozzolan where the blend has less than 0.05 percent expansion at 6 months or 0.10 percent expansion at 12 months when tested according to ASTM C1012

Class 3 requires that the concrete have a maximum Water/Cementitious Material Ratio of 0.40 and one of the following:

(1) A blend of portland cement meeting ASTM C150 Type II, III, or V with a minimum of a 20 percent substitution of Class F fly ash or slag cement by weight, where the blend has less than 0.10 percent expansion at 18 months when tested according to ASTM C1012

(2)

(3) ASTM C150 Type II, III, or V plus High-Reactivity Pozzolan where the blend has less than 0.10 percent expansion at 18 months when tested according to ASTM C1012

(4) ASTM C595 Type IL(MS) or IT(MS) plus High-Reactivity Pozzolan where the blend has less than 0.10 percent expansion at 18 months when tested according to ASTM C1012

(5) ASTM C595 Type IP(HS), IL(HS), or IT(HS) having less than 0.10 percent expansion at 18 months when tested according to ASTM C1012. Class F fly ash, slag cement, or High-Reactivity Pozzolan may be substituted for Type IL cement.

(6) ASTM C595 Type IL with a minimum of a 20 percent substitution of Class F fly ash or slag cement by weight, where the blend has less than 0.10 percent expansion at 18 months when tested according to ASTM C1012

(7) ASTM C150 Type I, II, III, or V or ASTM C595 Type IL plus a minimum of 20 percent Class F fly ash when the R factor of the fly ash is less than 0.75. R factor is determined using the following from the chemical composition of the fly ash:

$$R = \frac{CaO - 5}{Fe_2O_3}$$

# REVISION OF SECTIONS 601 & 701
# STRUCTURAL CONCRETE

ASTM C150 Type III cements may only be used in Class P or PS Concrete when approved by the Engineer.

Class C fly ash shall not be substituted for cement when Class 1, 2, or 3 sulfate resistance/exposure class is specified.

The maximum Water/Cementitious Material Ratio may be exceeded when an expansive cement additive is used.

When fly ash or high-reactivity pozzolan is used to enhance sulfate resistance, it shall be used in a proportion greater than or equal to the proportion tested in accordance to ASTM C1012, shall be the same source, and shall have a calcium oxide content no more than 2.0 percent greater than the fly ash or high-reactivity pozzolan tested according to ASTM C1012. ASTM C1012 test results are acceptable for up to two years from the completion date of the test.

**Table 601-2**

| Water-Soluble Sulfate ($SO_4$) in Dry Soil, (%) | Sulfate ($SO_4$) in Water, ppm | Sulfate Exposure Class |
|---|---|---|
| 0.00 to 0.10 | 0 to 150 | Class 0 |
| 0.11 to 0.20 | 151 to 1,500 | Class 1 |
| 0.21 to 2.00 | 1,501 to 10,000 | Class 2 |
| 2.01 or greater | 10,001 or greater | Class 3 |

SEE 1/20/2021 REVISION

Delete subsection 601.05, fourteenth and fifteenth paragraph and replace with the following:

The Contractor shall submit a new Concrete Mix Design Report meeting the above requirements when a change occurs in the source, type, or proportions of cement, slag cement, fly ash, high-reactivity pozzolan, silica fume, or aggregate. Addition, removal, change of source, dosage change or type of fibers to an approved mix design shall require a new mix design. Adjustments to aggregate weights may be made to adjust yield if the combined gradation remains constant (+/-1 percent) or within the optimized band.

In subsection 701.01, delete ASTM C1157 Type GU, MS & HS

# REVISION OF SECTION 601
# STRUCTURAL CONCRETE

Section 601 of the Standard Specifications is hereby revised for this project.

In Subsection 601.05 delete the last five paragraphs and replace them with the following:

The Contractor shall submit a new Concrete Mix Design Report meeting the above requirements when a change occurs in the source, type, or proportions of cement, slag cement, fly ash, high-reactivity pozzolan, silica fume, or aggregate. When a change occurs in the source of approved admixtures, the Contractor shall submit a letter electronically sealed by the Concrete Mix Design Engineer approving the changes to the existing mix design. The Engineer shall approve the change prior to use.

The Engineer may permit the use of approved accelerating, retarding or hydration stabilizing admixtures to existing mix designs when documentation includes the following:

(1) The manufacturer's recommended dosage of the admixture

(2) A letter approving the changes to the existing mix design electronically sealed by the Concrete Mix Design Engineer.

Unless otherwise permitted by the Engineer, the product of only one type of hydraulic cement from one source of any one brand shall be used in a concrete mix design.

When Fiber-Reinforced Concrete is specified in the Contract, polyolefin fibers may be added to an approved mix design except when Macro Fiber-Reinforced Concrete is specified. If Macro Fiber-Reinforced Concrete is specified a new trial mix will be required. When polyolefin fibers are added to an approved concrete mix design, the Contractor shall submit a letter electronically sealed by the Concrete Mix Design Engineer approving the changes. The Engineer will approve the letter prior to use. The electronically sealed letter shall include the following:

(1) The mix design number, both the CDOT mix ID number and the suppliers mix ID number.

(2) The brand and type of polyolefin fibers.

(3) The dosage of polyolefin fibers in pounds per cubic yard.

(4) Adjustment to the fine aggregate batch weight.

Review and approval of the concrete mix design by the Engineer does not constitute acceptance of the concrete. Acceptance will be based solely on the test results of concrete placed on the project.

Delete Subsection 601.10 (c) 8. and replace it with the following:

8. The Contractor shall submit two sets of the fabricator's shop and erection drawings to the Engineer. The drawings shall be designed and electronically sealed by the Contractor's Engineer. The drawings will not be approved or returned to the Contractor. The drawings shall indicate the grade of steel, the physical and section properties of all permanent steel bridge deck form sheets, and attachment details.

Delete Subsection 601.11 (a) and replace it with the following:

(a) *General.* The Contractor shall be responsible for designing and constructing falsework. The Contractor's Engineer shall determine whether falsework is necessary. When the Contractor's Engineer determines falsework is unnecessary, the Contractor shall submit a written statement signed by the Contractor's Engineer so stating. The Contractor’s Engineer shall prepare and electronically seal all falsework drawings including revisions, which shall meet the requirements of subsection 601.11. The Contractor shall stamp the drawings “Approved for Construction” and submit to the Engineer. The Engineer will not approve the drawings.

# REVISION OF SECTION 602
# REINFORCING STEEL

## DESCRIPTION

**602.1** This work consists of furnishing and placing reinforcing steel in accordance with these specifications and in conformity with the plans.

## MATERIALS

**602.2** Reinforcing steel and welded wire fabric that will be furnished either uncoated or coated shall meet the requirements of subsection 709.01.

The coating material for epoxy coated reinforcing shall be a light colored powdered epoxy resin which will highlight rusting of untreated bar areas.

Reinforcing steel that requires welding shall conform to ASTM A706. Welding shall be done in accordance with ANSI/AWS D1.4.

All accessories, including reinforcing steel supports, ties, and splicers used in conjunction with the reinforcing steel, shall be of the same, or compatible coating as the reinforcing utilized.

Reinforcing steel not identified on the plans as epoxy coated may be supplied as epoxy coated, at the Contractor's option, at no additional cost to the Department. Epoxy coated reinforcing steel may not be substituted for Stainless, Continuous Hot dipped Galvanized, Zinc Coated (Galvanized), and Chromium reinforcing alternatives.

Reinforcing alternatives such as: Stainless, Continuous Hot dipped Galvanized, Zinc Coated (Galvanized), and Chromium reinforcing may be supplied for reinforcing steel or epoxy coated reinforcing, at the Contractor's option, at no additional cost or time to the Department as approved by the Engineer.

Length of lap splices for reinforcing steel shall be in accordance with AASHTO *LRFD Bridge Design Specifications*, unless otherwise specified.

## CONSTRUCTION REQUIREMENTS

**602.3 Bar List.** Two copies of a list of all reinforcing steel and bending diagrams shall be furnished to the Engineer at the site of the work at least one week before the placing of reinforcing steel is begun. Such lists will not be reviewed for accuracy. The Contractor shall be responsible for the accuracy of the lists and for furnishing and placing all reinforcing steel in accordance with the details shown on the plans.

Bar lists and bending diagrams which are included on the plans, do not have to be furnished by the Contractor. When bar lists and bending diagrams are included on the plans, they are intended for estimating approximate quantities. The Contractor shall verify the quantity, size and shape of the bar reinforcement against those shown on the plans and make all necessary corrections before ordering.

**602.4 Protection of Materials.** Reinforcing steel and its coating shall be protected at all times from damage. When placed in the work, the reinforcing steel shall be free from dirt, loose mill scale, paint, oil, loose rust, or other foreign substance.

**602.5 Bending.** Unless otherwise permitted, all reinforcing bars shall be bent cold. Bars partially embedded in concrete shall not be field bent except as shown on plans or permitted. Bars shall not be bent or straightened in a manner that will injure the material or the coating. Should the Engineer approve the application of heat for field bending reinforcing bars, precautions shall be taken to assure that the physical properties of the steel will not be materially altered.

Hooks and bends shall conform to the provisions of the AASHTO LRFD Bridge Design Specifications

**REVISION OF SECTION 602**
**REINFORCING STEEL**

Bars which are shown as "hooked" on the plans shall have "standard hooks" unless otherwise indicated. The term "standard hook" as used herein shall mean one of the following:

(1) A 180-degree turn plus an extension of four bar diameters but at least 2½ inches at the free end of the bar, or

(2) A 90-degree turn plus an extension of 12 bar diameters at the free end of the bar, or

(3) For stirrup and tie anchorage only

(i) No. 5 bar and smaller, 90-degree turn plus an extension of six bar diameters at the free end of the bar.

(ii) No. 6, 7, and 8 bar, 90-degree turn plus an extension of 12 bar diameters at the free end of the bar.

(iii) No. 8 bar and smaller, 135-degree turn plus an extension of six bar diameters at the free end of the bar

The inside diameter of bend measured on the inside of the bar, other than for stirrups and ties, shall be as follows:

| **Bar Size** | **Grade 60** |
|---|---|
| No. 3 thru No. 8 | 6 bar dia. |
| No. 9, No. 10, and No. 11 | 8 bar dia. |
| No. 14 and No. 18 | 10 bar dia. |

The inside diameter of bend for stirrups and ties shall not be less than four bar diameters for sizes No. 5 and smaller, and five bar diameters for No. 6 to No. 8 inclusive.

Inside diameter of bend in welded wire fabric, smooth or deformed, shall not be less than four wire diameters for deformed wire larger than D6 and two wire diameters for all other wires. Bends with inside diameter of less than eight wire diameters shall not be less than four wire diameters from the nearest welded intersection.

**602.6 Placing and Fastening.** The minimum spacing center to center of parallel bars shall be 2½ times the diameter of the bar. However, the clear distance between the bars shall not be less than 1½ times the maximum size of the coarse aggregate or 1½ inches, whichever is greater.

Bundle bars shall be tied together at not more than 6 foot centers.

All reinforcement shall have a clear coverage of 2 inches, except as shown on the plans. Clear coverage shall be measured from the surface of the concrete to the outside of the reinforcement.

Reinforcement used in post-tensioned concrete shall be adjusted or relocated during the installation of prestressing ducts or tendons, as required, to provide location and planned clearances to the prestressing tendons, anchorages, jacks and equipment as approved by the Engineer.

All reinforcement shall be tied at all intersections except where spacing is less than 1 foot in each direction, in which case alternate intersections shall be tied.

In concrete bridge decks the upper mat of bars shall be tied to the lower mat of bars at 4 foot maximum spacing in each direction. Slab bolsters for the bottom mat and high chairs for the top mat shall each be placed at a maximum spacing of 4 feet on centers.

Welding on reinforcing bars will not be permitted except as noted on the plans. Reinforcement placed in any

member shall be inspected and approved before any concrete is placed.

The placing, fastening, splicing and supporting of reinforcing steel and wire mesh or bar mat reinforcement shall be in accordance with the plans and the latest edition of "CRSI Recommended Practice for Placing Reinforcing Bars." In case of discrepancy between the plans and the CRSI publication stated above, the plans shall govern. Automated tie wire devices may be used. The total cross-sectional area of the automated tie wire wrap shall roughly equal the total cross-sectional area of a manually installed tie wire wrap. The tie wire shall be epoxy coated or plastic coated for use with epoxy coated reinforcing steel. All epoxy coating on the reinforcing steel that is damaged from the use of automated tie wire devices shall be repaired at the Contractor's expense.

Precast concrete blocking or other approved blocking material shall be used to support footing bars and bars in slabs on grade. All other reinforcing steel shall be supported with steel chairs or precast mortar blocks. All chairs coming in contact with forms shall be CRSI Class 1 or Class 2, Type B.

The location of splices, except where shown on the plans, shall be based upon using 60 foot stock length bars for No. 6 bars and larger and 40 foot stock length bars for No. 4 and No. 5 bars (this does not preclude the use of 60 foot). Minimum splice lengths are as shown on the plans. Where bars of different size are spliced together, the splice length for the smaller bar will govern.

Unless otherwise shown on the plans or approved, splices in adjacent lines of reinforcing bars shall be staggered. The minimum distance between staggered splices for reinforcing bars shall be the length required for a lapped splice in the bar.

Lapped splices will be permitted only at locations where the concrete section is sufficient to provide a minimum clear distance of 2 inches between the splice and the nearest adjacent bar. The clearance to the surface of the concrete shall not be reduced.

Reinforcing bars may be continuous at locations where splices are shown on the plans. Reinforcing bars No. 14 and No. 18 shall not be spliced by lapping, but shall be joined by butt welding in accordance with AWS D1.4 in such a way as to develop at least 125 percent of the specified yield strength of the bar in both tension and compression. Alternate systems of welding or mechanical butt splices may be submitted for approval.

**REVISION OF SECTION 602**
**REINFORCING STEEL**

## METHOD OF MEASUREMENT

**602.7** The weight of reinforcing steel for payment will not be measured but shall be the quantities designated in the Contract; except, measurements will be made for revisions requested by the Engineer, or for an error of plus or minus 2 percent of the total weight shown on the plans for each structure.

Prospective bidders shall verify the weight of reinforcing steel before submitting a proposal. Adjustment will not be made in the weight shown on the plans, other than for approved design changes or for an error as stipulated above, even though the actual weight may deviate from the plan weight.

The computed weight of coated reinforcing bars will be based on the nominal weight before application of the coating. Nominal weights for various bar sizes are shown below.

| Bar Size | Weight per Linear Foot (in Pounds | Bar Size | Weight per Linear Foot in Pounds |
|---|---|---|---|
| ¼ inch | 0.167 | No. 8 | 2.670 |
| No. 3 | 0.376 | No. 9 | 3.400 |
| No. 4 | 0.668 | No. 10 | 4.303 |
| No. 5 | 1.043 | No. 11 | 5.313 |
| No. 6 | 1.502 | No. 14 | 7.650 |
| No. 7 | 2.044 | No. 18 | 13.600 |

## BASIS OF PAYMENT

**602.8** The accepted quantities of reinforcing steel will be paid for at the contract unit price per pound. No allowance will be made for supports, clips, wire or other material used for fastening reinforcement in place.

Payment will be made under:

| Pay Item | Pay Unit |
|---|---|
| Reinforcing Steel Pound | Pound |
| Reinforcing Steel (Epoxy Coated) | Pound |
| Reinforcing Steel (Galvanized) | Pound |
| Reinforcing Steel (Stainless) | Pound |
| Reinforcing Steel (High Performance) | Pound |

# REVISION OF SECTION 618
# PRESTRESSED CONCRETE

Section 618 of the Standard Specifications is hereby revised for this project.

In Subsection 618.04 delete (a) and replace it with the following:

(a) *General.* The Contractor shall furnish shop drawings in conformity with subsection 105.02 for all prestressed components. When the Contractor's Engineer completes or revises design details or engineering drawings, then those engineering drawings and details that are submitted to the Engineer shall contain the electronic seal of a Professional Engineer registered in the State of Colorado. CDOT review of the shop drawings does not relieve the Contractor of the responsibility for the adequacy of the prestressed members. Minor changes to design details or engineering drawings that do not represent a significant change to the original design will not require a Professional Engineer seal. The Contractor shall submit supporting calculations for these changes along with the shop drawings.

In Subsection 618.07 (c) 2. delete the first (1) and replace it with the following:

(1) The shop drawings shall show the alternative anchorage systems, including all associated reinforcing steel required for the system. A Professional Engineer registered in the state of Colorado shall electronically seal the shop drawings.

In Subsection 618.13 (b) delete the second paragraph and replace it with the following:

The Contractor’s Engineer shall electronically seal a letter that the repair work meets all design serviceability criteria and include the evaluation and test data. The finished repair work, including aesthetic acceptability, shall meet the approval of the Engineer.

In Subsection 618.14 (c) delete the fifth paragraph and replace it with the following:

At least one week prior to the Pre-Erection Conference, the Contractor shall submit an Erection Plan to the Engineer. The Engineer will review the and return comments within one week. The Contractor shall address the Engineer's comments in the final plan. The Contractor’s Engineer shall electronically seal and mark the Final Erection Plan "Approved for Construction". If falsework is required, falsework drawings shall conform to and be submitted in accordance with subsection 601.11.

In Subsection 618.14 (c) delete the ninth and tenth paragraphs and replace them with the following:

The Contractor shall submit a final Erection Plan to the Engineer prior to girder erection for acceptance. The Contractor's Engineer shall electronically seal (1), (5) and (7) listed above in the final Erection Plan. The final Erection Plan shall be stamped "Approved for Construction" and signed by the Contractor. The Contractor shall not proceed with the Erection Plan until the Engineer has provided written acceptance of the plan.

When a bridge spans traffic of any kind, including those where vehicles, railroad, watercraft, or pedestrians have access onto, underneath, or adjacent to the bridge, the Contractor's Engineer shall inspect and provide electronically sealed written approval of the stability of the erected girders prior to opening the area beneath the girders to traffic. The Contractor shall perform daily inspections of the erected girders and other permanent and temporary bridge elements until the deck concrete has attained the full design compressive strength. The Contractor's Engineer shall provide an inspection form to the Engineer that lists the items the Contractor will document during the daily inspection of the erected girders. The inspection form shall include inspection items specific to each bridge being constructed. The Contractor shall provide the Engineer and the Contractor's Engineer with written documentation of these inspections within 24 hours of each inspection.

1
NEW SECTION 650
SUBMERSIBLE DUPLEX SUMP SYSTEM AND ACCESSORIES

Section 650 is hereby added to the Standard Specifications for this project as follows:

## DESCRIPTION

**650.01** Provide a duplex sump pump system with lead/lag operation, via adjustable level floats, to pump storm water from collection basin to alternate location. Pumps shall be serviceable from the basin hatch without the need for confined space equipment. The collection basin shall be a separate structural component as specified on the structural plans.

## MATERIALS AND EQUIPMENT

### 650.02 Single Phase Pumps.

(1) Pump motor shall be hermetically sealed, submersible type, operating in a high-quality dielectric oil for cooling the windings and for lubrication of the motor bearings and ceramic-carbon shaft seal. Single phase motor shall have internal automatically resetting, thermal overload protection. Construction shall be of cast iron with 100% baked-on powder coated epoxy finish for corrosion resistance and longer casting durability. All fasteners and external metal parts shall be of stainless steel. Impeller shall be of vortex non-clog design. Pump shall have a permanent split capacitor motor. The impeller shall be "glass reinforced thermoplastic." Motor housing shall be cast iron. Pumps shall be CSA-US Certified or UL Listed. Model and performance requirements shall be as indicated on the equipment schedules.

### 650.03 Alternating System and Control Panel.

(1) An Electrical Alternator Panel with four float switches shall be furnished. Panel shall be UL Listed or CSA Certified and shall include an alternating circuit, separate contact relays, run lights, circuit breakers and H-O-A switches and starter for each pump. Also included shall be a numbered terminal strip and a high-water alarm and consisting a red pilot light, audible alarm, and dry contact for remote alarm devices. Overload protection shall be furnished in the pump motor. Panel shall have a NEMA 4X rating, with hinged lockable hasp. Electrical components shall be sized for the specified pump model. All conduit, cord connections and enclosure openings are to be properly sealed in a manner which prevents any liquids or vapors from entering the enclosure. A properly sized and rated main disconnect switch, separate from the panel, is it be installed in compliance with the adopted NEC Code.

(2) Sequence of Operation for Duplex Panel
   a. Operation can begin after the following:
      i. Correct voltage is supplied to Panel
      ii. Panel is properly grounded
      iii. Pumps are connected correctly to Panel
      iv. Panel Circuit Breakers are closed
      v. Floats are installed properly
      vi. Overload Protection is adjusted to Pump nameplate amps
      vii. Pump HOA Switches are set to "Auto"
      viii. Control On/Off Switch is set to "On"
   b. When the "Stop" and "Lead" floats are closed Pump 1 will energize and the Pump 1 Pump Run Light will illuminate. Pump 1 will remain operational until the "Stop" float opens.

c. The next time the "Stop" and "Lead" floats are closed the Alternating Circuit will energize Pump 2 and the Pump 2 Pump Run Light will illuminate. Pump 2 will remain operational until the "Stop" float opens. This cycle will repeat each time the fluid level rises and falls.
d. If the fluid level continues to rise after the first pump has been energized the "Lag" float will close. When the "Lag" float has closed the second Pump will Energize. Both Pumps will remain operational until the "Stop" float opens.
e. In a four-float system, the alarm float should be the fourth float causing an alarm to sound when the lead pump fails to operate or the rate of inflow into the basin exceeds the capacity of both pumps. When the alarm float is closed the following will occur.
    i. The External High-Water Light will illuminate
    ii. The Audible High-Water Alarm will sound
    iii. The Auxiliary Dry Contacts will close
f. The Audible High-Water Horn can be silenced by pressing the Alarm Silence Button. When the "Alarm" float opens the External High-Water Light, Audible High-Water Horn and Dry Auxiliary Contacts will be reset.

**650.04 Rail System.**

(1) General
    a. The rail system shall be furnished by the same manufacturer supplying the submersible pump so as to ensure compatibility and assurance in matching the proper rail system with the pump being supplied and assure single source responsibility.
    b. The rail system shall consist of the components enabling the contractor to install the assembly in the basin. These components shall consist of the stationary disconnect fitting, guide rail plate, rail guide, and upper rail support. For basin depths greater than 12', additional intermediate stabilizers shall be required. Each system will require two 3/4" schedule 40 stainless steel rail pipes to be furnished by the contractor. The design of the rail system pump connection and discharge shall be 1-1/2" male vertical NPT pump connection / 2" male NPT discharge pipe connection.
(2) Construction
    a. The rail system shall be designed to allow a pump with a threaded vertical discharge connection to easily adapt to an automatic disconnect system. The pump will engage onto the disconnect fitting in a suspended position. Rail system allowing the pump to rest on the basin floor or those that require special proprietary sealing or bracketing shall not be acceptable.
    b. The stationary disconnect fitting shall be epoxy powder coated ductile iron and secured to the floor of basin with (4) 1/2" bolts or rail studs. The disconnect fitting shall have a male NPT ductile iron discharge connection.
    c. The powder coated ductile iron sealing plate with integral rail guide shall have an O-ring to ensure a positive seal. Rail systems having a metal to metal seal with no O-ring or gasket are not acceptable.
    d. The upper rail support bracket shall be constructed of powder coated ductile iron.
    e. Intermediate stabilizer required for rail lengths greater than 12'. The stabilizer shall be constructed of 300 Series stainless steel.

(3) Accessory Equipment
   a. Stainless steel lifting cable shall be furnished in a suitable length.
   b. Basin cover shall be configured in a manner allowing the pump(s) to be removed from the basin via rail system with no interference from the cover.
   c. Piping
   d. Provide (2) 3/4" schedule 40 rail pipes for each rail system, as specified above. These pipes are to be cut to the proper length to interface with the disconnect fitting and upper rail support. The system(s) shall be positioned in such a way as to enable the operator to automatically remove the pump, without entering the basin, as shown in the drawings.
   e. The discharge piping will be as shown in the drawing and include a suitable check and shut-off valve for each pump. All pipe and fittings shall be corrosion resistant. Where piping passes through the wall of the basin, it shall be sealed with a watertight joint or fitting.

## METHOD OF MEASUREMENT

**650.05** Pumping System will not be measured but will be paid for as a single lump sum.

## BASIS OF PAYMENT

**650.06** Payment for Pumping System as shown on the Construction Plan will include all labor, materials, and equipment necessary to complete and maintain the work.

Payment will be made under:

| **Pay Item** | **Pay Unit** |
|---|---|
| Pumping System | Lump Sum |

**REVISION OF SECTION 709**
**REINFORCING STEEL AND WIRE ROPE**

Section 709 of the Standard Specifications is hereby revised for this project as follows:

**709.01 Reinforcing Steel.** Reinforcing steel shall conform to the requirements of the following specifications:

| | |
|---|---|
| Deformed and Plain Billet-Steel Bars for Concrete Reinforcement | ASTM A615 |
| Axle-steel Deformed and Plain Bars for Concrete Reinforcement | ASTM A996 |
| Low-Alloy Steel Deformed Bars for Concrete Reinforcement [to be Welded] | ASTM A706 |
| Fabricated Deformed Steel Bar Mats for Concrete Reinforcement | ASTM A184 |
| Steel Welded Wire Fabric, Plain for Concrete Reinforcement | AASHTO M 55 |
| Steel Welded Wire Fabric, Deformed for Concrete Reinforcement | AASHTO M 221 |
| Epoxy Coated Reinforcing Bars | AASHTO A 775 |
| Zinc-Coated (Galvanized) Steel Bars for Concrete Reinforcement | ASTM A767 |
| Deformed and Plain Stainless Steel Bars for Concrete Reinforcement | ASTM A955 |
| Deformed and Plain, Low-Carbon, Chromium, Steel Bars for Concrete Reinforcement | ASTM A1035 |
| Continuous Hot-Dip Galvanized Steel Bars for Concrete Reinforcement | ASTM A1094 |

Unless otherwise designated, bars conforming to ASTM A615 & ASTM A996 shall be furnished in Grade 60.

In ASTM A 184, bar material conforming to ASTM A616 will not be permitted.

In ASTM A955, bar material shall be furnished in Grade 75 unless otherwise designated.

In ASTM A1035, bar material of Type CL will not be permitted unless designated in the plans or otherwise approved by the Engineer.

**709.02 Wire Rope.** The wire rope shall conform to the requirements of AASHTO M 30 for the specified diameter and strength class.

**709.03 Dowel Bars and Tie Bars.** Tie bars for longitudinal and transverse joints shall conform to AASHTO A 775 and shall be grade 40, epoxy-coated, and deformed. Bar size shall be as designated on Standard Plan M-412-1.

Dowel bars for transverse joints shall conform to AASHTO M 254 for the coating and to ASTM A615, grade 60 for the core material and shall be epoxy-coated, smooth, and lightly greased, precoated with wax or asphalt emulsion, or sprayed with an approved material for their full length. Bar size shall be as designated on the Standard Plan M-412-1.

# Landscape & Irrigation Specifications (by Ciavonne, Roberts, & Associates)

## 1 General

328400.011 Scope of Landscape Irrigation Work

Furnish all labor, equipment, appliances, materials and perform all operations required to complete irrigation system installation and other work as shown on the applicable drawings and as specified herein, guarantee and meet conditions of this Contract.

328400.451 Job Supervision - Irrigation

All work specified herein shall be performed under the direct supervision of a superintendent thoroughly familiar with the work of this Section and who shall be at the Project site for the duration of the work of this Section.

328400.521 Job Conditions - Non-Interruption of existing irrigated areas

Adjacent landscape served by existing mainlines that are slated to be relocated shall have continuous use. Construction of new and relocated mainlines shall be coordinated to not interfere watering schedules. Adjacent landscape irrigation will continue in operation during construction.

328400.531 Qualifications for Electrical Work

Electrical service from service drop as located on drawing to controller shall be installed by a licensed electrician. A permit shall be secured by the Contractor at least 48 hours prior to construction.

328400.541 Job Conditions and Provisions-Irrigation

No irrigation system construction shall take place during freezing or wet weather or when temperatures are less than 40 degrees Fahrenheit, and no trenches shall be backfilled with frozen material. Installation of the system shall not take place until all earthwork has been substantially completed, compacted. Errors, conflicts or omissions from the Drawings or Specifications, or the misdescription of details of work which are manifestly necessary to carry out the intent of the Drawings or Specifications, or which are customarily performed, shall not relieve the Contractor from performing such omitted or misdescribed details or work, but they shall be performed as if fully and clearly set forth and described in the Drawings and Specifications.

328400.551 Substitute Products

Requests for substitution of products named in this section must be approved by the Owner's Representative one week prior to bid opening.

328401.021 Layout of Lines & Levels

Before any installation operations are started, the site shall be completely staked out for the work of this Section by the Contractor. Pipes are not to be installed through tree root ball locations. All mains and valve locations shall be staked out for approval before installation by the Owners Representative.

328401.031 Tolerances

Depths of mains and laterals shall be eighteen (18") bury, and pitch of pipes as specified shall be minimums. Coverage achieved on site shall be guaranteed according to plan; any unwatered areas due to poor placement of or insufficient heads shall be corrected by the Contractor.

## 2 Products

328423.212 Rotating Multi Stream Sprinkler Head

Pop-up heads for lawn areas shall be Rainbird 1804 plastic 4" pop-up heads nozzled with Rainbird Rotating multi stream nozzle, as shown on drawing, or equal, approved prior to bidding.

328424.222 Automatic Control Scrubber Valve

Automatic Control Valves are to be Rainbird PES-B Electric Remote Control Scrubber Irrigation Valves with PRS Dial Series Pressure Regulating of size indicated on drawings, or equal.

328424.362 Isolation Gate Valve

Isolation valves (3") are to be 3" Mueller A-2360 Resilient Wedge Gate Valve, and shall be listed by NSF for use in potable water service.

328424.382 Quick Coupler Valves

Quick coupler valves are to be Rainbird #33-D two piece assembly with 3/4" schedule. 80 PVC nipple of length to bring head 1" above finish grade. Marlex Street Ells are to be used for a swing joint assembly to main line.

328424.662 Manual Drain Valves

Manual Drain Valves shall be 3/4" Mueller curb stop or equal. Valves shall be of bronze construction with threaded connections, cross handle and operating key;

328424.682 Pressure Regulating Module

Pressure regulating valve to be Rainbird PRS-Dial or equal.

328424.702 Valve Boxes

Super Jumbo box (2 valves max), or equal.

328424.722 Manual Drain Valve Boxes

Manual drain valve boxes shall be 10" circular box with lid.

328425.142 Irrigation Pipe - Main Pressure Line, HDPE

Main Pressure Line pipe shall be HDPE pipe, sized as shown on plans. See section 3311-00 -13 for Specifications.

328425.202 Irrigation Pipe - Lateral Lines

Pipe shall be PVC Class 160 with PVC Schedule 40 fittings, solvent weld, as detailed, sized as shown on the plan.

328427.342 Irrigation Head Risers- Swing Pipe

All sprinkler heads with less than 5 gallons per minute flow shall have Rainbird SP-100 Swing Pipe, SB Series Spiral Barb Fittings, as shown in detail. Maximum length of swing pipe to be 10', minimum length to be 2'. No Spiral Barbed "T" fittings are to be used without prior approval from Owners Representative.

328429.452 Pipe Thread Material

All threaded pipe connections shall be made with Weld-on 87685 thread sealant shall be used, or equal.

328429.462 Solvent Weld Primer & Cement
Solvent Weld Primer & Cement shall be only that which is recommended for use on pipe installed.

328446.202 Irrigation Controller- LXD with IQ
Automatic irrigation controller shall be Rainbird ESP-LXD Two Wire Decoder Controller with IQ Communications Cartridge computer type controller.

328449.22 Irrigation 2 wire Field Decoder
Field decoder shall be Rainbird FD-401TURF or FD-601TURF, or equal.

328454.132 P7072 Decoder Cable
Communication cable for irrigation system shall be P7072 Shielded Communication Cable. Connections are to be made with waterproof connectors.

328460.012 Drip Distribution Tubing
to be Salco, or Landscape Products 1/4" tubing (or approved equal) used with necessary couplings, stakes and end plugs to provide the system shown on the drawing

328460.042 Drip Irrigation Pipe laterals - Polyethylene 1/2"
Pipe shall be flexible polyethylene pipe rated at 100 psi and of size indicated on drawings.

328460.512 Drip Emitter - Netafim Woodpecker/Pc Emitter
to be Netafim Woodpecker/PC Emitter, connected directly to 1/2" poly tubing or 1/4" distribution tubing and 1/4" barbed transfer fitting between 1/4" poly tubing and 1/2" poly tubing as shown on drawing. Emitter is to be of flow rate shown on Valve Schedule.

328460.522 In Line Drip Emitter Tubing - Netafim Techline CV
to be Netafim Techline CV, Emitter flow rate and spacing are to be as of shown on drawings.

328460.882 Flush Cap Assembly
Rainbird CF-22 Compression flush cap to be installed at the end of all polyethylene laterals in Ametek 6 or 10" circular box with tan/brown C.V. lid Part #181108. Contractor is to include one 1804 Rainbird pop-up SAM spray head w/ Maxijet "Top hat" spray jet or closed nozzle spray head connected with swing pipe to one 1/2" irrigation lateral.

328460.922 Flush Cap Box - 10"
Flush cap box to be Ametek 10" circular box with brown C.V. lid Part #181108.

## 4 Execution

328410.324 Water Service Connection
The Contractor shall tie into existing service(s) where shown on drawing.

328423.154 Pop-Up Spray Sprinkler Head
Install spray heads as shown in detail. Spray heads shall be set perpendicular with finished grade at locations shown on drawing. After finished grades are established and the ground has settled, Contractor shall lower heads to finished grade.

328424.354 Isolation Gate Valve
Isolation valves are to be installed in mainline at locations shown on drawings. Contractor is to provide extension sleeving from valve box to valve location.

328424.664 Manual Drain Valves

Manual drain valve shall be located at low points on irrigation main. A drain sump of not less than 4.0 cu. ft. of 3/4" washed gravel shall be installed surrounding each drain valve.

328424.724 Manual Drain Valve Boxes

All manual drain valves are to be installed with 6" round valve box and cover and 4" PVC sleeve of length to allow hand access to valve.

328424.734 Valve Boxes

All automatic control valve assemblies are to be installed in valve boxes. Extensions and adjustments shall be made to establish the valve box and cover flush with the final grade level, and provide 4" layer of washed gravel as sump.

328428.414 PVC sleeving

Sleeving shall be installed in locations noted on drawings and at a depth of 24" or as noted on drawings. Where changes in direction are necessary, the sleeve shall be bent to smoothly transition the change of direction. No fittings are to be used for direction changes. Ends are to be taped to prevent filling by backfill. Mark locations with lath and notation indicating "sleeve".

328440.44 Automatic Control Valves

All control valves shall be installed as close as possible to the locations shown on the plan; any variances must be approved by the Owners Representative. Install valves, unions, reducers, pipes, wiring, etc. per detail. Control valves shall be installed in accordance with the manufacturer's recommendations. All valves shall have sufficient clearance from adjacent obstructions to provide accessibility for maintenance, including complete removal without removal of valve box. Valves are not to be located in flow line of swales or drainages.

328446.224 Irrigation Controller-wall mount

Controller(s) shall be wall mounted where shown on the drawing. The Contractor shall provide and install all conduit, bushings, wiring, fused disconnect, etc. from the electric service 'drop' through the controller.

328449.884 Irrigation 2 wire Field Decoder

Field decoder shall be installed in line at valve locations as per manufacturer's directions

328452.024 Wire Connectors

Wire connectors are to be installed as per manufacturers recommendation.

328454.134 P7072 Decoder Cable

Communication cable for irrigation system is to be installed below irrigation mainline with loops at valve locations allowing connections to be made in valve boxes. Splices are to be made in valve boxes only.

328455.104 Irrigation Controller Grounding

All Maxicom components to meet current Rainbird grounding specifications. Grounding resistance shall be tested by a Meggar or Vigra Ground type equipment. Contractor is required to achieve a maximum resistance of 5 ohms.

328455.154 Trench Excavation

Trenches shall be cut to true line and grade. Over-excavation of trenches for piping shall require compacted backfill to bring bottom of trench up to grade. Provide for surface drainage during construction. De-water all excavations immediately.

328455.164 Pipe Trench Backfilling

Trenches for piping shall be carefully backfilled with non-swelling on-site soils exclusive of any organic materials, construction debris or other deleterious materials, free from clods of earth or stones larger than two inches (2") in maximum dimension, by depositing the backfill materials equally on both sides of the pipe in loose 8" layers and thoroughly compacting the backfill to a minimum 90% of the maximum dry density determined in accordance with ASHTO T180, Modified Proctor.

328455.164 Trenching & Backfilling

Comply with earthwork specifications, see Civil spec as required.

328456.044 Piping- general

Manufacturer's specifications covering installation of their material shall be followed. Underground lines up to 2" shall have minimum horizontal clearance of 2" of each other. No sprinkler lines shall be stacked vertically in a common trench. Lines shall have minimum horizontal clearance of 12" from the lines of other trades, and minimum 2" vertical clearance between lines crossing at 45° - 90°. Trenches for irrigation mainline shall be excavated so that the pipe shall drain uniformly toward drain valves deemed necessary to properly drain the system. Minimum grade of piping to drains shall be 3"/100'. When pipe laying is not in progress, or at end of each day, pipe ends shall be closed with tight plug or cap.

328460.044 Drip Irrigation Pipe laterals - 1/2" Polyethylene

Pipe shall be installed in lengths no longer than 200', max 200 gph. Pipe is to be staked a minimum of every 5'. Pipe is to be installed below weed control fabric where fabric occurs, and below mulch where mulch occurs. Pipe is to terminate with flush cap in 6" round valve box.

328460.064 Drip Distribution Tubing-1/4"

Tubing to be installed as shown on detail. Tubing is to be laid beneath mulch, stake at plant and every 2.5'.

328460.524 In Line Drip Emitter Tubing - Netafim Techline CV Tree Rings

Techline CV tubing to be installed in concentric rings as shown in detail and according to manufacturer, connected directly to poly lateral and spaced according to drawings.

328460.624 Drip Emitter - Woodpecker /PC Emitter

Install NetaFim Woodpecker/PC Emitter 1 gph emittters in quantities shown on detail, connected directly to 1/2" poly tubing or 1/4" distribution tubing and 1/4" barbed transfer fitting between 1/4" poly tubing and 1/2" poly tubing as shown on drawing. Emitters & tube is to be staked at root ball of plant. Install beneath fabric and/or mulch where mulches are used. Emitter is to be a flow rate as noted in Valve Schedule.

328460.884 Flush Cap Assembly

Rainbird CF-22 Compression flush cap to be installed at the end of all polyethylene laterals in Ametek 10" circular box with black C.V. lid Part #181108. Contractor is to include one 1806 Rainbird pop-up spray head with nozzle turned to closed adjustment, connected with swing pipe to one 1/2" irrigation lateral per flush cap assembly. Flush Cap Assemblies are to be located adjacent to walks or lawn areas where possible for maintenance access.

328470.054 Irrigation Valve Control Wires

Control wires shall be placed carefully alongside and slightly below the water main where it will receive the greatest possible protection. Control wire not protected by the water main shall be laid in a suitable sized PVC conduit unless otherwise noted on the plans. Control wire shall have an eighteen (18") inch expansion loop at each valve and every 200' of wire. Contractor to avoid mid-line splices, but where necessary will adequately note location on the "as-builts".

## 5 Warranty

328400.815 As-Built Submittals

Contractor shall submit an as-built or record plan upon completion of work showing precise location of control valves, mains, drain valves, etc., and any changes in location of heads, piping, etc. to the Owner and their representative before final application for payment. Provide pdf of drawing(s).

329380.55 Vandalism

Minor vandalism or other damage to the plantings or related work shall be the responsibility of the Contractor until all work receives Final Acceptance. Major vandalism or damage caused by others through no fault of the Contractor or his subcontractors shall be immediately brought to the attention of the Owners Representative who will be the sole judge as to the extent of such damage. Major damage is typically any damage over $500.00 worth of materials and/or labor required to repair the damage. For the Contractor to be awarded additional monies under the provisions of "extra work" stated in the General Conditions, he shall have fully protected his work as specified herein. Any failure, however slight, of the Contractor to have protected his work shall be grounds to nullify any request for additional remuneration.

Technical Specifications for:

G Road Bridge Replacement Project – Phase 1

SECTION 33 11 00.13

HIGH DENSITY POLYETHYLENE (HDPE) PIPE AND FITTINGS

PART 1: GENERAL

1.01 SECTION INCLUDES

Furnishing and installing up to 16-inch high density polyethylene (HDPE) pipe and fittings for water distribution, wastewater collection, force mains, service lines, and transmission mains.

1.02 SUBMITTALS Submit manufacturer's product data, installation instructions, and certification for all materials to be furnished in accordance with Section -Submittals. Submit classification and gradation test results for materials to be used for pipe embedment and backfill.

PART 2: PRODUCTS

2.01 MATERIALS

A. Products supplied under this Section assume that petroleum products or organic solvents will not be encountered. If during the course of pipeline installation the Contractor identifies, or suspects the presence of petroleum products or any unknown chemical substance, notify AW immediately. Stop installing piping in the area of suspected contamination until direction is provided by the AW Project Manager.

B. Pipe and fittings shall be made from the same resin meeting the requirements of the PPI material designation PE 3408 with an ATSM D3350 minimum cell classification of PE 345464C.

C. The material shall have a minimum Hydrostatic Design Basis (HDB) of 200 psi at 73 degrees F.

D. All materials which come in contact with water, including lubricants, shall be evaluated, tested, and certified for conformance with ANSI/NSF Standard 61.

2.02 PIPE

A. All pipe and fittings shall be manufactured in ductile iron pipe sizes (DIPS) only in accordance with AWWA Standard C906.

B. The pipe shall contain no recycled compound except for rework material generated in the manufacturer's own plant that has the same cell classification as the material to which it is being added. The pipe shall be homogeneous throughout and free of visible cracks, holes, voids, foreign inclusions, or other defects that may affect the wall integrity.

C. The nominal pipe diameter is specified on the Drawings. The DR (dimension ratio) and the pressure rating of the pipe shall be as noted on the Drawings.

D. The minimum pressure rating will be 200 psi.

E. HDPE may be deflected subject to approval by AW. The following table shows maximum deflection based upon the allowable strain of the pipe wall. Potential flow restrictions, surge and other non- trench stability and pipe strain issues may reduce the values shown here per the AW Project Manager recommendations. The bend radius multiplier determines the minimum radius of the pipe curvature and is calculated by multiplying the outside diameter of the pipe by the multiplier from the appropriate DR used. Bending radius allowed by the manufacturer can vary. Verify the multiplier with the manufacturer. In no case shall the radius be less than 125% of the manufacturer's permitted multiplier.

| HDPE pipe Dimension Ratio (DR) | Allowable deflection (percent) | Bend Radius Multiplier |
|---|---|---|
| 32.5 | 8.1 | 50 |
| 26.0 | 6.5 | 45 |
| 21.0 | 5.2 | 40 |
| 19.0 | 4.7 | 37.5 |
| 17.0 | 4.2 | 32.5 |
| 15.5 | 3.9 | 30 |
| 13.5 | 3.4 | 27.5 |
| 11.0 | 2.7 | 25 |

2.03 FITTINGS

A. Plain end butt fused fittings shall be used when joining polyethylene materials. Mechanical (compression) fittings shall be used only when joining polyethylene materials to different piping materials and approved by AW.

B. The fittings shall contain no recycled compound except for rework material generated in the manufacturer's own plant that has the same cell classification as the material to which it is being added. The fittings shall be homogeneous throughout and free of visible cracks, holes, voids, foreign inclusions, or other defects that may affect the wall integrity.

C. Butt fusion fittings shall comply with ASTM D3261.

D. Mechanical (compression) fittings used with polyethylene pipe shall be specifically designed for, or tested and found to be acceptable for, use with polyethylene pipe.

PART 3: EXECUTION

3.01 PACKAGING, HANDLING, AND STORAGE

A. The manufacturer shall ensure that the interior of all pipe is clean and install plastic cleanliness plugs in all pipes to keep the pipe interiors clean. The manufacturer shall package the pipe in a manner designed to ensure that it arrives at the project neat, clean, intact, and without physical damage. The transportation carrier shall use appropriate methods and intermittent checks to assure that the pipe is properly supported, stacked, and restrained during transport such that the pipe is not nicked, gouged, or physically damaged.

B. Inspect pipe and appurtenances for defects prior to installation in the trench. Set aside defective, damaged or unsound material and hold material for inspection by AW.

C. Pipe shall be stored on clean, level ground to prevent undue scratching or gouging. If the pipe must be stacked for storage, such stacking shall be done in accordance with the pipe manufacturer's recommendations. The pipe shall be handled in such a manner that it is not pulled over sharp objects or cut by chokers or lifting equipment.

D. Sections of pipe having been discovered with cuts or gouges in excess of 10% of the pipe wall thickness shall be cut out and removed. The undamaged portions of the pipe shall be rejoined by butt fusing or the use of electrofusion fittings.

3.02 PIPE INSTALLATION

A. Refer to Section - Piping - General Provisions and referenced drawings that are part of these Contract Documents. Trenching shall be performed in accordance with Section - Excavation Backfill and Compaction for Utilities and embedment materials shall be in accordance with Section - Utility Backfill Materials.

B. Remove all dirt and foreign matter from pipe before lowering into the trench. Do not place debris, hand tools, clothing or other materials in the pipe. Keep pipe clean during and after laying.

C. Maximum pipe bending radius shall be in conformance with the manufacturer's recommendation for the specific diameter and dimension ratio (DR) of the pipe. Whenever possible, changes in direction shall be accomplished by bending the pipe in lieu of installing a fitting, except as approved by AW Project Manager.

D. Place tracer wire in accordance with Section – Tracer Wire. The wire shall be contiguous except at test stations, and where splicing is required. All splices shall be encased. Wire insulation shall be highly resistant to alkalis, acid and other destructive agents found in soil. See City of Grand Junction Utility Specifications regarding Tracing Wire.

E. Prevent flotation of sealed pipe during work stoppages.

F. HDPE pipe will not be employed with directional drilling through rock and other abrasive conditions unless it is encased.

3.03 PIPE AND FITTING JOINING

A. Butt fusion procedures shall be in accordance with the manufacturer's recommendations. Surfaces must be clean and dry before joining. The fusion equipment operator shall be fully trained in the use of the respective equipment, and certified/qualified in accordance with the requirements of the manufacturer's recommendations. The wall thicknesses of the adjoining pipes shall have the same DR at the point of fusion.

B. Butt fusion equipment shall be equipped with a Data Logger to record and document key parameters of each fusion process including heater temperature, fusion pressure, melt time, hold time, etc. Information from the Data Logger shall be collected and filed daily. A record of each fused joint including a graph of the fusion cycle shall be submitted to AW Project Manager.

C. The temperature of the heating tool surfaces shall be monitored daily with a temperature measuring device, such as, a thermometer or temperature indicating crayons, to assure the temperature measuring device on the equipment is in sound working condition and that the appropriate temperature range is maintained.

D. Each HDPE joint shall be traceable to the fusion operator and equipment.

E. Mechanical (compression) joining of pipe and fittings is only permissible when joining polyethylene pipe to unlike materials. HDPE stiffeners shall be utilized with all mechanical (compression) fittings. Blocking must be provided at changes in direction for any mechanical fittings. Use of positive restrained joints fittings (non-friction type) is permissible when approved by AW Project Manager.

3.04 SERVICE CONNECTIONS

A. Sidewall fused polyethylene hot-tapping tees shall be used for 3 /4-inch and 1-inch service lines off mains 3-inches to 12-inches in diameter. For larger sized mains, polyethylene service saddles may be used, sidewall fused, and then tapped with a tapping tool or machine.

B. For large mains (>12-inch), mechanical clamps or tapping saddles may be used provided they are designed for HDPE pipe and acceptable to the manufacturer of the pipe.

3.05 INCLEMENT WEATHER

A. In inclement weather and especially in windy conditions, the fusion operation shall be shielded to avoid precipitation and excessive heat loss from wind chill.

B. Butt, saddle or socket, fusion is not recommended below -4°F without special provisions such as a portable shelter or trailer or other suitable protective measures with auxiliary heating. When making a butt fusion joint with the ambient temperature below 3°F, the pipe ends shall be preheated using a heating blanket or warm air device to elevate the pipe temperature to improve the heating cycle starting condition.

C. The heating tool shall also be stored in an insulated container to prevent excessive heat loss. Contractor shall remove all frost, snow or ice from the OD and ID of the pipe; all surfaces must be clean and dry prior to fusing.

D. The time required to obtain the proper melt may increase when fusing in cold weather. Contractor shall maintain the specified heating tool surface temperature during the fusion process.

E. The proper cycle time for any particular condition shall be determined by making a melt pattern on a piece of scrap HDPE pipe using the recommended standard heating time. If the melt pattern is incomplete, the Contractor shall increase the heating time by three (3) second intervals until a complete melt pattern is established. Each time the procedure is repeated, a new piece of scrap pipe shall be used.

3.06 VISUAL INSPECTION

A. The Contractor shall perform visual examination of HDPE piping installations to satisfy that they conform to the applicable assembly and erection requirements including: alignment, routing, elevation,

cuts or gouges exceeding 10% of wall thickness, flanged joints, bolting torque, bolt length, gaskets, and supports (if applicable.)

B. All fused joints shall be examined by in-process examination for cleanliness, joint preparation, alignment, plate temperature, melt, joining, holding pressure and time, bead size (uniformly rounded and consistent in size all around the joint), storage of joining materials, and appearance of the finished joint.

3.07 PRESSURE TESTING AND DISINFECTION

A. Pressure testing shall be conducted in accordance with the manufacturer's recommended procedure or as recommended by AW. Pressure testing shall use water as the test media. Pneumatic (air) testing is prohibited. Air must be completely removed before pressure testing. Under no circumstances shall HDPE pipe be pressure tested when the temperature of the pipe is above 80 °F.

END OF SECTION 33 11 00.13

Technical Specifications for:

# G Road Bridge Replacement Project - Phase 1

## 329 Planting

## 1 General

329000.151 Scope of Landscape Work

Include labor, equipment, material, incidentals, for the completion of planting, boulder placement, lawn, edging, and mulch work shown on the Drawings, stated in the Specifications or otherwise required.

329080.501 Stake Out Location of Landscape Work

The Contractor shall completely stake out the location of all trees, shrubs, and lawn area limits on the site for the approval of the Landscape Architect, making modifications as required.

329223.021 Irrigation & Establishment Restrictions - Sod

No sodding operations shall occur later than September 15.

329301.081 Applicable Standards

U.S. Department of Agriculture Rules and Regulations under the Federal Seed Act, American Association of Nurserymen, current edition of "American Standard for Nursery Stock". Published by the American Association of Nurserymen, Inc., Washington D.C. and/or Colorado State Law, whichever is greater.

329301.101 Shipment and Delivery

No plant materials shall be delivered to the site more than 3 days before planting. Plants left unplanted for more than 3 days shall be subject to rejection by the Owners Representative. A suitable method of handling shall be employed to insure the careful, workmanlike delivery of all plants, especially heavy balled trees. The Contractor shall protect the stock in a temporary nursery at the project, protected from sun, drying winds and shaded, kept moist and protected with damp soil, moss or other acceptable material.

329301.151 Notification of Delivery

The Landscape Contractor shall notify the General Contractor and Owners Representative a minimum of 2 days in advance of the delivery of the plant materials. Notification shall include the time and method of delivery.

329301.181 Quality Control Submittals

Certificates of Inspection for Plants: All necessary State, Federal and other inspection certificates shall accompany the invoice for each shipment of plant materials as may be required by law, and showing source of origin. Certificates shall be filed with the Owners Representative prior to his acceptance of the material.

329301.201 Plant Material Labeling

Durable, legible labels stating in weather-resistant ink indicating the correct plant name and size as specified on the plant list shall be securely attached to all plants, bundles or packages of plants of a single species and size, or plant container delivered to the planting site. Plants not properly labeled shall be subject to rejection by the Owners Representative.

329301.211 Plant List

A list of purchased plants to be provided is shown on the Drawings.

329301.221 Plant Material Inspection

The Owners Representative reserves the right to reject at any time or place prior to acceptance, any and all materials which in their opinion fail to meet specifications. Inspection of materials is primarily for quality, size and variety, but other requirements are not waived even though visual inspection results in approval. Plants may be inspected where available, but inspected at the places of supply shall not preclude the right of rejection at the site. Rejected materials shall be promptly removed from the site. No installation shall occur prior to inspection and acceptance of all plant material.

329320.021 Plant Sizes

Requirements for the measurement follow the code for standards currently recommended by the American Association of Nurserymen, Inc. in the American Standard for Nursery Stock

329350.011 Planting Commencement

No planting work shall commence until the adjacent site improvements, drainage improvements, pavements, irrigation installation and finish grading is completed. No heavy trucking or moving of plant materials or equipment shall be permitted on newly completed pavements, sod or seeded areas. Further, the irrigation system shall have been tested in the presence of the Operator's Representative and be in operating order prior to any planting, seeding or sodding, with the exception of drip emitters, which shall be placed following planting.

329350.051 Weather Restrictions

No lawn or planting work shall take place during inclement weather or when the ground conditions are, in the opinion of the Owners Representative, not in a condition to be properly worked.

329350.151 Irrigation & Establishment Restrictions

No seeding or planting operations shall occur prior to April 15 nor later than September 30.

329381.011 Substitute Products

Requests for substitution of products named in this section must be approved by the Owner's Representative one week prior to bid opening.

## 2 Products

329223.012 Sod

Shall be 100% bluegrass or a mixture approved by Landscape Architect. Sod shall have a healthy root system, shall have been regularly watered, mowed, fertilized and weeded; be free from objectionable weed of grasses; have been from 5/8" min. to 1" max. thickness of soil adhering to root system, cut into strips 18" by 24" min. size when installed. It shall not be allowed to dry out, or sod with adhering soil which breaks, crumbles will not be accepted, and will not be accepted if stored for longer than 36 hours from time of cutting.

329223.502 Fertilizer for Sod Areas

A commercial fertilizer providing 6 pounds per 1000 sq. ft. "treble super phosphate" (0-46-0), and 1 pounds per 1000 sq. ft. nitrogen, shall be supplied, in original manufacturer's containers, with label showing composition intact, free-flowing and dry, in quantities necessary to apply over all sod areas.

329333.022 Fertilizer for Shrub Areas

A commercial fertilizer providing 2 pounds per 1000 sq. ft. Phosphate, and 1 pound per 1000 sq. ft. Potash, shall be supplied, in original manufacturer's containers, with label showing composition intact, free-flowing and dry, in quantities necessary to apply over all shrub bed areas.

329334.012 Biosol Soil Amendment

Biosol soil amendment shall be "Biosol Planters Kit" as manufactured by Rocky Mountain Bio Products, 10801 E 54th Avenue, Denver, CO 80239 (888)696-8960, (20 lb Biosol, 50 lb humate, and 1 lb all purpose mycorrhizae),
or equal if approved by Owner's Representative prior to bidding.

329413.022 Concrete Edging

Concrete Edging for use as shrub bed borders shall be 6" x 4" fiber mesh reinforced extruded Mortar. Mortar shall consist of fine and course sands, 6 sacks Portland Cement per cubic yard, fiber mesh reinforcing as per manufacturers recommendations. Mix at least three minutes and not more than five minutes in mechanical batch mixer, with maximum amount of water to produce workable consistency.

329443.022 Fertilizer for Trees

Fertilizer shall be Agriform 20-10-5 tablets or equal.

329443.042 Tree Wrapping Material

Tree wrapping material shall be first quality 4" wide, bituminous impregnated tape, corrugated or crepe paper, brown in color, specifically manufactured for tree wrapping and having qualities to resist insect infestation.

329443.052 Tree Stakes

Standard "T" 6' high steel posts, dark green in color with safety caps or wood fence posts. Stakes for guying pines and spruce shall be 30" long (5' steel "T" posts cut in half)

329443.062 Protective Nylon Loops

1-1/2" wide (min.) for restraining tree in guying operations. Lengths as required.

329443.072 Guy Wire

14 gauge, double strand, pliable galvanized steel wire twisted to remove slack to each stake, and PVC Pipe section as shown in details for visibility. Leave 1" to 2" slack in wire to allow for trunk movement.

## 3 Materials

329113.013 Soil Amendment

50% Ground well-aged cow or chicken manure, or ground sheep manure, 50% finely ground and aged wood chip, with a proven analysis to verify organic content, PH, electro-conductivity, nitrogen, potassium, and phosphorus content. A sample of the material will be supplied to the Owner's Representative with an analysis.

329301.043 Container Grown Plants

Plants designated in various size and type containers in the plant list shall be of a reasonable age and state of development for the size container in which they are specified. They shall have been growing in their containers sufficiently long to develop a good sound root system capable of holding the soil intact after removal from the container, but not so long as to have become root bound.

329301.053 Balled Plants

Plants delivered as "B&B", balled and burlapped shall be adequately balled with firm, natural ball wrapped tightly with burlap. No plant shall be planted if the ball is cracked or broken either before or during the planting process. Any plant which is loose in the ball shall be removed from the site and another plant conforming to the specifications of the plant removed shall be planted in its place at the expense of the Contractor.

329301.103 Shrub Quality

All Plants shall conform to the Colorado Nursery Act. Shrubs shall have a well-developed branch structure with a vigorous root system typical of the size and species and be sound, healthy and vigorous plants free from visual defects, plant diseases and all forms of insect infestation until Final Acceptance. Unless noted, all plants shall be nursery-grown, meaning plants that have been growing in a nursery either lined out or containerized for a minimum of two growing seasons and have been root pruned according to acceptable nursery practice. All shall be freshly dug at the time of delivery, (Plants healed in or placed in cold storage for more than 9 months will not be accepted.) and shall have been grown under similar climatic conditions as that of the project's location prior to planting.

329301.213 Tree Quality

All tree specimens shall conform to The Colorado Nursery Act including grading specifications for deciduous trees; Height measurement, Caliper measurement, Height Relationship to Caliper, and Root Spread. All trees shall have lower branch structures five feet (5'-8") minimum height above root ball . Tree specimens shall have a well-developed branch structure with a vigorous root system typical of the size and species and be sound, healthy and vigorous plants free from visual defects, plant diseases and all forms of insect infestation until Final Acceptance. All trees shall be nursery-grown, meaning plants that have been growing in a nursery either lined out or containerized for a minimum of two growing seasons and have been root pruned according to acceptable nursery practice. Verify location of structural roots on trees. Structural roots to be between 1-2" below top of ball. All shall be freshly dug at the time of delivery, (Plants healed in or placed in cold storage for more than 9 months will not be accepted.) and shall have been grown under similar climatic conditions as that of the project's location prior to planting.

329301.223 Specifics for the Selection of Shade Trees, Part 1

1. Trees greater than one and one-half inches (1-1/2") caliper shall be able to stand erect without a supporting stake.
2. Trees shall have straight trunks with less than a five percent (5%) bow. 3. Branches shall be less than two-thirds (2/3) the trunk diameter.
4. Trees shall be healthy and have had adequate annual growth the previous two (2) growing seasons for that species. (See fact sheets on growth rates).
5. Trees shall be rooted into the root ball so that soil or media remains intact and trunk and root ball move as one when lifted, bur not root bound. The trunk should bend when gently pushed and should not be loose so it pivots at or below the soil line.
6. Trees shall have no roots larger than one-fifth (1/5) the diameter of the trunk protruding from the grow bag or container.

329301.233 Specifics for the Selection of Shade Trees, Part 2

7. Trees shall have one dominant leader for the top of the tree with a viable terminal bud or shoot.
8. Trees shall have no vertical branches except for those cultivars reported to be fastigiated.
9. Trees shall have branches evenly distributed around the trunk and no branches shall be directly above another.
10. The largest branches shall be spaced at least six inches (6") apart except for those cultivars with characteristic multiple tops.
11. The tree canopy shall be mostly symmetrical and free of large voids. Clear trunk should be no more than 40% of tree height unless otherwise specified in the planting specifications.
12. If any of the above conditions are not met, trees may be rejected by the Owner.

329301.243 General Considerations for Plant Quality

Trees and shrubs will be inspected by the Owner prior to panting and rejected if damage or imperfections in development are noted to include: flush cuts or open injuries on the main trunk; trunk cankers; Loose or torn bark in excess of 10% of the circumference of the trunk or branch; Borer holes or boring dust in trunks or main branches; Branch attachments with the included bark; Co-dominate stems - trees only; Trees and Shrubs in violation of Rules and Regulations pertaining to Title 34, Article 26 of the Colorado Nursery Act; Damaged or incomplete graft unions; When in leaf, with more than five percent (5%) chlorotic leaves; When any root is greater than one-tenth (1/10th) the diameter of the trunk, circles more than one-third (1/3) the trunk and is in the top half of the root ball; Plants infested with colonies of other insect pests will be rejected or properly treated at the discretion of the Owner.

329401.013 Rock Mulch - Smaller type for Trail Shoulder

Rock Mulch adjacent to Underpass Trail as shown on drawings shall be 1/2" inch red crushed granite to match nearby crushed red granite surfaces in Canyon View Park. Rock mulch shall be free of trash, sticks or roots, Submit sample to Owner's Representative prior to construction.

329401.043 Granite Rock Mulch -1-1/2"

Rock Mulch shall be 1-1/2 inch granite covering shrub beds. Rock mulch shall be free of trash, sticks or roots. Granite to be buff-tan colored granite. Submit sample to Owner's Representative prior to construction.

329453.33 Vine Trellis

Steel trellis frame, fabric, concrete to be supplied as shown on drawings

329460.083 Granite Boulders

Landscape boulders to be minimum 2 foot x 3.5 foot across x 1.5 feet deep. Boulders shall be buried such that exposed rock surface depicts natural exposure of outcrop formation. Boulders are to be tan/gold granite. Exposed surface of installed landscape boulders shall not show machine caused scarring or breakage. Typical examples of this type of boulder can be seen at "The Rock Shop, 800 S 15th Street, Grand Junction. Contractor to submit sample to Owner's Representative prior to acquisition.

## 4 Execution

329111.044 Landscape area excavation Procedure

Excavate areas to be planted (as per drawings) to a sufficient depth to recieve amended soil and to remove unsatisfactory material (including road base, asphalt, concrete and trash) and remove from site.

329113.154 Soil Preparation

Contractor shall prepare the landscape areas by applying soil amendment at a rate of 6 cu. yds. per 1000 sq. ft. over all landscape areas, discing or rototilling, the soil to a depth of 8". After this has been done, all rocks bigger than 1" shall be picked up and removed from the site.

329113.314 Fine Grading for Landscape areas

Smooth surface, contour to distribute irrigation to root ball. Remove any saucers/dikes in shrub beds at bubblers where there are no plants. Form trench at all landscape edgers or pavements to accommodate mulch at depth specified. See details. All rocks bigger than 1" shall be picked up and removed from the site

329219.814 Irrigation of Lawn Areas

Within 12 hours after planting lawn, the sprinkler system shall be activated to moisten planted areas to a depth of 1". All areas shall be kept moistened by frequent light watering for 3 weeks, or until the Final Acceptance of the Project, and such watering shall be the responsibility of the Contractor until seeded areas are accepted by the Owner.

329223.014 Sod

Perimeter of area to be sodded shall be graded to within 1/2" to 3/4" below adjacent pavements, edger, or foundations. Sod shall be laid on a firm, smoothly graded, and pre-moistened bed with tight joints so that no voids occur under or between strips. Joints shall be staggered perpendicular to the direction of flow (slope) in all drainage areas or steep slopes. Sod shall be watered immediately after each section of sod is laid. Operate sprinkler to soak all sod to a depth of 2", and maintain this moisture level for three (3) weeks. or until the Final Acceptance of the Project. Such watering shall be the responsibility of the Contractor until sodded areas are accepted by the Owner. In the event that sod dries or shrinks, a mixture of screened topsoil and bluegrass seed shall be brushed in the cracks and tamped flush. Excessively shrunk sod (over 3/4" shrinkage) shall be replaced.

329223.504 Fertilizer for Sod Areas

Fertilizer is to be incorporated into the soil to a depth of 6". Once sod has been laid, apply at rate specified in 2.0 Products.

329301.224 Tree Location conflicts with Underground Lines

The Contractor shall be responsible for damage to any underground utility, irrigation line or other improvements. In the event a pipe or line obstructs a plant location, the Contractor will notify the Owners Representative to receive a new plant location.

329310.034 Layout of Planted Areas

The Contractor shall layout and stake the boundary of all areas to be planted and rough grades. All layout and rough grades to be approved by the Landscape Architect prior to commencing any work.

329312.084 Planting Techniques - Part 1

1. Trees, shrubs and perennial flowers shall be in planting areas separate from turf areas.
a. In those instances where the Owner requires trees or shrubs planted in turf areas, the turf will be established prior to installation of trees or shrubs.
b. Trees and shrubs shall be planted a minimum of four inches (4") above the finished grade of the turf or mulched area based on their uppermost structural roots.
c. If the planting hole is inadvertantly dug too deep, soil shall be added and compacted.
d. The width of the planting hole shall be a minimum of at least one and one-half times the diameter of the root ball, two times the diameter of the rootball where possible.
2. Trees and shrubs shall be planted with two (2) or more of the upper-most structural roots no more than two inches (2”) below the surface of the root ball measured three to four inches (3-4”) from the trunk (except as noted below).

329312.094 Planting Techniques - Part 2

Soil shall be removed from the top of the root ball prior to planting to determine the actual depth of the structural roots. a. Hackberry (*Celtis occidentalis*), green ash (*Fraxinus americana*), red maple (*Acer rubrum*), little leaf linden (*Tilia cordata*), crabapples (*Malus spp.*) and poplars (*Populus spp.*) shall be planted with no more than one inch (1”) of soil over the uppermost structural roots. b. Adventitious roots above the structural roots shall be removed. c. The presence of encircling roots shall be checked for and treated as in 9. below. d. The planting hole shall be dug two to four inches (2-4”) shallower than the depth of the root ball (based on the location of the structural roots.) e. Soil shall be graded from the surrounding soil to near the top of the root ball to cover the exposed sides of the root ball. f. There shall be no landscape soil placed on top of the root ball.

329312.104 Planting Techniques - Part 3

3. The top 12 to 18 inches (two or three levels) of wire basket shall be removed from the root ball. The bottom half of baskets more than about 40 inches in diameter can be left intact.
4. All twine and wire at the base of the trunk shall be removed and disposed of offsite.
5. All synthetic and plastic burlap shall be cut as far down the root ball as possible so soil along the side of the root ball is in direct contact with backfill soil. All synthetic and plastic burlap shall be removed from the site.
6. Natural burlap shall be removed from the top of the ball and at least one-half (1/2) way down the side of the root ball. Burlap shall be removed from the site.
7. Fertilizer shall not be added to the back-fill soil.
8. Containers shall be removed from the root ball prior to planting. Containers shall be removed from the site and properly disposed of.

329312.114 Planting Techniques - Part 4

9. Pot bound (root bound) trees and shrubs shall be avoided.
a. There shall be no roots greater than 1/10 diameter of the trunk circling more than one-third the way around the top half of the root ball. There shall be no kinked roots greater than 1/5 the trunk diameter. Roots in violation can be cut and the tree accepted at the option of the Owner. b. If it is necessary to plant a pot bound tree or shrub, encircling roots shall be cut to prevent them from girdling the plant in the future. Three (3) or four (4) slices one inch (1”) or two inches (2”) deep shall be made from the bottom to the top of the root ball.
10. Mulch shall be placed on the root ball to within 6 to 8 inches of the trunk or main stem(s), and no closer.

329312.124 Planting Techniques - Part 5

11. The planting of clump aspen and other trees (i.e. two or more stems in one root ball) shall be avoided.
a. If a clump effect is desired, separate trees shall be planted with their root balls touching.
12. Trees and shrubs shall be moved by their root balls, not their trunks, in such a manner that trunk and branch damage shall be avoided.
13. Trees and shrubs planted on slopes shall be set so the to-most root in the ball on the uphill side is even with the soil. The side of the root ball on the downhill side shall be well above the surrounding soil and a basin formed to retain water. Sufficient soil shall be applied to cover the sides of the root ball.

329312.134 Planting Techniques - Part 6

14. A three inch (3") layer of mulch shall be applied around trees and shrubs to within six to eight (6-8") inches of the trunk or stem (s). A mulched area two feet (2') in diameter for each one inch (1") of tree trunk DBH (with a minimum diameter of eight feet (8') for trees), shall be maintained during the establishment period.
15. If staking is necessary it shall be accomplished using one of the following methods:
a. Two or three wood dowels shall be driven through the edge of the root ball into the underlying soil for three gallon and smaller trees.
b. One horizontal 2X2 shall be screwed or nailed to two 2X2's driven 12 inches into undisturbed soil on each side of the root ball. Two sets shall be needed for each root ball.
c. Two or three (2-3) t-posts driven into a minimum of 12 inches of undisturbed soil.

329312.144 Planting Techniques - Part 7

i. When two (2) posts are specified, these shall be placed on either side of the tree parallel to the prevalent wind direction.
ii. When three (3) posts are specified these shall be placed equidistant (120 degrees) around the tree.
iii. Stakes will be kept clear of branches to prevent rub damage.
iv. Guys shall be flagged with a conspicuous material and replaced as required by the Owner.
16. Feather growth on the lower portion of the trunk shall remain in place for one (1) year after planting.

329312.154 Planting Techniques - Part 8

17. Pruning other than to correct structural problems or remove broken branches shall be avoided.
18. The trunks and large branches and foliage of all pines shall be sprayed with a pyrethrum (organic product), pyrethroid or similar insecticide prior to or within a day of planting by a qualified applicator.
a. A wettable powder formulation shall be used if available.
b. Phytotoxicity resulting from this treatment shall be the responsibility of the applicator.

329333.034 Fertilizer for Shrub Areas

Fertilizer shall be spread at the rates noted in 2.0 Products, this Section. The area shall again be disced or rototilled at right angles to the first tillage, the shrub and seed beds shall be totally free from rock or clay clods over 1" diameter.

329334.014 Biosol Soil Amendment

Biosol Planters Mix shall be incorporated at the following rates

a. 1/2 cup per 1 gal Perennial
b. 1 cup per 5 gal shrub
c. 2 cups per 2" caliper of tree size of each tree.

329343.104 Watering

All trees and shrubs shall be watered-in using a deep-watering device, immediately after planting, staking and guying. All planting shall be watered the same day it is planted.

329401.014 Preparation for Mulch

Perimeter of Shrub Beds shall be graded 2" below top of curbs, walks, edger (see detail), or any other grade level improvements for receiving rock or wood chip mulch. Planted area of shrub bed shall remain at the same grade or higher than adjacent pavements or lawn areas to insure adequate drainage of shrub beds.

329401.014 Installation of Rock Mulch

Place rock in all areas shown to receive mulch on drawings. Spread carefully and evenly to a minimum depth of 3" on areas shown on drawing.

329413.034 Concrete Edging

The Contractor shall lay out and stake the location of all concrete edger defining shrub beds (coordinate with irrigation) to be approved by the Owner's Representative prior to commencing any work. Upon approval, concrete edger shall be installed to match existing top of curb or walk (where adjoining), or 1/2" to 3/4" above finish grade of lawn area. Lines are to be straight, and curbs to be single radius curves with adjoining lines tangent to curve. Curbing installed not in line, grade, or proper curve will be removed and replaced at Contractor expense. Edger to be scored perpendicular to vertical face at intervals not to exceed 4'.

329443.024 Fertilizer for Trees

Use 4 (four) 21 gram tablets per tree, 7 (seven) 10 gram tablets per tree. Distribute fertilizer tablets evenly at 6" depth in tree well around root ball. Complete backfilling procedure

329443.044 Tree Wrapping Material

All deciduous tree trunks shall be wrapped after October 1, with wrapping material overlapping one and one-half (1 1/2") inches wound from ground line to the second branch, and securely taped at five places, including the top, middle and bottom. Wrap is to be removed the following spring.

329443.054 Staking and Guying

Deciduous trees - place two 6' long steel fence posts at 180° driven vertically into firm soil, one on windward side and other opposite, run double strand of wire securely through nylon strap around trunk at minimum 1/3 height of tree and back to post, twist to remove slack. Evergreen trees 6' high and larger - Place three 30" long steel post stakes at 120° around tree, drive into firm soil at angle toward tree, run double strand of wire securely through nylon strap around trunk and guy twist to remove slack.

329453.44 Vine Trellis

Trellis to be assembled as shown on drawings

329460.074 Boulders

Boulders are to be placed with the intent of depicting natural formations and to provide retainage of soil where indicated on drawings. The nature of the selected rock will allow the cut side to be placed down, exposing the natural surface. Backfill following placement, compact.

## 5 Warranty

329223.015 Maintenance Period for Lawn Areas (sod)

The maintenance period shall begin immediately after each area is sodded and continue for thirty days or until final acceptance, whichever is longer. During this time the Contractor shall be responsible for watering, mowing, spraying, weeding, repair of areas damaged by erosion, wind, fire or other causes. Such areas shall be repaired to reestablish the condition and grade of the soil prior to application of the netting or mulch and shall be refertilized and resodded, as directed. After 30 days or until final acceptance of the entire project (whichever is longer), maintenance shall become the responsibility of Owner. The Owner's Representative will direct the Contractor on what sod areas need to be replaced at the final walk-through.

329223.025 Final Acceptance for Lawn Areas

The sodded area shall be accepted on the basis of having uniform live growth over the entire sodded area. Acceptable uniform live growth shall be defined as when scattered dead or brown spots, not greater then one (1) sq. ft., do not exceed five (5%) percent of the sodded area. Gaps created by shrinkage of sod strips shall not be readily visible. Dead or brown spots greater than (1) sq. ft. shall be replaced by the contractor at no cost to the Owner.

329310.015 Protection and Maintenance of Plant Materials

All planting shall be protected and maintained until final acceptance of all work. Maintenance shall include watering, weeding, cultivating, mulching, insect control (through spraying, biological control, or whatever method is recommended by the Tri River Extension Service), tightening and repairs of guys, removal of dead branches, resetting plants to proper grade or upright position, and other necessary operations.

329380.025 Replacement

All replacement planting is to be executed within ten (10) days of notice to replace such plants. Replacement of planting is to be in accordance with the original specifications and its cost considered to be included in the bid price. All areas damaged by tree or shrub planting or replacement operations are to be fully restored to their original condition as specified.

329380.055 Final Inspection and Acceptance

Inspection of the work to determine completion of contract, exclusive of the possible replacement of plants, will be made by the Owners Representative at the conclusion of construction operations. The condition of all planting will be noted and a determination made by the Owners Representative whether maintenance shall continue in any part. Contractor will be notified of acceptance of the work or any deficiencies in the requirements for completion. Plants must be in excellent and vigorous conditions. Excessively pruned trees and shrubs which, in the opinion of the Owners Representative, are no longer excellent representatives of their species shall be replaced prior to Final Acceptance.

# Electrical Specifications
# (by ACM Consulting & Engineering)

SECTION 16010

ELECTRICAL GENERAL PROVISIONS

PART 1 GENERAL

1.1_ GENERAL CONDITIONS

A. The Instructions to Bidders, General Conditions, Special Conditions, Addendas, Alternates, these technical specifications and all drawings, together with the Form of Proposal and Agreement, comprise the Contract Documents for the Electrical Contract. The Electrical Contractor shall examine all of these documents prior to submitting his or her proposal.

B. The Contractor is required to read carefully the specifications for all parts of the work so as to become familiar not only with the work covered by this Section, but also that of other Divisions and Sections, including all drawings.

C. The Contractor shall watch the progress of the work and report to the Owner immediately any cases where ample space has not been provided to accommodate his work. He must not cut through any finished work until he has received permission from the Owner. No claims for extra work will be allowed because of misinterpretation of Plans and Specifications, or due to conflict between trades for useable space.

D. The Contractor is invited to submit alternative methods or materials as a cost reduction factor; however safety and integrity of the systems must be maintained. These alternative methods or materials are not to be implemented unless written permission is provided by the Owner.

E. The General Contractor shall be responsible for all work included in this section and the delegation of work to the Electrical Contractor, shall not relieve him of this responsibility. The Electrical Contractor and his subcontractors who perform work under this section shall be responsible to the General Contractor.

F. Before submitting bid, Contractor shall visit the site and examine all adjoining existing buildings, equipment and site conditions on which his work is in any way dependent for the best workmanship and operation according to the intent of specifications and drawings. He shall report to the Owner any condition which might prevent him from installing his equipment in the manner intended. No consideration or allowance will be granted for failure to visit site, or for any alleged misunderstanding of materials to be furnished, or work to be done.

1.2_ CONTENTS

A. Specified Herein: General requirements for electrical work.

B. Described herein are the following:
1. Scope.
2. Work not included.
3. Quality Assurance, Standards and Symbols.
4. Fees and Inspection Certificates.
5. Materials.
6. Submittals.
7. Substitutions.
8. Temporary Power and Light.
9. Electrical Drawings.
10. Coordination.
11. Equipment Identification and Marking.
12. Sleeves, Inserts, Fastenings, Supports, Cutting and Patching.
13. Scaffolding.
14. Trenching and Backfilling.
15. Testing, Adjusting, Cleaning.
16. As-Built Drawings.
17. Operation and Maintenance Manuals.

1.32_ CLEANING AND REPAIR

A. Clean and repair existing materials and equipment that remain or are to be reused.

B. Clean exposed panelboards surfaces and check tightness of electrical connections. Replace damaged circuit breakers and provide closure plates for vacant positions. Provide typed circuit directory showing revised circuiting arrangement.

C. Remove all materials, scrap and debris relative to the electrical installation and leave the site and all equipment, lamps, fixtures, etc. in a clean and orderly condition. Any costs to the owner for clean-up of the site not provided by the contractor as defined in the drawings or specifications will be charged to the contractor.

1.4_ SCOPE

A. Any apparatus, appliance, material or work not shown on drawings but mentioned in the specifications, or vice versa, or any incidental accessories necessary to make the work complete and perfect in all respects and ready for operation, even if not particularly specified, shall be furnished, delivered and installed by the Contractor without additional expense to the Owner.

B. Minor details not usually shown or specified, but necessary for proper installation and operation, shall be included in the Contractor’s estimate, the same as if herein specified or shown. It is the intention of the Specifications and Drawings to call

for finished work, tested, and ready for operation.

C. With submission of bid, the Electrical Contractor shall give written notice to the Owner of any materials or apparatus believed inadequate or unsuitable, in violation of laws, ordinances, or rules; and any necessary items or work omitted. In the absence of such written notice, it is mutually agreed the Contractor has included the cost of all required items in his proposal, and that he will be responsible for the approved satisfactory functioning of the entire system without extra compensation.

D. Field coordination during construction is imperative. Contractors bidding this work must make reasonable allowances for unforeseen contingencies.

E. The work consists of the following:
1. Installation of pathway lighting.
2. Installation of Milbank panel, breakers, photocell and any associated equipment.
3. A complete conduit and raceway system, including rigid, thin-wall, flexible, sealtite and plastic conduits properly connected to the grounding system.
4. All power and control wiring including starters, switches, contactors, relays, fuses, etc., as shown on the plans or specified herein.
5. Cutting and patching of holes required for the installation in concrete, wood, steel or masonry.
6. Repair of all damage done as a result of the installation and removal of all debris or surplus material left by those engaged in the work.
7. Complete and thorough cleaning of all equipment furnished and installed, both inside and outside, and made ready for painting by others.
8. Testing and adjusting of all equipment.
9. Provisions and installation of all bases, supports, hangers and vibration isolators for the work outlined herein.
10. Cooperation with other crafts in putting the installation in place at any time when space required is ready and the progress of the work so dictates.

F. Utility service requirements outlined above are general in nature. Consult with local utilities for exact requirements.

## 1.5_ WORK NOT INCLUDED

A. The following work is not included in this Division unless specifically called for in individual Sections:
1. Motors and controls, unless indicated otherwise, shall be furnished by others, but shall be installed and connected by the Electrical Contractor as indicated on the drawings.
2. Controls for motors will be furnished, installed, and wired by others, unless otherwise noted on the drawings.

1.6_ QUALITY ASSURANCE, STANDARDS AND SYMBOLS

A. All materials and workmanship shall comply with all applicable codes, specifications, local ordinances, industry standards, utility company and fire insurance carrier's requirements. Contact proper authorities, obtain and pay for required permits, inspections and utility service connections. Do not include any utility company charges that can be billed directly to the Owner.

B. In case of difference between the building codes, specifications, state laws, local ordinances, industry standards, utility company regulations, fire insurance carrier's requirements, and the contract documents, the most stringent shall govern. The Contractor shall promptly notify the Owner in writing of any such difference.

C. Noncompliance: Should the Contractor perform any work that does not comply with the requirements of the applicable building codes, state laws, local ordinances, industry standards, fire insurance carrier's requirements, and utility company regulations, he shall bear the cost arising in correcting any such deficiency.

D. Applicable codes and all standards shall include all state laws, local ordinances, utility company regulations and the applicable requirements of the following nationally accepted codes and standards:

1. Building Codes
    1. National Building Code.
    2. International Building Code.
    3. International Energy Conservation Code.
    4. Local Building Code.
    5. National Electrical Code.
    6. State Electrical Code.
    7. Local Municipal Electrical Code.
2. Industry Standards, Codes, and Specifications
    1. AMCA -Air Moving and Conditioning Association.
    2. ASHRAE - American Society of Heating, Refrigeration, and Air Conditioning Engineers.
    3. ASME - American Society of Mechanical Engineers.
    4. ASTM - American Society for Testing and Materials.
    5. EIA -Electronic Industries Association.
    6. IEEE - Institute of Electrical and Electronic Engineers.
    7. IPCEA - Insulated Power Cable Engineers' Association.
    8. NEC - National Electrical, Code (NFPA No. 70-1996).
    9. NBS - National Bureau of Standards.
    10. NEMA -National Electrical Manufacturers' Association.
    11. NFPA - National Fire Protection Association.
    12. USASI - United States of America Standards Institute.
    13. UL -Underwriters' Laboratories.
3. Insurance Carriers
    1. FIA - Factory Insurance Association.

2. FMED - Factory Mutual Engineering Division.

E. The Drawings are diagrammatic and indicate generally the locations of material and equipment. These Drawings shall be followed as closely as possible. The Electrical Contractor shall coordinate the work under this section with the Ownerural, structural, plumbing, heating and air conditioning, and the drawings of other trades for exact dimensions, clearances and roughing-in locations. This Contractor shall cooperate with all other trades in order to make minor field adjustments to accommodate the work of others. Do not rely on the scale of the drawings for rough-in measurements, nor use them as Shop Drawings.

F. All materials and equipment for which label service is available shall bear the label of the Underwriters' Laboratories Inc.

G. Guarantee: This Contractor shall guarantee his workmanship and material (incandescent lamps, fuses, and any existing equipment are exempt) for a period of one year from the date of final acceptance and leave his work in perfect order at completion. Should defects develop within the guarantee period, this Contractor shall, upon notice of same, remedy the defects and have all damages to other work or furnishings caused by the defects or the work of correcting same repaired and/or replaced at his expense, to the condition before such damage.

1.7_ FEES AND INSPECTION CERTIFICATES

A. The Contractor shall obtain and pay for all permits and inspection services and certificates in conjunction with this work.

B. Upon completion of the work, Contractor shall obtain the approval of all recognized agencies concerned with the work, along with the approval of the National Board of Fire Underwriters, such certificates of inspection and approval from said bureau and/or agencies must be submitted to the Owner.

1.8_ MATERIALS

A. All materials shall be new, the best of their respective kinds, unless otherwise specified, and shall be installed by labor thoroughly skilled in the class of work anticipated by this Contract.

B. Provide products, which are compatible with other products of the electrical work and with other work-requiring interface with the electrical work, including electrical connections and control devices. For exposed electrical work, coordinate colors and finishes with other work.

C. Grounding systems use driven ground rod as grounding electrodes. Grounding system connections use mechanical fasteners.
1. Select materials, sizes, and types of anchors, fasteners, and supports to carry loads of equipment and raceway, including weight of wire and cable

in raceway.

D. All equipment and materials used in relation to control work for the project shall be new and shall bear the manufacturer’s name and trade name. The equipment and material shall be essentially the standard product of a manufacturer regularly engaged in the production of the required type of equipment and shall be the manufacturer's latest approved design.

## 1.9_ SUBMITTALS

A. Furnish the Owner with complete shop drawings and associated data in accordance with General Conditions, for all major elements of the Electrical work for review, checking and approval. None of the following equipment shall be fabricated, delivered, erected or connected other than from drawings officially approved by the Owner.
   1. Enclosed controls commercial pedestal.
   2. Lighting fixtures.
   3. Conduit, wiring, and fittings.
   4. Photocells.
   5. Junction boxes and pull boxes.

B. The Electrical Contractor shall furnish and present three (3) copies of shop drawings or brochures for all fixtures, equipment, and accessories to the Engineer for the Engineer's approval. The Electrical Contractor shall furnish and present three (3) copies of a schedule of manufacturers of all materials for which shop drawings or brochures are not presented. No equipment shall be ordered, purchased, or installed prior to approval of the shop drawings, brochures, and schedules. Checking is only for general conformance with the design concept of the project and general compliance shown is subject to the requirements of the plans and specifications. Contractor is responsible for: dimensions, which shall be confirmed and correlated at the job site; fabrication processes and techniques of construction; coordination of his work with that of all other trades; and the satisfactory performance of his work.

## 1.10_ SUBSTITUTION OF MATERIALS

A. In general, the contract drawings and specifications show and describe arrangements suitable for the specific items of equipment either named or described. In the event that Contractor submits for approval, and receives such approval, for a device or piece of equipment which requires connections or arrangements of these services differing from those indicated or described in the contract documents, Contractor shall give timely notice and shall make suitable alterations in the work to accommodate the substitute equipment, and shall be responsible for any and all additional costs incurred by virtue of the substitution of such equipment for the equipment named or described in the contract documents. The naming of a certain brand or make or manufacturer in the specifications is to establish a quality standard for the article desired. The Contractor is not restricted to the use of the specific brand of the manufacturer named unless so indicated in the specifications. However, where a substitution is requested, a substitution will be permitted only with the written approval of the Owner. Request for such substitutions shall be submitted in triplicate to the Owner at least five working days prior to the Bid Opening date. Such requests shall be accompanied by Manufacturer's Data Sheets and other information that, in the opinion of the Owner, is necessary for review. No substitute material or equipment shall be ordered, fabricated, shipped or processed in any manner prior to the approval of the Owner. The Contractor shall assume all responsibility for

additional expenses as required in any way to meet changes from the original material or equipment specified.

## 1.11_ TEMPORARY POWER AND LIGHTING

A. The Electrical Contractor shall be responsible for all arrangements and costs for providing temporary electrical metering, main switches, and distribution panels at the site as required for construction purposes. The distribution panels shall be located at a central point designated by the Owner. The General Contractor shall indicate prior to installation whether three phase or single-phase service is required.

B. Installation
   1. Install work in neat and orderly manner.
   2. Make structurally and electrically sound throughout.
   3. Maintain to give continuous service and to provide safe working conditions.
   4. Modify and extend service as work progress requires.
   5. Locate so that power is available at any desired point with no more than 100 ft. (30.00 m) extension, and with no more than 5% voltage drop at full load.
   6. Provide circuit breaker protection for each outlet with ground fault interrupting capacity.
   7. Provide equipment grounding continuity for entire system.
   8. Completely remove temporary materials and equipment upon completion of construction. Repair damage caused by installation and restore to specified or original condition.

## 1.12_ ELECTRICAL DRAWINGS

A. The Drawings are diagrammatic and indicate generally the locations of material and equipment. These Drawings shall be followed as closely as possible. The Electrical Contractor shall coordinate the work under this section with the Ownerural, structural, plumbing, heating and air conditioning, and the drawings of other trades for exact dimensions, clearances and roughing-in locations: This Contractor shall cooperate with all other trades in order to make minor field adjustments to accommodate the work of others. Do not rely on the scale of the drawings for rough-in measurements, nor use them as Shop Drawings.

B. The Drawings and Specifications are complementary, each to the other, and the work required by either shall be included in the Contract as if called for by both.

C. If directed by the Owner, the Contractor shall, without extra charge, make reasonable modifications in the layout as needed to prevent conflict with work of other trades or for proper execution of the work.

D. Electrical symbols used on this project are shown in a Symbol List on the accompanying working drawings. This list shows standard symbols and all may

not appear on the project drawings. However, wherever the symbol on project drawings occurs, the item shall be provided and installed.

E. Conductor and conduit sizes are shown on the drawings in an equipment schedule for equipment and in the one line diagram for electrical distribution. Unless otherwise noted all other circuits shall be 2" schedule 80 PVC conduit with 2#4(CU, THWN). In any case, minimum sizes for wire and conduit shall comply with all applicable codes.

F. The drawings are indicative of the work to be installed, but do not show all bends, fittings, boxes and specialties required to complete the installation.

G. All conduits, wires, outlet boxes, devices and fixtures shall be included in the work.

H. The Electrical Contractor shall note that all items of equipment are specified in the singular; however, the Contractor shall provide and install the number of items of equipment as indicated on the drawings and as required for complete systems.

I. Where it is stated that the contractor shall "provide" a device or piece of equipment, it shall mean that such devices or equipments are furnished and installed.

## 1.13_ COORDINATION

A. General: It is recognized that the contract documents are diagrammatic in showing certain physical relationships which must be established within the electrical work, and in its interface with other work including utilities and mechanical work, and that such establishment is the exclusive responsibility of the Contractor. Install the wiring and equipment at such times and in such manner as will in no way retard progress or completion of the project.

B. The layout of wiring on the small scale drawings shall not be considered absolute. The design shall be subject to such revisions as may be necessary to overcome obstructions.

## 1.14_ EQUIPMENT IDENTIFICATION AND MARKING

A. Identification of Equipment
   1. Provide and install laminated black and white lamacoid nameplates for all service switches, distribution switches, distribution switchboards, branch circuit panelboards, safety switches, cabinets, starters, and other equipment with their correct designation. Label equipment in areas accessible to the public on inside of enclosure only. Nameplates shall be firmly secured to front cover or door with two properly sized pop rivets.
   2. Mount a typewritten directory behind plastic on the inside of each branch

circuit panel door, giving the number, description and location of the circuit controlled by each circuit breaker. Revise existing directories to reflect circuit modifications under this contract.

3. All fused safety switches and fused switch units in switchboards shall individually bear a fuse label showing proper size and type of fuse to be used.
4. Install wiring diagrams on the inside cover of all starters, switches and other such equipment. Such diagrams shall not be handwritten.
5. All junction boxes with blank covers shall have circuits contained therein identified by means of permanent black "Magic Marker" on the cover.

B. Lettering shall include name of equipment, the specific unit number and any reference to "On-Off", or other instructions that are applicable.

C. Nameplates shall be laminated phenolic with a black surface and white core. Use 1/16" thick material for plates up to 2" x 4". For larger sizes use 1/8" thick material.

D. Lettering shall be condensed Gothic. The space between lines shall be equal to the width of the letters. Use 1/4" minimum height letters which occupy four to the inch. Increase letter size to 3/4" on larger plates.

E. Provide warning signs where there is hazardous exposure or danger associated with access to, or operation of, electrical facilities. Provide text of sufficient clarity and lettering of sufficient size to convey adequate information at each location; mount permanently in an appropriate and effective location. Comply with recognized industry standards for color and design.

F. Operational Tags: Where needed for proper and adequate information on operation and maintenance of electrical systems, provide tags of plasticized card stock, either pre-printed or hand printed to convey the message; example: "DO NOT OPEN THIS SWITCH WHEN BURNER IS OPERATING".

G. Feeders, mains, branches for power and light, common and section wires for any special signal or control systems, etc., shall be tagged and identified with standard wire markers in all panels and pull boxes. The tagging should convey the circuit number and the equipment it serves (i.e. - “PP1-7,9,11 AC-1". Lighting and receptacle circuits need only identify the circuit number.

H. All exterior underground conduits shall be identified with a 4" plastic ribbon tape for the full length of the underground conduit, installed 6" below the ground and above the conduit. Tape shall be printed to warn and identify electrical conduit buried below.

1.15_ SLEEVES, INSERTS, FASTENINGS, SUPPORTS, CUTTING AND PATCHING

A. The Electrical Contractor shall provide and install metallic supports as required for the proper installation of raceway systems and all other equipment installed under this division of the contract conforming to the latest edition of the NEC.

B. Conduit shall be supported on approved types of wall brackets, strap hangers or pipe supports. All fastenings, supports, clamps and anchors, etc., shall be of type made for the purpose. The use of insulated wire shall not be acceptable as an attaching means for conduit or other equipment.

C. Conduit shall be securely fastened to all sheet metal outlets, junction and pull boxes with two galvanized locknuts and bushing, care being taken to see that the full number of threads project through, to permit the bushing to be drawn tight against the end of the conduit, after which the locknuts shall be made tight sufficiently to draw them into firm electrical contact with the outlet box. Install a plastic bushing on end of conduits stubbed into ceiling spaces to protect cabling.

D. The Electrical Contractor shall be responsible for all concrete pads, supports, piers, bases, foundations, and encasement required for the electrical equipment and conduit. The concrete pads for the electrical equipment shall be six inches larger all around than the base of the equipment unless specifically indicated otherwise.

E. Obtain written approval of the Owner before notching, boring, chipping, burning, drilling, and welding to structural members.

F. Furnish and install all sleeves which are required to protect equipment or which may be necessary to facilitate its installation. Sleeves used in conjunction with formed concrete shall be located where required and approved by the Owner. Provide "Flameseal" or other approved fire stopping material at all penetrations through rated walls, floors and ceilings.

G. Provide and install all inserts required for equipment. Inserts shall be cast iron or cast steel of slotted type to receive a machine bolt head or nut, after installation. Be responsible for the proper spacing of inserts and their alignment and preservation before and during construction.

## 1.16_ TRENCHING AND BACKFILLING

A. Perform all trenching and backfill required by work under this division of the specifications. Trenching and backfilling shall be done in accordance with the "Site Work" division of the specifications and as herein specified. This portion of the work shall be executed under the direct supervision of the General Contractor. Trenches shall be excavated to the depth required for the utilities involved. The trench bottom shall be graded true and free from debris, stones and soft spots. Where direct burial cables are used, four inches of fine sand shall be placed in the bottom of the trench prior to cable placement.

## 1.17_ TESTING, ADJUSTING AND CLEANING

A. As soon as electric power is available and connected to serve the equipment, and

everything is ready for final testing and placing in service, a complete operational test shall be made in the presence of the Owner. The Contractor shall furnish all necessary instruments and equipment, and make all tests, adjustments, and trial operations required to place the system in balanced and satisfactory operating condition, and he shall pay all professional engineering fees required in such testing. Data on all tests shall be submitted to the Owner. Furnish all necessary assistance and instructions to properly instruct the Owner's authorized personnel in the operation and care of the system.

B. The voltage levels between the different phases shall be balanced to within 5% of each other. A recording meter shall be used to measure simultaneously the voltages from phase to phase, and phase to neutral, for a continuous period of not less than 24 hours. The printed results of this test shall be forwarded to the Owner for review. The Electrical Contractor shall be responsible for making any circuiting changes deemed necessary by the Owner in order to maintain the balanced voltage levels under normal operating conditions.

C. Prior to testing the system, the feeders and branch circuits shall be continuous from main feeders to main panels, to subpanels, to outlets, with all breakers and fuses in place. The system shall be tested free from shorts and grounds.

D. No circuits shall be energized without the Owner's approval.

E. The right is reserved to inspect and test any portion of the equipment and/or materials during the progress of its erection. The Contractor shall further test all wiring and connections for continuity and grounds before connecting any fixtures or equipment.

F. The Contractor shall test the entire system in the presence of the Owner or his engineer when the system is finally completed to insure that all portions are free from short circuits or ground faults.

G. The Electrical Contractor shall provide the Owner with certification of the inspection and approval of an active member of the International Association of Electrical Inspectors of all work completed and included in the section, if required. The Contractor shall be responsible for notifying the Inspector when work reaches inspection stage.

H. The Electrical Contractor shall pay for all permits, inspection fees, and installation fees as required to complete the work under this Section of the Contract.

I. This Contractor shall guarantee the materials and workmanship for a period of twelve (12) months from the time the installation is accepted by the Owner. If, during this time, any defects should show up due to any defective materials, workmanship, negligence or want of proper care on the part of this Contractor, he shall furnish any new materials as necessary, repair said defects, and put the system in order at his own expense on receipt of notice of such defects from the Owner. This specification is not intended to imply that the Electrical Contractor

shall be responsible for negligence of the Owner.

J. Upon completion of the work, all component parts, both singularly and as a whole, shall be adjusted and left in satisfactory condition. All parts of the installation, including lighting fixtures, panelboards, etc., shall be cleaned, dusted or washed and adjusted to the satisfaction of the Owner.

1.18_ AS-BUILT DRAWINGS

A. Contractor shall keep an accurate record of all deviations from contract drawings and specifications. He shall neatly and correctly enter in colored ink or pencil any deviations on drawings affected, and shall keep drawings available for inspection.

B. At the completion of the job, and before final acceptance, the Contractor shall provide to the Owner two complete sets of electrical prints marked to show the work "as-built". The Contractor shall show modifications to locations for all major electrical devices, including panelboards and all major runs of conduit, the circuiting of each fixture, outlet, etc., shall be shown. Certify to the accuracy of each print, by signature and date thereon, and deliver same to Owner. Drawings shall be reproducibles.

1.19_ OPERATION AND MAINTENANCE MANUALS

A. Contractor shall prepare, assemble and submit three (3) copies of an Operation and Maintenance Manual for the electrical system as installed.

B. Operation and Maintenance manuals shall be typed and bound in a hard cover, three ring binder or equivalent protection, and shall contain as a minimum the following:
   1. Maintenance instructions for all equipment furnished under this contract.
   2. Table of equipment listing motor starter sizes, overload sizes, and fuse sizes.

C. Table of light fixtures listing manufacture and model number; lamp type, manufacture and model number; ballast type, manufacture and model number.

D. A list of contacts with phone numbers for all systems for Owners' use, in the event the electrical system requires service work within the Warranty period.

E. Copy of Certificate of Acceptance from the Electrical Inspector, and any other applicable authorities.

F. Copy of Warranty Letter from Electrical Contractor and appropriate sub-contractors.

G. Final acceptance by the owner will not occur until all operating and maintenance manuals are received and owner's personnel have been thoroughly indoctrinated in the maintenance and operation of all equipment.

## 1.20_ PROJECT CLOSEOUT

A. Training of owner's operating and maintenance personnel:
   1. Provide a qualified representative of the supplier of each item or system for which training is specified or required, for the purpose of instructing specific personnel, as designated by the owner, in the operation and maintenance of such items or systems.
   2. Provide training when the installation is complete and at times coordinated with the owner a minimum of 14-days in advance. A representative of the contractor shall be present for all training.

B. The electrical system installed under this contract shall be left in proper working order. Replace, at no additional cost to the owner, any work, materials, or equipment which exhibit defects in design, construction or workmanship within one year, or as specifically noted elsewhere in these specifications, from date of final owner acceptance.

END OF SECTION 16010

SECTION 16060

GROUNDING AND BONDING

# 1 GENERAL

## 1.1 SUMMARY

A. Section Includes:
   1. Rod electrodes.
   2. Active electrodes.
   3. Wire.
   4. Grounding well components.
   5. Mechanical connectors.
   6. Exothermic connections.

B. Related Sections:
   1. Section 02590 - Site Grounding: Site related grounding components for buildings and facilities.
   2. Section 03200 - Concrete Reinforcement: Bonding or welding bars when reinforcing steel is used for electrodes.

## 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. National Fire Protection Association:
   1. NFPA 70 - National Electrical Code.

## 1.3 SYSTEM DESCRIPTION

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

C. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.

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 of Colorado and Municipality of Grand Junction 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 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.

1.10 COORDINATION

A. Section 01300 - Administrative Requirements: Requirements for coordination.

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

## 2 PRODUCTS

### 2.1 ROD ELECTRODES

A. Manufacturers:
1. Apache Grounding/Erico Inc.
2. Copperweld, Inc.
3. Erico, Inc.
4. O-Z Gedney Co.
5. Thomas & Betts, Electrical.
6. Substitutions: Permitted.

B. Product Description:
1. Material: Copper-clad steel or Copper.
2. Diameter: 3/4 inch (19 mm).
3. Length: 8 feet ( 2.4 m).

C. Connector: Connector for exothermic welded connection or U-bolt clamp.

### 2.2 WIRE

A. Material: Stranded copper.

B. Foundation Electrodes: 4 AWG.

C. Grounding Electrode Conductor: Copper conductor bare.

D. Bonding Conductor: Copper conductor bare or insulated.

### 2.3 MECHANICAL CONNECTORS

A. Manufacturers:
1. Apache Grounding/Erico Inc.
2. Copperweld, Inc.
3. Erico, Inc.
4. ILSCO Corporation.
5. O-Z Gedney Co.
6. Thomas & Betts, Electrical.
7. Substitutions: Permitted.

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

### 2.4 EXOTHERMIC CONNECTIONS

A. Manufacturers:
   1. Apache Grounding/Erico Inc.
   2. Cadweld, Erico, Inc.
   3. Copperweld, Inc.
   4. ILSCO Corporation.
   5. O-Z Gedney Co.
   6. Thomas & Betts, Electrical.
   7. Substitutions: Section 01600 - Product Requirements.

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

## 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, and surface contaminants at connection points.

### 3.3 INSTALLATION

A. Install in accordance with IEEE 142 and 1100.

B. Install rod electrodes as required to achieve specified resistance to ground.

C. Install grounding and bonding conductors concealed from view.

D. Install 4 AWG bare copper wire in foundation footing.

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

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

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

H. 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.

I. 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 panel boards with installed number 12 conductor to grounding bus.

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

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

3.4 FIELD QUALITY CONTROL

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

B. Perform continuity testing in accordance with IEEE 142.

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

END OF SECTION

SECTION 16400

LOW-VOLTAGE DISTRIBUTION

## PART 1 GENERAL

### 1.1 SUMMARY

1. Section includes enclosed circuit breakers; panelboards and load centers;

### 1.2 SUBMITTALS

1. Product Data: Submit catalog data showing products with specified features.

### 1.3 EXTRA MATERIALS

1. Furnish two of each panelboard key.

## PART 2 PRODUCTS

### 2.1 BRANCH CIRCUIT PANELBOARDS

1. Manufacturers:
    1. Milbank.
    2. Substitutions: Not Permitted.

2. Product Description: NEMA PB1, circuit breaker type, lighting and appliance branch circuit panelboard.

3. Minimum Integrated Short Circuit Rating: 22,000 amperes rms symmetrical.

4. Panelboard Bus: Copper.

5. Molded Case Circuit Breakers: NEMA AB 1, plug-on type thermal magnetic trip circuit breakers, with common trip handle for poles, listed as Type SWD for lighting circuits, Class A ground fault interrupter circuit breakers where scheduled. Do not use tandem circuit breakers.

6. Enclosure: NEMA PB 1, Type to meet conditions.

7. Cabinet Front: Surface cabinet front with concealed trim clamps, concealed hinge, metal directory frame, and flush lock keyed alike. Finish in manufacturer's standard gray enamel.

## PART 3 EXECUTION

### 3.1 EXISTING WORK

1. Disconnect abandoned distribution equipment. Remove abandoned enclosures and boxes.

2. Maintain access to existing distribution equipment remaining active and requiring access. Modify installation or provide access panel.

3. Clean and repair existing distribution equipment to remain or to be reinstalled.

3.2 INSTALLATION

1. Install distribution equipment plumb.

2. Select and install overload heater elements in motor controllers to match installed motor characteristics.

3. Install panel boards in accordance with NEMA PB 1.1.

4. Provide typed or neatly handwritten circuit directory for each branch circuit panel board.

END OF SECTION

SECTION 16520

# EXTERIOR LUMINAIRES

## 1 GENERAL

### 1.1 SUMMARY

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

### 1.2 SUBMITTALS

A. Section 01330 - Submittal Procedures: Submittal procedures.

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. Section 01600 - Product Requirements: Product storage and handling requirements.

### 1.5 COORDINATION

A. Section 01300 - Administrative Requirements: Coordination and project conditions.

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

1 PRODUCTS

1.1 LUMINARIES

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

1.1 METAL POLES

A. Material and Finish: Steel with prime finish for field painting.

B. Section Shape and Dimensions: Round.

C. Height: As scheduled.

D. Base: As shown in site drawings.

1.2 LED LAMPS

A. Manufacturers:
   1. Sternburg Lighting.
   2. Substitutions: Permitted.

2 EXECUTION

2.1 EXAMINATION

A. Verify foundations are ready to receive fixtures.

2.2 INSTALLATION

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

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

C. Install lamps in each luminaire.

D. Bond and ground luminaries, metal accessories and metal poles in accordance with Section 16060.

2.3 FIELD QUALITY CONTROL

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

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

2.4 ADJUSTING

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

2.5 CLEANING

A. Clean photometric control surfaces as recommended by manufacturer.

B. Clean finishes and touch up damage.

2.6 PROTECTION OF FINISHED WORK

A. Re-lamp luminaries having failed lamps at Substantial Completion.

END OF SECTION