# Project Manual

Bid Package 04
Underground Utilities/Steel
Vol. 01

COLLEGE OF
Osteopathic Medicine
AT THE CHEROKEE NATION

Tahlequah, Oklahoma

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**NOTE FOR REVISED SPECIFICATION SECTIONS**

1. DELETED INFORMATION IS INDICATED BY A STRIKETHROUGH (IE, ~~THIS IS DELETED~~).
2. NEW INFORMATION IS INDICATED BY A DOUBLE UNDERLINE (IE, THIS IS ADDED).
3. ALL REVISED INFORMATION IS FURTHER IDENTIFIED BY A HEAVY VERTICAL LINE TO THE RIGHT OF ALL REVISIONS IN EACH INDIVIDUAL SPECIFICATION SECTION (REFER TO HEAVY BOLD LINE TO THE RIGHT FOR AN EXAMPLE).

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**SECTION 05 1000**

**STRUCTURAL STEEL**

## PART 1 - GENERAL

### 1.1 WORK INCLUDED

A. This section includes the fabrication and erection of structural steel.

### 1.2 RELATED WORK SPECIFIED ELSEWHERE

A. Architecturally Exposed Structural Steel Framing – Section 05 1213

B. Steel Joists - Section 05 2100

C. Metal Deck - Section 05 3000

D. Painting and Coating – Section 09 90 00

### 1.3 QUALITY ASSURANCE

A. Qualifications of Fabricator: Fabricator shall have a minimum of 5 years experience in the fabrication of structural steel of structures of similar size. Fabricator shall have AISC or IAS certification or other certification as approved by the building official and the engineer of record. If the fabricator does not have approved certification, special inspection shall be done on the fabrication process and on the fabricated material as required by Section 1704.2, Inspection of Fabricators of the International Building Code. The non-certified fabricator shall engage a special inspector that meets the requirements of IBC section 1704.1 and is acceptable to the building official and the engineer of record. Provide documentation verifying certification or provide special inspector information for approval prior to issuance of a building permit.

B. Qualifications of Erector: Erector shall have a minimum of 5 years experience in the erection of structural steel of structures of similar size.

C. Qualifications of Field Welders: Welders shall be certified in accordance with AWS D1.1 within the last 12 months.

D. Reference Standards:

1. ASTM International (ASTM), latest versions.

| | | |
|---|---|---|
| a. | ASTM A 36/ A36M | Standard Specification for Carbon Structural Steel |
| b. | ASTM A 53/ A 53M | Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-coated Welded and Seamless |
| c. | ASTM A 61/ A6M | Standard Specification for General Requirements for Rolled Structural Steel Bars, Plates, Shapes, and Sheet Piling. |
| d. | ASTM A 307 | Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength |

| | | |
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| e. | ASTM A 325 | Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength |
| f. | ASTM A 490 | Specification for Structural Bolts, Alloy Steel, Heat Treated, 150 ksi Minimum Tensile Strength |
| g. | ASTM A 500/ A500M | Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes |
| h. | ASTM A 992/ A 992M | Standard Specification for Structural Steel Shapes |
| i. | ASTM C 1107/ C1107M | Standard Specification for Packaged Dry, Hydraulic-Cement Grout (non-shrink) |
| j. | ASTM F1554 | Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength. |

2. American Welding Society (AWS), latest edition.

   a. AWS D1.1 Structural Welding Code-Steel

3. American Institute of Steel Construction (AISC), Steel Construction Manual, latest edition.

   a. Specification for Structural Steel Buildings

   b. AISC Code of Standard Practice

   c. Specification for Structural Joints Using ASTM A 325 or A 490 Bolts.

## 1.4 SUBMITTALS

A. Shop Drawings: Submit shop drawings including erection plans, complete details and schedules for fabrication and assembly of structural steel members. Include details of cuts, connections, camber, holes, and other pertinent data. Indicate welds by standard AWS symbols, and show size, length, and type of each weld. Shop drawings shall not be made by reproduction of the Contract Drawings.

B. Provide setting drawings and directions for installation of anchor bolts and other anchorages to be installed by others.

C. Welder Certification: Submit affidavit stating that all welders are certified in accordance with AWS and provide copies of welder's certificates.

## 1.5 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Support structural steel above ground on skids, pallets, platforms, or other supports.

B. Protect steel from damage.

C. Store packaged materials in original unbroken package or container.

D. Do not store materials on structure in a manner that might cause distortion or damage to members or supporting structures.

E. Replace damaged shapes or members.

F. Waste Management and Disposal; As specified in Division 01 Section “Construction Waste Management” and as follows: Collect cut offs and scrap and place in designated area for recycling in accordance with the Waste Management Plan and local recycler standards.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

A. All Wide Flange Shapes shall conform to ASTM A 992, Grade 50 unless noted otherwise.

B. All Angles, Channels, Plates, and Bars: ASTM A 36.

C. Structural Steel Pipe: ASTM A 53, Type E or S, Grade B Fy=35 ksi

D. Rectangular or Square Hollow Structural Section: ASTM A 500, Grade B, Fy = 46 ksi.

E. Round Hollow Structural Sections: ASTM A 500, Grade B, Fy-42 ksi.

F. Anchor Bolts: ASTM F1554, Grade 36

G. High Strength Tension Control Threaded Fasteners: Meet requirements of ASTM A 325 or ASTM A 490.

H. Headed Anchor Shear Studs: By the Nelson Division of TRW.

I. Welding Electrodes: E 70 Series.

J. Shop Primer Paint: Fabricators standard rust inhibitive primer.

K. Non-Metallic, Non-Shrink Grout: Meets the requirements of ASTM C 1107.

L. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, non-staining, mixed with water to consistency suitable for application and a 30-minute working time. Grout shall have a minimum 28 day compressive strength of 6,000 psi.

1. Subject to compliance with requirements, provide products by one of the following or an approved equal:

   a. Five Star Fluid Grout 100; Five Star Products, Inc., Fairfield, Connecticut.

   b. Crystex; L&M Construction Chemicals, Inc. Omaha, Nebraska.

   c. Sure-Grip High Performance Grout; Dayton superior Corp., Miamisburg, Ohio.

   d. Sonnogrout 10K; Sonneborn Building Products, Shakopee, Minnesota.

   e. Sealight Pac-It Grout; W.R. Meadows, Inc., Hampshire, Illinois.

f. Enduro 50; Conspec Marketing & Manufacturing Co., Inc, Kansas City, Kansas.

## 2.2 FABRICATION

A. Fabrication shall be in accordance with the AISC "Code of Standard Practice for Buildings and Bridges".

B. Connections: Weld or bolt shop connections as indicated on the approved shop drawings. Design connections to support reactions and forces where indicated on the drawings.

C. Shop Welds: Shall be visually inspected by the Fabricator's quality control department.

## 2.3 SHOP PAINTING

A. General: Shop paint structural steel, except those members or portions of members to be embedded in concrete, mortar or to receive sprayed on fireproofing. Paint embedded steel, which is partially exposed on exposed portions and initial 2 inch of embedded areas only.

B. Do not paint surfaces, which are to be welded or high-strength bolted with friction-type connections.

C. Surface Preparation: After inspection and before shipping, clean steel work to be painted. Remove loose rust, loose mill scale, and spatter, slag or flux deposits. Clean steel in accordance with Steel Structures Painting Council (SSPC) as follows:

1. SP-1 "Solvent Cleaning"

2. SP-2 "Hand Tool Cleaning"

D. Painting: After surface preparation, apply structural steel primer paint in accordance with manufacturer's instructions. Provide one coat.

# PART 3 - EXECUTION

## 3.1 COORDINATION

A. Field Measurements: Verify all elevations, locations, and dimensions of surfaces to receive structural steel.

B. Anchor Bolts and Other Embedded Items: Verify locations and positions of anchor bolts and other embedded items used to support structural steel.

All Anchor bolts for column base plates, anchors and bearing plates for beams shall be located prior to installation by a Registered Professional surveyor. The Professional Surveyor shall use project control points, such as bench marks, grid lines, or building corners established and accurately maintained by the General Contractor for vertical and horizontal control of location. Templates shall be used to locate groupings of bolts or anchors and shall be confirmed as to orientation and hole geometry accuracy.

Anchor bolts and bearing plates with anchors shall be stabilized against movement, vertical and horizontal, prior to and during concrete casting of concrete supporting these devices.

Upon completion of the concrete casting the Professional Surveyor shall verify vertical and horizontal locations and orientation of anchor bolts or bearing plates with anchors. A report shall be furnished to the Engineer of Record (through the General Contractor and Architect) noting non compliant locations.

The EOR, will furnish remedial actions required to correct the non compliant anchor bolt or bearing plate locations. Allow ten days for the EOR's report on remedial actions necessary.

It shall be the General Contractor's responsibility to have this work performed.

C. Correct any unsatisfactory conditions prior to erection of structural steel.

## 3.2 PREPARATION

A. Clean surfaces to receive structural steel prior to erection.

## 3.3 ERECTION

A. General: Erect structural steel in accordance with AISC "Code of Standard Practice for Steel Buildings and Bridges".

B. Field Assembly: Assemble structural steel accurately to the lines and elevations shown on the drawings. Align and adjust components accurately before fastening.

C. Temporary Bracing: Provide temporary bracing or guys to secure structural steel against wind, seismic, or construction loads. It is the responsibility of the Contractor to maintain stability of the structure during erection.

D. Field Bolted Connections: Install high strength tension control bolts in accordance with AISC Specifications for Structural Joints Using ASTM A325 and A490 Bolts and the manufacturer's instructions. Where clearance within a connection does not permit the use of tension control bolts, standard A325 bolts shall be used and inspected in accordance with the AISC Specification for Structural Joints.

E. Field Welding: Perform all welds in accordance with AWS.

F. Welded Connections: Field welds shall be visually inspected according to AWS D1.1/D1.1M.

a. In addition to visual inspection, field welds will be tested and inspected according to AWS D1.1/D1.1M and the following inspection procedures, at testing agency’s option:
   i. Liquid Penetrant Inspection: ASTM E 165.
   ii. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
   iii. Ultrasonic Inspection: ASTM E 164.
   iv. Radiographic Inspection: ASTM E 94

G. Gas Cutting: Do not use gas-cutting torches in field to cut structural framing.

H. Do not enlarge unfair holes by burning. Ream holes that must be enlarged to admit bolts.

I. Field Touch-up Painting (Primer): Paint all exterior exposed bolts, washers, and nuts after connections have been tightened and checked. Paint all exterior exposed field welds. Paint all exterior exposed abrasions in shop coat. Use same paint as for shop painting.

J. Grout Placement: Comply with the manufacturer's instructions.

K. Tighten anchor bolts after supported members have been positioned and plumbed.

**END OF SECTION**

**SECTION 05 1213**

**ARCHITECTURALLY EXPOSED STRUCTURAL STEEL FRAMING**

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 RELATED WORK SPECIFIED ELSEWHERE

A. Structural Steel – Section 051 10 00

B. Steel Joists - Section 05 21 00

C. Metal Deck - Section 05 30 00

D. Painting and Coating – Section 09 90 00

### 1.3 SUMMARY

B. Section includes architecturally exposed structural-steel (AESS).

1. Division 5 - "Structural Steel Framing" also apply to AESS.

C. Related Requirements:

1. Division 5 - "Structural Steel Framing" for additional requirements applicable to AESS.
2. Division 5 – “Metal Fabrications" for steel lintels and shelf angles not attached to structural-steel frame, miscellaneous steel fabrications, and other metal items not defined as structural steel.
   Division 9 - “Painting” and “High-Performance Coatings”

### 1.4 DEFINITIONS

D. AESS: Structural steel designated as "architecturally exposed structural steel" or "AESS" in the Contract Documents.

### 1.5 COORDINATION

E. Coordinate selection of shop primers with topcoats to be applied per Division 9 - “Painting” and “High-Performance Coatings”. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.

### 1.6 PREINSTALLATION MEETINGS

F. Preinstallation Conference: See Division 5 - "Structural Steel Framing"

## 1.7 ACTION SUBMITTALS

G. Shop Drawings: Show fabrication of AESS components. Shop Drawings for structural steel may be used for AESS provided items of AESS are specifically identified and requirements below are met for AESS.

1. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
2. Include embedment Drawings.
3. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld. Show backing bars that are to be removed and supplemental fillet welds where backing bars are to remain. Indicate grinding, finish, and profile of welds.
4. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pretensioned and slip-critical, high-strength bolted connections. Indicate orientation of bolt heads.
5. Indicate exposed surfaces and edges and surface preparation being used.
6. Indicate special tolerances and erection requirements.

H. Samples: Submit Samples of AESS to set quality standards for exposed welds.

1. Two steel plates, 3/8 by 8 by 4 inches (9.5 by 200 by 100 mm), with long edges joined by a groove weld and with weld ground smooth.
2. Steel plate, 3/8 by 8 by 8 inches (9.5 by 200 by 200 mm), with one end of a short length of rectangular steel tube, 4 by 6 by 3/8 inches (100 by 150 by 9.5 mm), welded to plate with a continuous fillet weld and with weld ground smooth and blended.
3. Round steel tube or pipe, minimum 8 inches (200 mm) in diameter, with end of another round steel tube or pipe, approximately 4 inches (100 mm) in diameter, welded to its side at a 45-degree angle with a continuous fillet weld and with weld ground smooth and blended.

## 1.8 INFORMATIONAL SUBMITTALS

I. Qualification Data:

1. Installer/Erector.
2. Fabricator.
3. Welder.

J. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.

## 1.9 QUALITY ASSURANCE

1. Fabricator Qualifications:
   a. A qualified fabricator that participates in the AISC Quality Certification Program and is designated an AISC-Certified Plant, Category BU: Certified Building Fabricator.
   b. Minimum of 5 years' experience fabricating steel for jobs of similar size and complexity.

2. Installer Qualifications:
   a. Minimum of 5 years' experience erecting structural steel for jobs of similar size and complexity.
3. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

K. -Painting Applicators: Qualified according to AISC's Sophisticated Paint Endorsement P1 or SSPC-QP 3, "Standard Procedure for Evaluating Qualifications of Shop Painting Applicators."

L. Mockups: Build mockups of AESS to set quality standards for fabrication and installation.

1. Build mockup of typical portion of AESS as shown on Drawings.
2. Coordinate painting requirements with Division 9 - "Paintings" and "High-Performance Coatings".
3. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

### 1.10 DELIVERY, STORAGE, AND HANDLING

M. Use special care in handling to prevent twisting, warping, nicking, and other damage. Store materials to permit easy access for inspection and identification. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect steel members and packaged materials from corrosion and deterioration.

1. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.

### 1.11 FIELD CONDITIONS

N. Field Measurements: Where AESS is indicated to fit against other construction, verify actual dimensions by field measurements before fabrication.

## PART 2 - PRODUCTS

### 2.1 BOLTS, CONNECTORS, AND ANCHORS

A. Tension-Control, High-Strength Bolt-Nut-Washer Assemblies: ASTM F 1852, Type 1, round-head assemblies, consisting of steel structural bolts with splined ends, heavy-hex carbon-steel nuts, and hardened carbon-steel washers.

1. Finish: Plain unless noted otherwise.

### 2.2 FILLER

B. Filler: Polyester filler intended for use in repairing dents in automobile bodies.

### 2.3 PRIMER

C. Primer: Comply with Division 9 - “Paints and Coatings”.

D. Galvanizing Repair Paint: ASTM A 780/A 780M.

E. Shop Primer for Galvanized Steel: MPI#26, cementitious galvanized metal primer.

## 2.4 FABRICATION

F. Shop fabricate and assemble AESS to the maximum extent possible. Locate field joints at concealed locations if possible. Detail assemblies to minimize handling and to expedite erection.

G. In addition to special care used to handle and fabricate AESS, comply with the following:

1. Fabricate with exposed surfaces smooth, square, and free of surface blemishes including pitting, rust, scale, and roughness.
2. Grind sheared, punched, and flame-cut edges of AESS to remove burrs and provide smooth surfaces and edges.
3. Fabricate AESS with exposed surfaces free of mill marks, including rolled trade names and stamped or raised identification.
4. Fabricate AESS with exposed surfaces free of seams to maximum extent possible.
5. Remove blemishes by filling or grinding or by welding and grinding, before cleaning, treating, and shop priming.
6. Fabricate with piece marks fully hidden in the completed structure or made with media that permits full removal after erection.
7. Fabricate AESS to the tolerances specified in AISC 303 for steel that is designated AESS.
8. Fabricate AESS to the tolerances specified in AISC 303 for steel that is not designated AESS.
9. Seal-weld open ends of hollow structural sections with 3/8-inch (9.5-mm) closure plates for AESS.

H. Curved Members: Fabricate indicated members to curved shape by rolling to final shape in fabrication shop.

1. Distortion of webs, stems, outstanding flanges, and legs of angles shall not be visible from a distance of 20 feet (6 m) under any lighting conditions.
2. Tolerances for walls of hollow steel sections after rolling shall be approximately 1/2 inch (13 mm).

I. Coping, Blocking, and Joint Gaps: Maintain uniform gaps of 1/8 inch (3.2 mm) with a tolerance of 1/32 inch (0.8 mm) for AESS.

J. Bolt Holes: Cut, drill, or punch standard bolt holes perpendicular to metal surfaces.

K. Holes: Provide holes required for securing other work to structural steel and for other work to pass through steel members.

1. Cut, drill, or punch holes perpendicular to steel surfaces. Do not thermally cut bolt holes or enlarge holes by burning.
2. Baseplate Holes: Cut, drill, mechanically thermal cut, or punch holes perpendicular to steel surfaces.
3. Weld threaded nuts to framing and other specialty items indicated to receive other work.

## 2.5 SHOP CONNECTIONS

L. High-Strength Bolts: Shop install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.

1. Joint Type: Snug tightened unless noted otherwise.

M. Weld Connections: Comply with AWS D1.1/D1.1M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work, and comply with the following:

1. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding specified tolerances.
2. Use weld sizes, fabrication sequence, and equipment for AESS that limit distortions to allowable tolerances.
3. Provide continuous, sealed welds at angle to gusset-plate connections and similar locations where AESS is exposed to weather.
4. Provide continuous welds of uniform size and profile where AESS is welded.
5. Make butt and groove welds flush to adjacent surfaces within tolerance of plus 1/16 inch, minus zero inch (plus 1.5 mm, minus zero mm) for AESS. Do not grind unless required for clearances or for fitting other components, or unless directed to correct unacceptable work.
6. Remove backing bars or runoff tabs; back-gouge and grind steel smooth for AESS.
7. At locations where welding on the far side of an exposed connection of AESS occurs, grind distortions and marking of the steel to a smooth profile aligned with adjacent material.
8. Make fillet welds for AESS oversize and grind to uniform profile with smooth face and transition.
9. Make fillet welds for AESS of uniform size and profile with exposed face smooth and slightly concave. Do not grind unless directed to correct unacceptable work.

## 2.6 GALVANIZING

N. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to structural steel according to ASTM A 123/A 123M.

1. Do not quench or apply post-galvanizing treatments that might interfere with paint adhesion.
2. Fill vent and drain holes that are exposed in the finished Work, unless indicated to remain as weep holes, by plugging with zinc solder and filing off smooth.
3. Galvanize. As shown on drawings.

## 2.7 SHOP PRIMING

O. Shop prime steel surfaces except the following:

1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches (50 mm).
2. Surfaces to be field welded.
3. Surfaces to be high-strength bolted with slip-critical connections.
4. Surfaces to receive sprayed fire-resistive materials.
5. Galvanized surfaces.

P. Surface Preparation: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces according to the following specifications and standards:
   6. SSPC-SP 3, "Power Tool Cleaning."
   7. SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."

Q. Preparing Galvanized Steel for Shop Priming: After galvanizing, thoroughly clean steel of grease, dirt, oil, flux, and other foreign matter, and treat with etching cleaner.

R. Priming: Immediately after surface preparation, apply primer according to manufacturer's written instructions per Division 9 - “Painting” and “High-Performance Coatings”. Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

A. Verify, with steel erector present, elevations of concrete- bearing surfaces and locations of anchor rods, bearing plates, and other embedments for compliance with requirements.

   1. Prepare a certified survey of bearing surfaces, anchor rods, bearing plates, and other embedments showing dimensions, locations, angles, and elevations.

B. Examine AESS for twists, kinks, warping, gouges, and other imperfections before erecting.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

D. Provide temporary shores, guys, braces, and other supports during erection to keep AESS secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place unless otherwise indicated.

   1. If possible, locate welded tabs for attaching temporary bracing and safety cabling where they will be concealed from view in the completed Work.

### 3.3 ERECTION

E. Set AESS accurately in locations and to elevations indicated and according to AISC 303 and AISC 360.

   1. Erect AESS to the tolerances specified in AISC 303 for steel that is designated AESS.
   2. Erect AESS to the tolerances specified in AISC 303 for steel that is not designated AESS.

F. Do not use thermal cutting during erection.

## 3.4 FIELD CONNECTIONS

G. High-Strength Bolts: Install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.

1. Joint Type: Snug tightened unless noted otherwise.
2. Orient bolt heads in same direction for each connection and to maximum extent possible in same direction for similar connections.

H. Weld Connections: Comply with requirements in "Weld Connections" Paragraph in "Shop Connections" Article.

1. Remove backing bars or runoff tabs; back-gouge and grind steel smooth for AESS.
2. Remove erection bolts in AESS, fill holes, and grind smooth.
3. Fill weld access holes in AESS and grind smooth.

## 3.5 FIELD QUALITY CONTROL

I. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to inspect AESS as specified in Division 5 "Structural Steel Framing." The testing agency is not responsible for enforcing requirements relating to aesthetic effect.

J. Architect will observe AESS in place to determine acceptability relating to aesthetic effect.

## 3.6 REPAIRS AND PROTECTION

K. Remove welded tabs that were used for attaching temporary bracing and safety cabling and that are exposed to view in the completed Work. Grind steel smooth.

L. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780/A 780M.

**END OF SECTION**

**SECTION 05 3000**

**METAL DECKING**

## PART 1 - GENERAL

### 1.1 WORK INCLUDED

A. Provide all metal decking complete in place as shown on the drawings, specified herein, and needed for a complete and proper installation.

### 1.2 RELATED WORK SPECIFIED ELSEWHERE

A. Structural Steel - Section 05 1000

B. Steel Joists - Section 05 2100

C. Cold-Formed Metal Framing - Section 05 4000

D. Painting and Coating – Section 09 90 00

### 1.3 QUALITY ASSURANCE

A. Reference Standards:

1. Qualification of Field Welders: Welders shall be certified in accordance with AWS D1.3 within the last 12 months.

2. ASTM International, latest versions.

| | | |
|---|---|---|
| a. | ASTM A 653/ A653M | Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process |
| b. | A 1008/ A 1008M | Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low Alloy, High-Strength Low Alloy with Improved Formability |
| c. | ASTM A 1011/ A 1011M | Standard Specification for Steel, Sheet and Strip, Hot Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low Alloy with Improved Formability, and Ultra- High-Strength |

3. American Welding Society (AWS), latest edition.

| | | |
|---|---|---|
| a. | D1.3 | Structural Welding Code - Sheet Steel |

4. Steel Deck Institute.

| | | |
|---|---|---|
| a. | SDI | Design Manual for Floor Decks, Form Decks and Roof Decks |
| b. | SDI | Diaphragm Design Manual Third Edition |

## 1.4 SUBMITTALS

A. Product Data: Submit manufacturer's specifications and installation instructions for each type of decking and accessories.

B. Shop Drawings: Submit detailed drawings showing layout and types of deck panels, anchorage details, and conditions requiring closure panels, supplementary framing, sump pans, cant strips, cut openings, special jointing or other accessories. Shop Drawings shall not be made by reproduction of the Contract Drawings.

## 1.5 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Support metal deck above ground on skids, pallets, platforms or other supports.

B. Protect metal deck from damage.

C. Store packaged materials in original unbroken package or container.

D. Waste Management and Disposal: As specified in Division 01 Section “Construction Waste Management” and as follows:

1. Collect off cuts and scrap and place in designated area for recycling in accordance with the Waste Management Plan and local recycler standards.

# PART 2 - PRODUCTS

## 2.1 MATERIALS

A. Metal Roof Deck: ASTM A 1008, Grade C. See plans for type, size and finish. Metal deck used in fire rated assemblies shall meet the requirements of UL. The UL mark on the product will be accepted as evidence of compliance.

B. Metal Floor Deck: ASTM A 1011 with galvanized finish. See plans for type and size.

C. Finishes:

1. Painted: Manufacturer's baked-on, rust-inhibitive paint.

2. Galvanized: Conform to ASTM A 653, G60.

# PART 3 - EXECUTION

## 3.1 COORDINATION

A. All edge angle shall be in place with proper attachment prior to installation of metal deck. All roof and floor opening frames shall be installed prior to deck installation.

## 3.2 INSTALLATION

A. General: Install deck units and accessories in accordance with manufacturer's recommendations and final shop drawings, and as specified herein. Locate deck bundles to prevent overloading of structural members.

B. Place deck units on supporting steel framework and adjust to final position with ends accurately aligned and bearing on supporting members before being permanently fastened. Do not stretch or contract side lap interlocks.

C. Place deck units in straight alignment for entire length of run.

D. Place deck units flat and square secured to adjacent framing without warp or excessive deflection.

E. Lap ends of deck units a minimum of 2 inches over supports.

F. Place deck units to permit proper attachment to the perimeter deck angle.

G. Do not use deck units for storage or working platforms until permanently secured.

H. Cut and neatly fit deck units and accessories around other work projecting through or adjacent to the decking, as shown.

I. Fasten deck units to steel supporting members as shown on the structural drawings.

J. Fasten side laps of units as called for on the structural drawings.

K. Care shall be exercised in the selection of electrodes and amperage to provide positive welds and to prevent high amperage blowholes.

L. Comply with AWS D1.3 requirements and procedures.

M. Provide additional metal reinforcement and closure pieces as required for strength, continuity of decking and support of other work shown.

N. Install closure strips at all locations as recommended by the manufacturer to provide a complete installation.

O. Provide cleaning and touch-up painting of field welds, abraded areas and rust spots, as required for all exposed areas after erection and before proceeding with field painting.

**END OF SECTION**

**SECTION 05 4000**

**COLD FORMED METAL FRAMING**

## PART 1 - GENERAL

### 1.1 WORK INCLUDED

A. This section includes all lightgage studs, joists and track, 20 gage or heavier, including bridging, and related accessories as indicated on the Contract Drawings and specified herein.

### 1.2 RELATED WORK SPECIFIED ELSEWHERE

A. Structural Steel - Section 05 1000

B. Steel Joists - Section 05 2 00

C. Painting and Coating – Section 09 90 00

### 1.3 QUALITY ASSURANCE

A. Reference Standards:

1. American Iron and Steel Institute (AISI) North American Specification for the Design of Cold-Formed Steel Structural Members, 2001.

2. American Welding Society of (AWS) D1.3, Structural Welding Code-Sheet Steel.

3. ASTM International, latest versions.

| | | |
|---|---|---|
| a. | ASTM A 653/ A653M | Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process |
| b. | A 1008/ A 1008M | Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low Alloy, High-Strength Low Alloy with Improved Formability |
| c. | ASTM A 1011/ A 1011M | Standard Specification for Steel, Sheet and Strip, Hot Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low Alloy with Improved Formability, and Ultra-High-Strength |

4. Qualifications of Erector: Erector shall have a minimum of 5 years experience in the erection of structural steel of structures of similar size.

5. Qualifications of Field Welders: Welders shall be certified in accordance with AWS D1.1 within the last 12 months.

### 1.4 SUBMITTALS

A. Submit stamped and signed calculations by a professional engineer registered in the state of the project.

B. Submit manufacturer's product information and installation instructions for each item of lightgage framing. Submit shop drawings for all prefabricated lightgage systems.

## 1.5 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Protect metal framing units from rusting and damage. Deliver to project site in manufacturer's unopened containers or bundles, fully identified with name, brand, type, and grade. Store off ground in a dry ventilated space or protect with suitable waterproof coverings.

B. Waste Management and Disposal: As specified in Division 01 Section “Construction Waste Management” and as follows:

1. Collect off cuts and scrap and place in designated area for recycling in accordance with the Waste Management Plan and local recycler standards.

# PART 2 - PRODUCTS

## 2.1 MATERIALS

A. Metal Framing:

1. All 12, 14, and 16 gage steel studs and joists shall be formed from steel that meets the requirements of one of the following standards with a minimum yield strength of 50,000 psi:

a. Painted Material - ASTM A 1011, Grade 50.

b. Galvanized Material - ASTM A 653 Grade 50.

2. All 18 and 20 gage steel studs and joists; all track, bridging and accessories shall be formed from steel that meets the requirements of one of the following with a minimum yield strength of 33,000 psi:

a. Painted Material - ASTM A 1008, Grade C.

b. Galvanized Material - ASTM A 653.

B. Material Finishes: All stud and joist components shall be primed with paint meeting the performance requirements of TT-P-1636C, or shall be formed from steel having a G-60 galvanized coating or better.

## 2.2 FABRICATION

A. Framing components may be prefabricated into panels prior to erection. Prefabricated panels shall be square, with components attached to prevent racking. Handling and lifting of panels shall be done in a manner as to not cause distortion in any member.

B. All framing components shall be cut squarely for attachment to perpendicular members, or as required for an angular fit against abutting members. Members shall be held positively in place until properly fastened.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

A. Install metal framing systems in accordance with manufacturer's printed instructions and recommendations, unless otherwise indicated on Contract Drawings.

B. Install and align tracks accurately to layout at base and tops of studs. Secure tracks as indicated on Contract Drawings. Provide fasteners at corners and ends of tracks.

C. Install supplementary framing, blocking and bracing in metal framing system to support fixtures, equipment, etc. Comply with stud manufacturer's recommendations and industry standards, considering weight and loading of each item.

D. Secure studs to top and bottom tracks at both inside and outside flanges.

E. Frame wall openings larger than 2 foot-0 inches square with double studs at each jamb of frame except where more than 2 are either shown or indicated in manufacturer's instructions. Install tracks and jack studs above and below wall openings. Anchor tracks to jamb studs with stud shoes or by welding, and space jack studs same as full-height studs of wall. Secure stud system wall opening frame in manner indicated.

F. All components of build-up stud sections, including jack studs, full height studs, columns, headers, etc. shall be welded together with utilizing 1/8” fillet welds 1” long at 12” on center along the full height of each flange to flange connection.

G. Install horizontal bridging in stud system, spaced (vertical distance) at no more than 4 foot – 0 inches o.c. Weld at each intersection.

H. Touch-up shop-applied protective coatings damaged during handling and installation. Use compatible primer for prime coated surfaces; use galvanizing repair paint for galvanized surfaces, such as zinc-rich paint.

**END OF SECTION**

**SECTION 05 50 00**

**METAL FABRICATIONS**

## PART 1 - GENERAL

### 1.1 DESCRIPTION OF WORK

A. Definition: Metal fabrications include items made from iron and steel shapes, plates, bars, strips, tubes, pipes and castings which are not a part of metal systems specified elsewhere.

B. Extent of metal fabrication is indicated on the Drawings and schedules.

C. Types of work in this section include metal fabrications for:

1. Rough hardware.

2. Bollards.

3. Steel pipe railings.

4. Safety grip treads.

D. Structural steel is specified in another section within Division 5.

### 1.2 QUALITY ASSURANCE

A. Reference Standards: See Section 01090.

1. American Institute for Steel Construction (AISC)

a. Work shall conform to the AISC Manual of Steel Construction and the Code of Standard Practice for Steel Buildings and Bridges, except as modified by deleting the following sentence: "This approval constitutes the Owner's acceptance of all responsibility for the design adequacy of any connection designed by the fabricator in preparation of the shop drawings".

2. ASTM International, latest versions.

| | | |
|---|---|---|
| a. | ASTM A 27<br>A 27M | Standard Specification for Steel Castings, Carbon, for General Application |
| b. | ASTM A 36/<br>A36M | Standard Specification for Carbon-Structural Steel |
| c. | ASTM A 47/<br>A 47M | Standard Specification for Ferritic Malleable Iron Castings |

| | | |
|---|---|---|
| d. | ASTM A 53/ A 53M | Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-coated Welded and Seamless |
| e. | ASTM A 153/ A 153M | Standard specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware |
| f. | ASTM A 283/ A 283M | Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates |
| g. | ASTM A 307 | Standard Specification for Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength |
| h. | ASTM A 501 | Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing |
| i. | ASTM A 1008/ A 1008M | Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low Alloy, High-Strength Low Alloy with Improved Formability |
| j. | ASTM A 1011/ A 1011M | Standard Specification for Steel, Sheet and Strip, Hot Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low Alloy with Improved Formability, and Ultra-High Strength |
| k. | ASTM E 935 | Standard Test Methods for Performance of Permanent Metal Railing Systems and Rails for Buildings |

B. Take field measurements prior to the preparation of shop drawings and fabrication, where possible, to ensure proper fitting of the work. Allow for trimming and fitting wherever the taking of field measurements before fabrication might delay the work. Coordinate measurements prior to the preparation of shop drawings and fabrication to ensure proper fitting of the work.

C. Shop Assembly: Preassemble items in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.

D. Qualifications for Welding Work: Use welding processes and welding operations which qualify with AWS "Standard Qualification Procedure".

**1.3 SYSTEM PERFORMANCES**

A. Structural Performances: Provide assemblies which, when installed, comply with the following minimum requirements for structural performance, unless otherwise indicated.

B. Provide handrails capable of withstanding the following loads applied as indicated when tested per ASTM E 935.

1. Concentrated loads of 200 lbs. applied at any point in any direction.

2. Uniform load of 50 lbs. per linear ft. applied simultaneously in both vertical and horizontal directions.

3. Concentrated and uniform loads above need not be assumed to act concurrently.

**1.4 SUBMITTALS**

A. See Sections 01 3300 and 01 7823.

1. Catalog Data: Submit manufacturer's catalog data, specifications, and anchor details for products used in miscellaneous metal fabrications, including paint products and grout.

2. Submit shop drawings for fabrication and erection of miscellaneous metal fabrications. Include plans, elevations and details of sections and connections. Show anchorage and accessory items. Furnish templates for anchor bolt installation.

3. Where materials or fabrications are to comply with stated requirements for design loading, include structural computations, material properties and other information used in structural analysis.

B. Waste Management and Disposal: As specified in Division 01 Section “Construction Waste Management” and as follows:

1. Collect off cuts and scrap and place in designated area for recycling in accordance with the Waste Management Plan and local recycler standards.

**1.5 DELIVERY, STORAGE, AND HANDLING**

A. Waste Management: Collect off cuts and scrap and place in designated area for recycling in accordance with the Waste Management Plan and local recycler standards.

**PART 2 – PRODUCTS**

**2.1 MATERIALS**

A. Metals:

1. Metal Surfaces, General: For fabrication of miscellaneous metal work which will be exposed to view, use only materials which are smooth and free of surface blemishes including pitting, seam marks, roller marks, rolled trade names and roughness.

2. Use steel plates, shapes and bars complying with ASTM A 36.

3. Use bent or cold formed steel plates complying with ASTM A 283, Grade C.

4. Use steel bars and bar-size shapes complying with ASTM A 36.

5. Use hot-rolled steel tubing complying with ASTM A 501.

6. Use hot-rolled structural steel sheet complying with ASTM A 1011, Grade 33; or use cold-rolled complying with ASTM A 1008, Class 1; or grade required for design loading.

7. Use steel pipe complying with ASTM A 53, Type and grade (if applicable) as selected by fabricator and as required for design loading; black finish unless galvanizing is indicated; standard weight (schedule 40), unless otherwise indicated.

8. Use cold finished steel bars complying with ASTM A 108, Grade as selected by fabricator.

9. Use cold rolled carbon steel sheets complying with ASTM A 1008.

10. Use cast or formed metal brackets, flanges and anchors of the same type material and finish as supported rails, unless otherwise indicated.

11. Use threaded or wedge type concrete inserts with galvanized ferrous casting, either malleable iron complying with ASTM A 47 or cast steel complying with ASTM A 27. Furnish and install hot-dip galvanized bolts, washers and shims as required to comply with ASTM A 153.

B. Fasteners:

1. General: Furnish and install zinc-coated fasteners for exterior use or where built into exterior walls. Select fasteners for the type, grade and class required.

2. Use regular hexagon head type anchor bolts and nuts, ASTM A 307, Grade A.

3. Use square head type lag bolts, FS FF-B-561.

4. Use cadmium plated steel machine screws, FS FF-S-92.

5. Use flat head carbon steel wood screws, FS FF-S-111.

6. Use round plain carbon steel washers, FS FF-W-92.

7. Use anchors conforming to the following requirements:

   a. Use threaded type concrete inserts with galvanized ferrous castings, internally threaded to receive ¾ inch diameter machine bolts; either malleable iron complying with ASTM A 47, or cast steel complying with ASTM A 27 hot-dip galvanized complying with ASTM A 153.

8. Use helical spring type carbon steel lock washers, FS FF-W-84.

C. Paint:

1. Primer selected must be compatible with finish coats of paint. Coordinate selection of metal primer with finish paint requirements specified in Division 9.

2. Use high zinc dust content paint for regalvanizing welds in galvanized steel, complying with the Military Specifications MIL-P-21035 (Ships) or SSPC-Paint-20.

**2.2 FABRICATION, GENERAL**

A. Workmanship: Use materials of size and thickness indicated, or if not indicated, as required to produce strength and durability in the finished product for use intended. Use type of materials indicated or specified for various components of work.

B. Form exposed work true to line and level with accurate angles and surfaces and straight sharp edges. Ease exposed edges to a radius of approximately 1/32 inch unless otherwise indicated. Form bent-metal corners to the smallest radius possible without causing grain separation or otherwise impairing work.

C. Weld corners and seams continuously, complying with AWS recommendations. At exposed connections, grind exposed welds smooth and flush to match and blend with adjoining surfaces.

D. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners wherever possible. Use exposed fasteners of type indicated or, if not indicated, Phillips flathead (countersunk) screws or bolts.

E. Provide for anchorage of the type shown and required to support the structure either as shown on the Drawings or for temporary or permanent erection. Fabrication and spacing of anchoring devices shall provide adequate support for their intended use.

F. Cut, reinforce, drill and tap miscellaneous metal work as indicated to receive finish hardware and similar items.

G. Use hot-rolled steel bars for work fabricated from bar stock, unless work is indicated to be fabricated from cold finished or cold-rolled stock.

H. Galvanizing: Provide a zinc coating for those items shown or specified to be galvanized, as follows:

1. ASTM A 153 for galvanizing iron and steel hardware.

2. ASTM A 123 for galvanizing rolled, pressed and forged steel shapes, plates, bars and strip 1/8 inch thick and heavier.

I. Fabricate joints which will be exposed to weather in a manner to exclude water or provide weep holes where water may accumulate.

J. Apply shop primer to surfaces of metal fabrication except those which are galvanized or indicated to be embedded in concrete or masonry, unless otherwise indicated, and in compliance with requirements of SSPC-PA1 "Paint Application Specification No. 1" for shop painting.

K. Surface Preparation: Prepare ferrous metal surfaces to comply with minimum requirements indicated below for SSPC surface preparation specifications and environmental exposure conditions of installed metal fabrications.

1. Exteriors (SSPC Zone 1B): SSPC-SP6 "Commercial Blast Cleaning".

2. Interiors (SSPC Zone 1A): SSPC-SP3 "Power Tool Cleaning".

## 2.3 ROUGH HARDWARE

A. Furnish bent or otherwise custom fabricated bolts, plates, anchors, hangers, dowels and other miscellaneous steel and iron shapes as required for framing and supporting woodwork, and for anchoring or securing woodwork to concrete or other structures. Straight bolts and other stock rough hardware items are specified in Division-6 sections.

B. Fabricate items to sizes, shapes and dimensions required. Furnish malleable iron washers for heads and nuts which bear on wood structural connections; elsewhere, furnish steel washers.

## 2.4 LOOSE BEARING AND LEVELING PLATES

A. Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction, made flat, free from warps or twists, and of required thickness and bearing area. Drill plates to receive anchor bolts and for grouting as required. Galvanize after fabrication.

## 2.5 MISCELLANEOUS FRAMING AND SUPPORTS

A. Provide miscellaneous steel framing and supports which are not a part of structural steel framework, as required to complete work.

B. Fabricate miscellaneous units to sizes, shapes and profiles indicated or, if not indicated, of required dimensions to receive adjacent other work to be retained by framing. Except as otherwise indicated, fabricate from structural steel shapes and plates and steel bars of welded construction using mitered joints for field connection. Cut, drill and tap units to receive hardware and similar items.

C. Equip units with integrally welded anchors for casting into concrete or building into masonry. Furnish inserts if units must be installed after concrete is placed.

1. Except as otherwise indicated, space anchors 24 inches o.c. and provide minimum anchor units of 1- ¼ inch X ¼ inch X 8 inch steel straps.

D. Galvanize miscellaneous frames and supports where indicated.

## 2.6 MISCELLANEOUS STEEL TRIM

A. Provide shapes and sections indicated for profiles shown. Unless otherwise indicated fabricate units from structural steel shapes, plates and steel bars, with continuously welded joints and smooth exposed edges. Use concealed field splices wherever possible. Provide cutouts, fittings and anchorages as required for coordination of assembly and installation with other work.

## 2.7 STEEL PIPE HANDRAILS

A. Fabricate steel pipe handrail to meet design requirements for location indicated. Provide handrail members formed of pipe sizes and wall thickness not less than that required to support design loading.

B. Interconnect handrail members by butt-welding or welding with internal connectors, at fabricator's option, unless otherwise indicated.

1. At tee and cross intersections provide coped joints.

2. At bends interconnect pipe by means of prefabricated elbow fittings of flush radius bends, as applicable, of radiuses indicated.

C. Provide wall returns at ends of wall-mounted handrails, except where otherwise indicated.

D. Close exposed ends of pipe by welding 3/16 inch thick steel plate in place or by use of prefabricated fittings.

E. Brackets, Flanges, Fittings and Anchors: Provide wall brackets, end closures, flanges, miscellaneous fittings and anchors for attachment of handrails to other work. Furnish inserts and other anchorage devices for connecting handrails to concrete or masonry work.

### 2.8 SAFETY GRIP TREADS

A. Provide exterior stair treads with Type 101 Alumogrit by Wooster Products, Inc. Provide safety treads 4 inches wide by width of stairs less 8 inches. Provide concealed steel integral anchors at 24 inches on center.

## PART 3 - EXECUTION

### 3.1 PREPARATION

A. Coordinate and furnish anchorages, setting drawings, diagrams, templates, instructions, and directions for installation of anchorages, such as concrete inserts, sleeves, anchor bolts and miscellaneous items having integral anchors, which are to be embedded in concrete or masonry construction. Coordinate delivery of such items to project site.

### 3.2 INSTALLATION

A. General:

1. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing miscellaneous metal fabrications to in-place construction; including, threaded fasteners for concrete and masonry inserts, through-bolts, wood screws and other connectors as required.

2. Cutting, Fitting and Placement: Perform cutting, drilling and fitting required for installation of miscellaneous metal fabrications. Set work accurately in location, alignment and elevation, plumb, true and free of rack, measured from established lines and levels. Provide temporary bracing or anchors in formwork for items which are to be built into concrete or similar construction.

3. Fit exposed connections accurately together to form tight hairline joints. Do not weld, cut or abrade the surfaces of exterior units which have been hot-dip galvanized after fabrication, and are intended for bolted or screwed field connections.

4. Field welding: Comply with AWS Code for procedures of manual shielded metal-arc welding, appearance and quality of welds made, and methods used in correcting welding work.

5. Setting Loose Plates: Clean concrete bearing surfaces of any bond-reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of bearing plates.

6. Set loose leveling and bearing plates on wedges, or other adjustable devices. After the bearing members have been positioned and plumbed, tighten the anchor bolts. Do not remove wedges or shims, but if protruding, cut-off flush with the edge of the bearing plate before packing with grout. Use metallic non-shrink grout in concealed locations where not exposed to moisture; use non-metallic non-shrink grout in exposed locations, unless otherwise indicated.

   a. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

**3.3 ADJUST AND CLEAN**

A. Touch-up Painting: Cleaning and touch-up painting of field welds, bolted connections and abraded areas of the shop paint on miscellaneous metal is specified in a section within Division 9.

B. For galvanized surfaces: Clean field welds, bolted connections and abraded areas and apply galvanizing repair paint to comply with ASTM A 780.

**3.4 SAFETY GRIP TREADS**

A. Install safety grip treads with anchorage system embedded into concrete stairs to comply with the manufacturer's recommendations.

**END OF SECTION**

**SECTION 05 5100**

**METAL STAIRS**

## PART 1 - GENERAL

### 1.1 SUMMARY – DESCRIPTION OF WORK

A. Section Includes: This Section specifies prefabricated metal stairs and railings.

B. Related Requirements:

1. Section 03 3000 - Cast-in-Place Concrete
2. Section 05 1000 - Structural Steel
3. Section 05 5000 – Metal Fabrications
4. Painting and Coating – Section 09 90 00

### 1.2 QUALITY ASSURANCE

A. Reference Standards:

1. ASTM International (ASTM), latest versions.
    a. ASTM A36 Standard Specification for Carbon Structural Steel.
    b. ASTM A53 Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
    c. ASTM A500 Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
    d. ASTM A513 Standard Specification for Electric-Resistance-Welded Carbon and Alloy Steel Mechanical Tubing.
    e. ASTM A786 Standard Specification for Hot-Rolled Carbon, Low-Alloy, High-Strength Low-Alloy, and Alloy Steel Floor Plates.
    f. ASTM A1008 Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable.
    g. ASTM A1011 Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength.
2. American Welding Society (AWS):
    a. AWS D1.1 Structural Welding Code - Steel.
    b. AWS D1.3 Structural Welding Code - Sheet Steel.

3. American National Standards Institute (ANSI):

a. ANSI A117.1 Accessible and Usable Buildings and Facilities Standards.

4. The Society for Protective Coatings (SSPC):

a. SSPC-SP3 Power Tool Cleaning.

## 1.3 ADMINISTRATIVE REQUIREMENTS

A. Coordination: Coordinate work of this Section with work of other trades for proper time and sequence to avoid construction delays. Comply with Section 01 31 00 - Project Management and Coordination, if applicable.

B. Sequencing: Sequence work of this section in accordance with Section [01 12 16 - Work Sequence and manufacturer's written recommendations for sequencing construction operations] if applicable.

C. Scheduling: Schedule work of this Section in accordance with Section 01 3200 – Construction Progress Documentation, if applicable.

## 1.4 ACTION SUBMITTALS

A. General: Submit listed submittals in accordance with Contract Conditions and Section 01 3300 - Submittal Procedures.

B. Product Data: Submit specified products as follows:

1. Manufacturer's product data.

2. Manufacturer's installation instructions.

C. Shop Drawings: Indicate information on shop drawings as follows:

1. Stair plans, elevations, details, methods of installation and anchoring.

a. Show members, sizes and thickness, anchorage locations and accessory items.

b. Furnish setting diagrams for anchorage installation as required.

c. Include calculations stamped by a structural engineer registered in the jurisdiction in which the project is located.

D. Samples: Submit as follows:

1. Two samples, minimum size 6 inches (152 mm) square, representing actual product, finish and patterns for each finished tread product specified.

## 1.5 INFORMATION SUBMITTALS

A. General: Submit listed submittals in accordance with Contract Conditions and Section 01 3300 - Submittal Procedures.

B. Manufacturer's Instructions: Submit manufacturer's storage and installation instructions.

C. Source Quality Control: Submit documentation verifying that components and materials specified in this Section are from single manufacturer.

D. Qualification Statements:

1. Submit certificate verification that manufacturer is American Institute of Steel Construction (AISC) Certified for Standard Steel Building Structures.

2. Submit letter of verification for Installer's Qualifications.

## 1.6 QUALITY ASSURANCE

A. Qualifications:

1. Manufacturer:

a. American Institute of Steel Construction (AISC) Certified firm having 10 years experience manufacturing components similar to or exceeding requirements specified in scope of project.

b. Having sufficient capacity to produce and deliver required materials without causing delay in work.

2. Installer: Acceptable to manufacturer.

## 1.7 DELIVERY, STORAGE & HANDLING

A. Delivery and Acceptance Requirements:

1. Deliver material in accordance with Section 01 6000 - Product Requirements and in accordance with manufacturer's written instructions.

2. Deliver materials in manufacturer's original packaging with identification labels intact and in sizes to suit project.

B. Storage and Handling Requirements:

1. Store materials protected from exposure to harmful weather conditions and at temperatures recommended by manufacturer.

C. Packaging Waste Management:

1. Separate waste materials for reuse and recycling in accordance with Section 01 7419 - Construction Waste Management and Disposal.

2. Remove packaging materials from site and dispose of at appropriate recycling facilities.

3. Collect and separate for disposal paper, plastic, polystyrene, corrugated cardboard, packaging material in appropriate onsite bins for recycling.

4. Fold metal and plastic banding; flatten and place in designated area for recycling.

5. Remove:

a. Pallets from site and return to supplier or manufacturer.

## PART 2 - PRODUCTS

### 2.1 METAL STAIRS

1. Single Source Responsibility: Provide components and materials specified in this section from a single American Institute of Steel Construction (AISC) Certified manufacturer.

2. Substitution Limitations:

    a. Substitutions: In accordance with Section 01 2500 - Substitution Procedures.

B. Description:

1. Sustainability Characteristics:

    a. In accordance with general project requirements.

2. Compatibility:

    a. Ensure components and materials are compatible with specified accessories and adjacent materials.

C. Design Criteria:

1. Structural Performance of Stairs: Stairs shall withstand the following structural loads without exceeding the allowable design working stress of materials, including anchors and connections. Apply each load to produce the maximum stress in each component:

    a. Treads and Platforms of Metal Stairs: Capable of withstanding a uniform load of 100 psf (4.8 kN/$m^2$) and concentrated load of 300 lbf (1.33 kN) applied on an area of 4 square inches (2581 square mm). Concentrated and uniform loads need not be assumed to act concurrently.

    b. Stair Framing: Capable of withstanding stresses resulting from loads specified, in addition to stresses resulting from railing system loads.

    c. Limit Deflection of Treads, Platforms and Framing Members: To L/240.

2. Structural Performance of Handrails and Railings: Handrails and railings shall withstand the following structural loads without exceeding the allowable design working stress of materials, including handrails, railings, anchors and connections.

    a. Top Rail of Guardrail: Capable of withstanding a concentrated load of 200 lbf (0.89 kN) applied in any direction and a uniform load of 50 psf (2.39 kN/$m^2$) applied in any direction. Concentrated and uniform loads need not be assumed to act concurrently.

D. Standard Stair and Rail System:

1. Manufacturer's standard prefabricated, pre-engineered straight run stair and landing system, consisting of hot rolled steel sheet stringers, risers, treads, landings, fasteners/supports and railings.

    a. Stringers:

1) Steel plate or channel with side mounted prefabricated railings.

2) Minimum thickness or gage as determined by structural design calculations, structural grade steel plate or channel.

2. Risers: Closed riser, minimum 14 gage (1.9 mm) hot rolled mild steel sheet, sloped maximum 1 1/2 inches (38.1 mm) and conforming to Americans with Disabilities Act (ADA) nosing requirements.

3. Treads: Manufacturer's standard concrete pan system, field poured. Tread pans to be minimum of 14 gage (1.9 mm), or as determined by design calculations. Pan depth 1 1/2 inches (38.1 mm). Exposed welds from the bottom side of flight assemblies will not be allowed. All welds to be from topside of tread pans as recommended by manufacturer.

4. Mid Landings: Minimum of 12 gage (2.7 mm) hot-rolled mild steel sheets, formed for a minimum 2 1/2 inches (64 mm) concrete fill, with 11 gage channel supports and bracing welded to perimeter frame at 12 inches (305 mm) on center.

5. Fasteners and Supports: Sized by the manufacturer to meet structural design criteria. If hanger rod connections are applicable to any of the landing connections, they shall be a minimum of 5/8 inch (15.9 mm) diameter steel rod, with actual size based on stair load.

6. Manufacturer's standard welded steel tube railing system complying with the following requirements:

a. Rails: 1 1/2 inches (38.1 mm) diameter x 13 gage (2.3 mm) minimum round steel tube, continuous multi-strand type, equally spaced with not more than 3 15/16 inches (100 mm) clearance between strands and with a minimum extension per code at top and bottom risers. Wrap rail continuously past space between flights to form guardrail as required by building code. Terminate rail ends with radiused returns, newel posts or safety terminations approved by local code. Provide not less than 1 1/2 inches (38.1 mm) clearing between rail and wall.

b. Rail Posts: 1 1/2 inches (38.1 mm) square x 11 gage (3 mm) tubing. Rail posts to fasten to side of plate stringers per manufacturer's shop drawings. Manufacturer to pre-weld erection aid to rail post for proper height to aid stair erector. Erection aid (setting block) to be removed and weld-ground smooth after installation.

c. Fabrication:

1) Use preformed or prefabricated bends.

2) Butt weld tee and cross intersections in tubing. Cope and weld intersections in pipe. Miter elbows.

3) Mechanically fasten internal sleeves and fittings.

4) Provide minimum 12 gage (2.7 mm) welded steel plate closures or hemispherical closure fittings on all exposed rail ends.

E. Custom Stair and Rail System:

1. Support System: Provide landing support with manufacturer's standard system. Comply with details indicated on Drawings.

    a. Hanger rod landing supports.

    b. Tube strut landing supports.

    c. Shelf angle landing supports.

    d. Knockdown (KD) landing supports.

2. Rail System: Provide rail system. Comply with details indicated on Drawings.

    a. Standard 34 inch (864 mm) height handrail system with 42 inch (1067 mm) guardrails at landings and openings.

        1) Rail Type: Full mesh panel rail, Picket style rail, 5-Line sweep rail, or Perforated panel rail, unless noted otherwise by architectural drawings.

    b. Standard 36 inch (914 mm) height handrail system with 42 inch (1067 mm) guardrails at landings and openings.

        1) Rail Type: Full mesh panel rail, Picket style rail, 6-Line sweep rail, or Perforated panel rail, unless noted otherwise by architectural drawings.

    c. Standard 42 inch (1067 mm) height guard rail system with 34 inch (864 mm) ADA Grab and with 42 inch (1067 mm) guardrails at landings and openings.

        1) Rail Type: Full mesh panel guard rail with hand rail, Picket style guard rail with handrail, 7-Line sweep guard rail with handrail, or Perforated panel guard rail with handrail, unless noted otherwise by architectural drawings.

3. Wall Handrails: Match stair handrails. Provide manufacturer's standard pressed steel wall brackets with anchors suitable for supporting construction.

4. Tread Construction: Comply with details indicated on Drawings.

    a. 1 1/2 inch (38.1 mm) pan type treads for field-poured concrete.

        1) Acceptable Material: Field-Poured Reinforced Concrete Treads.

F. Materials:

1. Steel Shapes and Plates: To ASTM A36.

2. Steel Pipe: To ASTM A53 Type E or S, Grade B.

3. Steel Tubing:

    a. Structural Use: To ASTM A500, Grade B or C.

    b. Non-Structural Use: To ASTM A513, hot rolled or coiled rolled (mill option).

4. Steel Sheet:

a. Structural Use: To ASTM A1011 (hot rolled).

b. Non-Structural Use: To ASTM A786, ASTM A1008.

5. Fasteners: As recommended by manufacturer.

6. Welding Rods: In accordance with AWS code and AWS filler metal specifications for material being welded.

7. Primer: HAPS-free, solvent-based, rust inhibitive primer containing less than 3.5 lb/gal (1.6 kg/L) Volatile Organic Compounds (VOC) and compatible with conventional alkyds topcoats.

G. Fabrication:

1. Use same material and finish as parts being joined. Use stainless steel between dissimilar metals and non-corrosive fasteners at exterior connections or joints.

2. Provide fasteners of sufficient strength to support connected members and loads, and to develop full strength of parts fastened or connected.

3. Construct stairs and rails with all components necessary for support and anchorage, and for a complete installation.

H. Finishes

1. Rails and Stair Components: Completely remove oil, grease, dirt, mill scale, rust, corrosion products, oxides, paint or other foreign matter from steel surface in accordance with SSPC SP3.

2. Shop Primer: Immediately after fabrication and cleaning, spray apply primer to dry film thickness recommended by the primer manufacturer, but not less than 2.0 mil thickness. Apply one coat High Solids Red Oxide Anticorrosive primer meeting SSPC-15 Paint.

## 2.2 ACCESSORIES

A. Anchor bolts, clip angles, hanger rods, hardware and incidental materials required for complete installation, as recommended by the manufacturer.

# PART 3 - EXECUTION

## 3.1 EXAMINATION

A. Verification of Conditions: Verify that conditions of substrates previously installed under other sections or contracts are acceptable for product installation in accordance with manufacturer's instructions prior to metal stair and railing installation.

1. Inform Architect of unacceptable conditions immediately upon discovery.

2. Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval from Architect.

## 3.2 PREPARATION

A. Ensure structure or substrate is adequate to support metal stairs and railings.

## 3.3 INSTALLATION

A. Coordinate installation of metal stairs and railings in accordance with Section 01 7300 - Execution.

B. Coordinate metal stairs and railings work with work of other trades for proper time and sequence to avoid construction delays.

C. Install stairs, landings and handrails in accordance with manufacturer's instructions. Install square, plumb, straight and true to line and level, with neatly fitted joints and intersections.

1. Do not cut or alter structural components without written authorization.

2. Field welding and joining shall conform to AWS D1.1 and AWS D1.3.

3. Grind all exposed welds smooth and touch-up shop-primed areas with same primer as used by manufacturer.

## 3.4 ADJUSTING

A. Adjust components and systems for correct function and operation in accordance with manufacturer's written instructions.

## 3.5 CLEANING

A. Perform cleanup in accordance with Section 01 7416 - Cleaning Up (Site Maintenance).

B. Upon completion, remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 16 – Clean Up (Site Maintenance).

C. Waste Management:

1. Coordinate recycling of waste materials with Section 01 74 19 - Construction Waste Management and Disposal.

2. Collect recyclable waste and dispose of or recycle field generated construction waste created during demolition, construction or final cleaning.

3. Remove recycling containers and bins from site.

**END OF SECTION**

**SECTION 05 6000**

**MEDICAL EQUIPMENT SUPPORT SYSTEMS**

## PART 1 – GENERAL

### 1.1 SCOPE OF WORK

A. Contractor shall provide and install medical equipment support systems as indicated on the Contract Drawings.

B. In order to accommodate original and future similar equipment, support systems shall be a “Universal Grid” type fabricated from a “Strut System” (i.e. B-Line®). See the Architectural Reflected Ceiling Plans for required locations of the grid support systems. Strut System channel rails shall extend wall to wall perpendicular to the path of travel of the equipment. Rails shall be on 2’-2” centers, permitting standard size (24”) ceiling panels, light fixtures, and HVAC grilles to fit between them. Rails shall be installed in such a manner as to permit continuous attachment along any point on the rail. System shall be true, plumb, and level and meet the tolerances required by the equipment manufacturer, when loading conditions are applied due to equipment operation.

C. Surgical light, exam light and monitor support systems shall provide a rigidly supported plate and/or threaded rod studs at or below ceiling level, as required by the equipment manufacturer and as indicated on the Medical Equipment Drawings.

D. Provide all equipment, labor, supervision, design and fabrication required for installation of the Medical Equipment Support System in accordance with the Contract Drawings and as specified herein.

E. Finish painting of the exposed portions of the support system, if required, to be performed by the painting contractor.

F. Related work specified elsewhere: Ceiling; Electrical; HVAC; Painting; Other.

### 1.2 QUALITY ASSURANCE

A. Manufacturer’s qualifications - The manufacturer shall not have had less than 10 year’s experience in manufacturing Strut Systems.

B. Installer’s qualifications - Due to the potential need to make last minute changes to accommodate field conditions, the Contractor must be specifically trained in the design and installation of medical equipment supports using Strut Systems, with not less than five years practical experience in the design and installation of medical equipment supports.

C. Standards

1. Work shall meet the requirements of the following standards:

a. Federal, State and Local Codes

b. American Iron and Steel (AISI) Specification for the Design of Cold-Formed Steel Structural Members

c. American Society for Testing and Materials (ASTM)

## 1.3 SUBMITTALS

A. Shop drawings

1. Submit all shop/assembly drawings necessary to install the Medical Equipment Support System in compliance with the Contract Drawings.

2. Submit all pertinent manufacturers' published data. Manufacturers' catalog shall show materials, strengths, finishes and sizes. Sufficient engineering information shall be provided to permit stress calculations.

3. The medical support system shall lend itself to a rational structural analysis.

## 1.4 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. All material is to be delivered to the work site properly packaged to avoid damage.

B. Upon delivery to the work site, all components shall be protected from the elements by a shelter or other covering.

## 1.5 GUARANTEE

A. Materials shall be warranted by manufacturer for a period of one year against defects in materials and workmanship.

B. Installation shall be warranted by contractor for a period of one year against defects in workmanship.

# PART 2 – PRODUCTS

## 2.1 ACCEPTABLE MANUFACTURERS

A. All Strut System components shall be as manufactured by UniStrut, B-Line Systems, Inc., or approved equal as determined by the Architect or Engineer of record in writing 10 days prior to bid date.

B. Some Components necessary for construction, but not manufactured as standard components of the Strut System may be fabricated by the contractor, using only materials of quality comparable to the Strut System. All welding must be performed by a certified welder.

## 2.2 MATERIALS

A. All channel members shall be fabricated from structural grade steel conforming to one of the following ASTM specifications:
A 570 Gr 33
A 446 Gr A

B. All fittings shall be fabricated from steel conforming to the following ASTM specifications:
A635

C. Materials that appear damaged or distressed shall not be used and will not be accepted.

D. The Engineer of Record must approve any substitutions of product or manufacturer. Approvals must be made in writing ten days prior to bid date.

## 2.3 FINISHES

A. Strut System components shall be finished in accordance with one of the following standards:

1. DURA-GREEN (GR) Water-borne epoxy coating applied by cathodic electro-deposition after cleaning and phosphatizing, and thoroughly baked.

2. ELECTRO-PLATED ZINC (EG) Electrolytically zinc coated per ASTM B633.

3. PRE-GALVANIZED (PG) Zinc coated by hot-dipped process prior to roll forming Zinc weight

4. HOT-DIPPED GALVANIZED (HG) Zinc coated after all manufacturing operations are complete. Coating shall conform to ASTM A 123 or A153.

## 2.4 DESIGN

A. SUPPORT STRUCTURE: The support members at the ceiling plane shall be located as indicated on the Medical Equipment Drawings. The system shall be adequately braced to prevent unacceptable movement during equipment use.

B. SURGICAL AND EXAM LIGHT SUPPORTS: The support members at the ceiling plane shall be located as indicated on the drawings. It shall be possible to attach lights to support and adjust leveling/mounting plate without modification to the support.

C. CEILING ANCHORAGE: Wherever possible, attachment to structure above ceiling shall be by means of thru-bolts or beam/joist clamps to the structural framing of the building.

D. VERTICAL SUPPORTS: The exposed rails and the ceiling anchorage shall be connected by a series of adjustable telescoping square tubing supports as indicated on the drawings. Vertical supports shall provide for vertical adjustments without field welding.

E. GENERAL: Support System to be designed to allow adjustments to accommodate restrictive field conditions. Design shall permit complete installation without field welding.

F. SEISMIC BRACING: Medical system shall be adequately braced to meet all code requirements.

G. LOADING: The support structure shall be designed to support a concentrated load of 1000 pounds, at any single point along the exposed rails. The concentrated load shall be the maximum that will be encountered by positioning the equipment at the extremities of its travel (maximal load configuration).

H. SAFETY FACTOR: The system shall be designed with a minimum safety factor of 2.5 based upon ultimate strength under static loading conditions.

# PART 3 – EXECUTION

## 3.1 EXAMINATION

A. The installer shall inspect the work area prior to installation. If work area conditions are unsatisfactory, installation shall not proceed until satisfactory corrections are completed.

## 3.2 INSTALLATION

A. Installer's qualifications - Due to the potential need to make last minute changes to accommodate field conditions, the Contractor must be specifically trained in the design and installation of medical equipment supports.

B. Set Strut System components into final position true, level, and plumb, in accordance with approved shop drawings.

C. Anchor material firmly in place. Tighten all connections to their recommended torques.

## 3.3 CLEANUP

A. Upon completion of this section of work, remove all protective wraps. Clean any debris due to installation of this section of work.

## 3.4 PROTECTION

A. During installation, it shall be the responsibility of the installer to protect this work from damage.

B. Upon completion of this scope of work, it shall become the responsibility of the general contractor to protect this work from damage during the remainder of construction on the project and until substantial completion.

**END OF SECTION**

**SECTION 13 8500**

**SEISMIC PROTECTION**

## PART 1 - GENERAL

### 1.1 SECTION INCLUDES

A. Seismic protection and restraints for mechanical/electrical equipment and systems.

### 1.2 PERFORMANCE REQUIREMENTS FOR SEISMIC RESTRAINTS

A. Criteria: Provide seismic restraints for mechanical and electrical systems, components and elements in accordance with International Building Code (IBC) 2015 and ASCE 7-10, "Minimum Design Loads for Buildings and Other Structures." Include seismic bracing, supports, and attachments.

B. Project Conditions

1. Site Class as Defined in the IBC: C

2. $S_{DS}$, Design Spectral Acceleration at Short Periods: 0.122.

3. $S_{D1}$, Design Spectral Acceleration at One Second Period: 0.092.

4. Seismic Risk Category as Defined in the IBC: III

5. Component Importance Factor Ip: determine in accordance with ASCE 7 for each component.

C. Design: Design seismic restraints in accordance with stated criteria. Design and detailed drawings shall be by a Registered Professional Engineer.

D. Exclusion: Install seismic protection of water pipes for fire protection systems as specified in Section 21 1000.

E. Exclusion: Install seismic protection of ceilings as specified in section 09 5000.

### 1.3 SUBMITTALS

A. Product Data: Submit details including materials, configuration and fastenings for manufactured seismic restraint devices. Submit test data approved by ICBO confirming load capacity.

B. Shop Drawings: Signed and sealed by a qualified professional engineer. Include the following:

1. Seismic-Restraint Details: Detail fabrication, arrangement, locations, spacing and attachment of seismic restraints and snubbers. Show anchorage details.

C. Design Analysis for Seismic Restraints: Submit complete calculations for seismic restraints, stamped by a Registered Professional Engineer.

D. Component Certification: When ASCE 7 requires Component Certification for any particular component, submit manufacturer's certificate of compliance indicating that the component complies with ASCE 7 requirements.

## PART 2 - PRODUCTS

### 2.1 SEISMIC RESTRAINTS

A. Provide seismic restraints of type permitted by IBC and ASCE 7 and in accordance with the Contractor have approved design.

## PART 3 - EXECUTION

### 3.1 SEISMIC RESTRAINT INSTALLATION

A. Install seismic restraints in accordance with IBC, ASCE 7 and Contractor's approved design.

**END OF SECTION**

**SECTION 14 2100**

**ELECTRIC TRACTION ELEVATORS**

## PART 1 - GENERAL

### 1.1 SUMMARY

A. Section Includes: Pre-engineered electric traction passenger elevators and supplementary items necessary to complete their installation.

1. Designated elevator complying with code requirements for stretcher.

B. Related Requirements: Including but not limited to the following:

1. Division 05 Section "Structural Steel Framing" for the following:

a. Attachment plates, angle brackets, and other preparation of structural steel for fastening guide-rail brackets.
b. Divider beams.
c. Hoist beams.
d. Structural-steel shapes for subsills.

2. Division 05 Section "Metal Fabrications" for the following:

a. Pit ladders.

### 1.2 PRODUCT VARIATIONS AND ADJUSTMENTS

A. Product Variations: In the event of differences between products and systems of acceptable or available manufacturer/fabricators, Contractor shall notify Architect of such differences and resolve conflicts prior to awarding Contract. Failure of Contractor to provide notification shall be construed as acceptance of conditions indicated, and changes caused by differences between products and Contract Documents shall be included in the Work at no additional cost to Owner.

B. Adjustments: Proposed deviations shall include a detailed analysis of impact to adjacent substrates, structural, mechanical, electrical or other building systems, including related design or construction cost impacts. Deviations causing changes in materials, constructability, substrates, systems or conditions shall be included in the Work at no additional cost to Owner.

~~1.3 ALLOWANCES~~

~~A. Elevator Car Allowances: Provide finished elevator cars under the Elevator Car Allowance. Allowance includes furnishing and installing the following:~~

~~1. Car wall finishes including trim.~~
~~2. Car floor finishes.~~
~~3. Car ceiling finishes.~~
~~4. Car light fixtures.~~
~~5. Handrails.~~
~~6. Cutouts and other provisions for installing elevator signal equipment in cars.~~



BASIS OF DESIGN FINISHES

## 1.4 DEFINITIONS

A. Definitions in ASME A17.1/CSA B44 apply to work of this Section.

B. Service Elevator: A passenger elevator that is also used to carry freight.

C. Defective Elevator Work: Operation or control system failures; performances below specified ratings; excessive wear; unusual deterioration or aging of materials or finishes; unsafe conditions; the need for excessive maintenance; abnormal noise or vibration; and similar unusual, unexpected, and unsatisfactory conditions.

## 1.5 ACTION SUBMITTALS

A. Product Data: Manufacturer's technical literature for each product and system indicated.

1. Include manufacturer's specifications for materials, finishes, construction details, installation instructions, and recommendations for maintenance.
2. Include capacities, sizes, performances, operations, safety features, finishes, and similar information. Include product data for car enclosures, hoistway entrances, and operation, control, and signal systems.

B. Shop Drawings: Show details of fabrication and installation, including plans, elevations, sections, details of components and attachments to other work. Distinguish between shop and field-assembled work.

1. Include large-scale details indicating service at each landing, coordination with building structure, relationships with other construction, and locations of equipment.

a. Include machine room layout if applicable.
b. Include large-scale layout of car-control station.
c. Include standby power operation control panel if applicable.

2. Indicate maximum dynamic and static loads imposed on building structure at points of support, and maximum and average power demands.
3. Indicate variations from specified requirements.

C. Samples for Verification: For exposed car, hoistway door and frame, and signal equipment finishes; 3 inch (75 mm) square Samples of sheet materials; and 4 inch (100 mm) lengths of running trim members.

1. Signal and Fixtures: Architect shall select and approve all fixture selections.

## 1.6 INFORMATIONAL SUBMITTALS

A. Seismic Qualification Certificates: For elevator equipment, accessories, and components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

B. Manufacturer Certificates: Signed by elevator manufacturer certifying that hoistway, pit, and machine room or control closet layout and dimensions, as shown on Drawings, and electrical service including standby power generator if applicable, as shown and specified, are adequate for elevator system being provided.

C. Field Quality Control Reports: Written report of testing and inspection required by "Field Quality Control".

D. Qualification Data:

1. For firms and persons specified in "Quality Assurance" to demonstrate their capabilities and experience. Include list of completed projects.

E. Warranty: Sample of warranty.

1. Provide manufacturer's written warranty covering materials and installation (labor) stating obligations, remedies, limitations and exclusions.

## 1.7 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For elevators to include in emergency, operation, and maintenance manuals.

B. Diagnostic Test Equipment and Instructions: Provide all diagnostic test devices together with one set of all supporting information necessary for interpretation of test data and troubleshooting of system. The elevator installation shall be a design that can be maintainable by any licensed elevator maintenance company employing journeymen mechanics, without the need to purchase or lease additional diagnostic devices, special tools, or instructions from the original equipment manufacturer.

C. Inspection and Acceptance Certificates and Operating Permits: As required by authorities having jurisdiction for normal, unrestricted elevator use.

## 1.8 QUALITY ASSURANCE

~~A. Manufacturer Qualifications: Manufacturer with not less than 5 years of experience in the successful production and in-service performance of products and systems similar to scope of this Project.~~

B. Installer Qualifications:

1. Experience: Installer's personnel with not less than 5 years of experience in the successful performance of Work similar to scope of this Project.
2. Supervision: Installer shall maintain a competent supervisor at Project while the Work is in progress, and who has not less than 5 years of experience installing products and systems similar to scope of this Project.
3. Manufacturer Acceptance: Installer shall be certified, approved, licensed, or acceptable to manufacturer to install products.

## 1.9 PRE-INSTALLATION CONFERENCE

A. Pre-Installation Conference: Before Work begins, conduct conference at Project site.

1. Participants:

    a. Architect.
    b. Contractor, including superintendent.
    c. Installer, including project manager and supervisor.
    d. If requested, Manufacturer's qualified technical representative.
    e. Installers of other construction interfaced with Work.

2. Minimum Agenda: Installer shall demonstrate understanding of the Work required by describing detailed procedures for preparing, installing, and cleaning the Work. Demonstration shall include, but not be limited to, following topics:

    a. Tour representative areas of Work, inspect and discuss condition of substrate, and other preparatory work performed by other trades.
    b. Review Contract Document requirements.
    c. Review approved submittals.
    d. Review inspection and testing requirements.
    e. Review environmental conditions and procedures for coping with unfavorable conditions.
    f. Resolve deviations or differences between Contract Documents and the manufacturer's specifications.

3. Record discussions, including decisions and agreements, and prepare report.

## 1.10 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle materials, components, and equipment in manufacturer's protective packaging. Store materials, components, and equipment off of ground, under cover, and in a dry location.

## 1.11 COORDINATION

A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.

B. Coordinate installation of sleeves, block outs, elevator equipment with integral anchors, and other items that are embedded in concrete or masonry for elevator equipment. Furnish templates, sleeves, elevator equipment with integral anchors, and installation instructions and deliver to Project site in time for installation.

C. Coordinate locations and dimensions of other work relating to electric traction elevators including pit ladders; sumps and floor drains in pits; entrance subsills; electrical service; and electrical outlets, lights, and switches in hoistways, pits, and machine rooms.

## 1.12 WARRANTY

A. Manufacturer’s Warranty: Furnish manufacturer’s written material and labor warranty signed by an authorized representative using manufacturer’s standard form agreeing to furnish materials and labor required to repair or replace work which exhibits material defects caused by manufacture or design and installation of product. "Defects" is defined to include but not limited to deterioration or failure to perform as required.

1. Failures include, but are not limited to, operation or control system failure, including excessive malfunctions; performances below specified ratings; excessive wear; unusual deterioration or aging of materials or finishes; unsafe conditions; need for excessive maintenance; abnormal noise or vibration; and similar unusual, unexpected, and unsatisfactory conditions.
2. Warranty Period: Manufacturer shall warrant the products to be free from material and labor Defects for a period of 1 year from date of Substantial Completion.

## 1.13 MAINTENANCE SERVICE

A. Initial Maintenance Service: Beginning at Substantial Completion, provide 12 months' full maintenance service by skilled employees of the elevator Installer. Include monthly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper elevator operation at rated speed and capacity. Provide parts and supplies as used in the manufacture and installation of original equipment.

1. Service Records: Installer shall provide a report of all service calls, maintenance service and repairs made during the initial maintenance service period.
2. Perform maintenance, including emergency callback service, during normal working hours with two hour or less response time.
3. Include 24-hour-per-day, 7-day-per-week emergency callback service with one hour or less response time.

B. Continuing Maintenance Proposal: Submit a continuing maintenance proposal from Installer to Owner, in the form of a standard one-year maintenance agreement, starting on date initial maintenance service is concluded. State services, obligations, conditions, and terms for agreement period and for future renewal options.

C. Parts: Contractor guarantees to sell parts, including circuit boards, to the Owner or Owner's Agent.

# PART 2 - PRODUCTS

## 2.1 MANUFACTURERS AND PRODUCTS

A. Acceptable Manufacturers and Products: Subject to compliance with requirements of Contract Documents as judged by the Architect, provide product by one of manufacturers listed. If not listed, submit as substitution according to the Conditions of the Contract and Division 01 Section "Substitution Procedures".

~~B. Available Manufacturers and Products: Subject to compliance with requirements of Contract Documents as judged by the Architect, manufacturers offering products that may be incorporated into the Work include, but are not limited to, those listed.~~

1. KONE Inc.
2. Otis Elevator Co.
3. Schindler Elevator Corp.
4. ThyssenKrupp Elevator.

C. Basis of Design (Product Standard): Contract Documents are based on products and systems specified to establish a standard of quality. Other manufacturers offering products having equivalent characteristics may be considered, provided deviations are minor and comply with requirements of Contract Documents as judged by the Architect.

1. Manufacturer and Product: KONE Monospace 500 - CLASSIC CHIC - 42004

## 2.2 MATERIALS, GENERAL

A. Source Limitations: Obtain elevators, including hydraulic passenger elevators when specified in another Section, from single manufacturer.

1. Major elevator components, including driving machines, controllers, signal fixtures, door operators, car frames, cars, and entrances, shall be manufactured by single manufacturer.

## 2.3 PERFORMANCE REQUIREMENTS

A. Regulatory Requirements: Comply with requirements of authorities having jurisdiction and applicable provisions of ASME A17.1/CSA B44 "Safety Code for Elevators and Escalators".

B. Accessibility Requirements: Comply with requirements of authorities having jurisdiction and Section 407 in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines and with ICC A117.1.

C. Seismic Performance: Elevator system shall withstand the effects of earthquake motions determined according to the building code and shall comply with elevator safety requirements for applicable seismic risk Zone in ASME A17.1/CSA B44.

1. The term "withstand" means "the system will remain in place without separation of any parts when subjected to the seismic forces specified and the system will be fully operational after the seismic event."

## 2.4 ELEVATORS

A. Elevator System, General: Manufacturer's standard elevator systems. Unless otherwise indicated, manufacturer's standard components shall be used, as included in standard elevator systems and as required for complete system.

B. Elevator Description – Passenger Elevator, No 1:

1. Machine Location:

~~a. Machine room above hoistway~~
b. Hoistway; no machine room is provided.

2. Machine Type:

a. Traction; Geared for speeds up to 450 fpm; Gearless for speeds of 500 fpm and higher.

~~3. Rated Load: 2000 lb (908 kg.~~
4. Rated Load: 2500 lb (1135 kg).

5. ~~Rated Load: 3000 lb (1362 kg).~~
6. ~~Rated Load: 3500 lb (1589 kg).~~
7. ~~Rated Load: 4000 lb (1816 kg).~~
8. ~~Rated Load: 4500 lb (2043 kg).~~
9. ~~Rated Load: 5000 lb (2270 kg).~~
10. ~~Freight Loading Class for Service Elevator(s): Class A.~~
11. ~~Rated Speed: 150 fpm~~ 200 FPM
12. ~~Rated Speed: 350 fpm (1.8 m/s).~~
13. ~~Rated Speed: 400 fpm (2.0 m/s).~~
14. ~~Rated Speed: 450 fpm (2.3 m/s).~~
15. ~~Rated Speed: 500 fpm (2.5 m/s).~~
16. ~~Rated Speed: 700 fpm (3.6 m/s).~~
17. Operation System: Microprocessor operation, VVVF control.
18. Auxiliary Operations:

    a. Standby power operation.
    b. ~~Battery-powered lowering.~~
    c. Earthquake Emergency Operation: Comply with requirements in ASME A17.1/CSA B44
    d. Automatic dispatching of loaded car.
    e. Nuisance call cancel.
    f. Emergency hospital service at all floors.
    g. Independent service for service elevator and all cars in group.
    h. Loaded-car bypass.
    i. Distributed parking.

19. ~~Security Features:~~

    a. ~~Card-reader operation~~
    b. ~~Car-to-lobby feature.~~

20. Dual Car-Control Stations: Provide two car-control stations in each elevator; equip only one with required keyswitches if any.
21. Car Enclosures:

    a. As indicated on Drawings.
    b. Inside Width: Unless otherwise indicated, Manufacturer's standard for rated load; measured from side wall to side wall.
    c. Inside Depth: Unless otherwise indicated, Manufacturer's standard for rated load; measured from back wall to front wall (return panels).
    d. Inside Height: Unless otherwise indicated, 108 inches (2700 mm) measured to underside of ceiling.
    e. ~~Front Walls (Return Panels) and Car Fixtures:~~

        1) ~~Polished stainless steel, No. 8 finish~~
        2) ~~Satin stainless steel, No. 4 finish~~
        3) ~~Polished bronze, lacquered~~
        4) ~~Satin bronze, lacquered~~

    f. ~~Side and Rear Wall Panels and Reveals:~~

        1) ~~Enameled steel~~
        2) ~~Primed steel~~

SIDE WALLS: BRUSHED STAINLESS STEEL (4SS)
REAR WALL: MADAGASCAR (L416) WOOD LAMINATE

3) Plastic laminate
4) Satin stainless steel, No. 4 finish
5) Textured stainless steel
6) Satin bronze, lacquered

g. Door Faces (Interior):

1) Enameled steel
2) Primed steel
3) Polished stainless steel, No. 8 finish
4) Satin stainless steel, No. 4 finish
5) Textured stainless steel
6) Polished bronze, lacquered
7) Satin bronze, lacquered

h. Door Sills:

1) Aluminum
2) Bronze
3) Nickel silver

i. Ceiling:

1) Luminous ceiling
2) Polished stainless steel, No. 8 finish
3) Satin stainless steel, No. 4 finish
4) Polished bronze, lacquered

CEILING: BRUSHED STAINLESS STEEL (4SS) W/ ROUND LED SPOTLIGHTS (CL88)

j. Handrails: Unless otherwise indicated, at rear of car.

1) Mirror-polished stainless steel, No. 8 finish
2) Satin stainless steel, No. 4 finish
3) Mirror-polished bronze, lacquered
4) Satin bronze, lacquered

HANDRAIL: ROUND, STRAIGHT ENDS (HR61) BRUSHED STAINLESS STEEL (4SS)

k. Floor prepared to receive carpet.
l. Floor prepared to receive resilient flooring (specified in Section "Resilient Flooring").
m. Floor recessed and prepared to receive dimension stone tile or ceramic tile
n. Floor Thickness, Including Setting Materials: Verify thickness above subfloor; coordinate car door sill height with manufacturer.
o. Floor: Stainless steel checkered plate.

22 Hoistway Entrances: Refer to drawings

a. Width: Unless otherwise indicated, 42 inches (1050 mm).
b. Height: Unless otherwise indicated, 96 inches (2400 mm).
c. Type:

1) Single-speed side sliding
2) Two-speed side sliding
3) Single-speed center opening
4) Two-speed center opening.

d. Doors and Frames at First Floor:

1) Enameled steel
2) Primed steel
3) Polished stainless steel, No. 8 finish
4) Satin stainless steel, No. 4 finish
5) Polished bronze, lacquered
6) Satin bronze, lacquered
7) Textured stainless steel at doors

e. Doors and Frames at Other Floors:

1) Enameled steel
2) Primed steel
3) Polished stainless steel, No. 8 finish
4) Satin stainless steel, No. 4 finish
5) Polished bronze, lacquered
6) Satin bronze, lacquered
7) Textured stainless steel at doors

f. Sills at First Floor:

1) Aluminum, mill finish
2) Bronze, polished
3) Nickel silver, polished

g. Sills at Other Floors:

1) Aluminum, mill finish
2) Bronze, polished
3) Nickel silver, polished

23. Hall Fixtures: Refer to Drawings

a. Polished stainless steel, No. 8 finish
b. Satin stainless steel, No. 4 finish
c. Polished bronze, lacquered
d. Satin bronze, lacquered
e. Recessed type with no exposed-metal surfaces

24. Additional Requirements:

a. Provide inspection certificate in each car, mounted under acrylic cover with frame matching adjacent metal finish.
b. Provide hooks for protective pads in all cars and two complete set(s) of full-height protective pads.

**C.** Elevator Description – Service Elevator, No 2:

1. Machine Location:

a. Machine room above hoistway
b. Hoistway; no machine room is provided.

2. Machine Type:

    a. Traction; Geared for speeds up to 450 fpm; Gearless for speeds of 500 fpm and higher.

3. ~~Rated Load: 2000 lb (908 kg.~~
4. ~~Rated Load: 2500 lb (1135 kg).~~
5. ~~Rated Load: 3000 lb (1362 kg).~~
6. ~~Rated Load: 3500 lb (1589 kg).~~
7. ~~Rated Load: 4000 lb (1816 kg).~~
8. ~~Rated Load: 4500 lb (2043 kg).~~
9. Rated Load: ~~5000 lb (2270 kg).~~

10. ~~Freight Loading Class for Service Elevator(s): Class A.~~
11. ~~Rated Speed: 150 fpm~~ 200 FPM
12. ~~Rated Speed: 350 fpm (1.8 m/s).~~
13. ~~Rated Speed: 400 fpm (2.0 m/s).~~
14. ~~Rated Speed: 450 fpm (2.3 m/s).~~
15. ~~Rated Speed: 500 fpm (2.5 m/s).~~
16. ~~Rated Speed: 700 fpm (3.6 m/s).~~
17. Operation System: Microprocessor operation, VVVF control.
18. Auxiliary Operations:

    a. Standby power operation.
    b. ~~Battery-powered lowering.~~
    c. Earthquake Emergency Operation: Comply with requirements in ASME A17.1/CSA B44.
    d. Automatic dispatching of loaded car.
    e. Nuisance call cancel.
    f. Emergency hospital service at all floors.
    g. Independent service for service elevator and all cars in group.
    h. Loaded-car bypass.
    i. Distributed parking.

19. ~~Security Features:~~

    a. ~~Card-reader operation~~
    b. ~~Car-to-lobby feature.~~

20. Dual Car-Control Stations: Provide two car-control stations in each elevator; equip only one with required keyswitches if any.
21. Car Enclosures:

    a. As indicated on Drawings.
    b. Inside Width: Unless otherwise indicated, Manufacturer's standard for rated load; measured from side wall to side wall.
    c. Inside Depth: Unless otherwise indicated, Manufacturer's standard for rated load; measured from back wall to front wall (return panels).
    d. Inside Height: Unless otherwise indicated, 108 inches (2700 mm) measured to underside of ceiling
    e. ~~Front Walls (Return Panels) and Car Fixtures:~~

1) Polished stainless steel, No. 8 finish
2) Satin stainless steel, No. 4 finish
3) Polished bronze, lacquered
4) Satin bronze, lacquered

finishes same as the previouse finishes

f. Side and Rear Wall Panels and Reveals:

1) Enameled steel
2) Primed steel
3) Plastic laminate
4) Satin stainless steel, No. 4 finish
5) Textured stainless steel
6) Satin bronze, lacquered

g. Door Faces (Interior):

1) Enameled steel
2) Primed steel
3) Polished stainless steel, No. 8 finish
4) Satin stainless steel, No. 4 finish
5) Textured stainless steel
6) Polished bronze, lacquered
7) Satin bronze, lacquered

h. Door Sills:

1) Aluminum
2) Bronze
3) Nickel silver

i. Ceiling:

1) Luminous ceiling
2) Polished stainless steel, No. 8 finish
3) Satin stainless steel, No. 4 finish
4) Polished bronze, lacquered.

j. Handrails: Unless otherwise indicated, at rear of car.

1) Mirror-polished stainless steel, No. 8 finish
2) Satin stainless steel, No. 4 finish
3) Mirror-polished bronze, lacquered
4) Satin bronze, lacquered

k. Floor prepared to receive carpet.
l. Floor prepared to receive resilient flooring (specified in Section "Resilient Flooring").
m. Floor recessed and prepared to receive dimension stone tile or ceramic tile
n. Floor Thickness, Including Setting Materials: Verify thickness above subfloor; coordinate car door sill height with manufacturer.
o. Floor: Stainless steel checkered plate.

22. Hoistway Entrances: Refer to Drawings

a. ~~Width: Unless otherwise indicated, 42 inches (1050 mm).~~
b. ~~Height: Unless otherwise indicated, 96 inches (2400 mm).~~
c. ~~Type:~~

1) ~~Single-speed side sliding~~
2) ~~Two-speed side sliding~~
3) ~~Single-speed center opening~~
4) ~~Two-speed center opening.~~

d. ~~Doors and Frames at First Floor:~~

1) ~~Enameled steel~~
2) ~~Primed steel~~
3) ~~Polished stainless steel, No. 8 finish~~
4) ~~Satin stainless steel, No. 4 finish~~
5) ~~Polished bronze, lacquered~~
6) ~~Satin bronze, lacquered~~
7) ~~Textured stainless steel at doors~~

e. ~~Doors and Frames at Other Floors:~~

1) ~~Enameled steel~~
2) ~~Primed steel~~
3) ~~Polished stainless steel, No. 8 finish~~
4) ~~Satin stainless steel, No. 4 finish~~
5) ~~Polished bronze, lacquered~~
6) ~~Satin bronze, lacquered~~
7) ~~Textured stainless steel at doors~~

f. ~~Sills at First Floor:~~

1) ~~Aluminum, mill finish~~
2) ~~Bronze, polished~~
3) ~~Nickel silver, polished~~

g. ~~Sills at Other Floors:~~

1) ~~Aluminum, mill finish~~
2) ~~Bronze, polished~~
3) ~~Nickel silver, polished~~

23. Hall Fixtures: Refer to Drawings

a. ~~Polished stainless steel, No. 8 finish~~
b. ~~Satin stainless steel, No. 4 finish~~
c. ~~Polished bronze, lacquered~~
d. ~~Satin bronze, lacquered~~
e. ~~Recessed type with no exposed-metal surfaces~~

24. Additional Requirements:

a. Provide inspection certificate in each car, mounted under acrylic cover with frame matching adjacent metal finish.

b. Provide hooks for protective pads in all cars and two complete set(s) of full-height protective pads.

D. Elevator Description – Passenger Elevator, No. 3:

~~1. Machine Location:~~

a. Machine room above hoistway
b. Hoistway; no machine room is provided.

2. Machine Type:

a. Traction; Geared for speeds up to 450 fpm; Gearless for speeds of 500 fpm and higher.

~~3. Rated Load: 2000 lb (908 kg.~~
4. Rated Load: 2500 lb (1135 kg).
~~5. Rated Load: 3000 lb (1362 kg).~~
~~6. Rated Load: 3500 lb (1589 kg).~~
~~7. Rated Load: 4000 lb (1816 kg).~~
~~8. Rated Load: 4500 lb (2043 kg).~~
~~9. Rated Load: 5000 lb (2270 kg).~~
~~10. Freight Loading Class for Service Elevator(s): Class A.~~
11. Rated Speed 150 fpm
~~12. Rated Speed: 350 fpm (1.8 m/s).~~
~~13. Rated Speed: 400 fpm (2.0 m/s).~~
~~14. Rated Speed: 450 fpm (2.3 m/s).~~
~~15. Rated Speed: 500 fpm (2.5 m/s).~~
~~16. Rated Speed: 700 fpm (3.6 m/s).~~
17. Operation System: Microprocessor operation, VVVF control.
18. Auxiliary Operations:

a. Standby power operation.
~~b. Battery-powered lowering.~~
c. Earthquake Emergency Operation: Comply with requirements in ASME A17.1/CSA B44.
d. Automatic dispatching of loaded car.
e. Nuisance call cancel.
f. Emergency hospital service at all floors.
g. Independent service for service elevator and all cars in group.
h. Loaded-car bypass.
i. Distributed parking.

~~19. Security Features:~~

~~a. Card-reader operation~~
~~b. Car-to-lobby feature.~~

20. Dual Car-Control Stations: Provide two car-control stations in each elevator; equip only one with required keyswitches if any.
21. Car Enclosures:

a. As indicated on Drawings.
b. Inside Width: Unless otherwise indicated, Manufacturer's standard for rated load; measured from side wall to side wall.
c. Inside Depth: Unless otherwise indicated, Manufacturer's standard for rated load; measured from back wall to front wall (return panels).
d. Inside Height: Unless otherwise indicated, 108 inches (2700 mm) measured to underside of ceiling
~~e. Front Walls (Return Panels) and Car Fixtures:~~

~~1) Polished stainless steel, No. 8 finish~~
~~2) Satin stainless steel, No. 4 finish~~
~~3) Polished bronze, lacquered~~
~~4) Satin bronze, lacquered~~

~~f. Side and Rear Wall Panels and Reveals:~~

~~1) Enameled steel~~
~~2) Primed steel~~
~~3) Plastic laminate~~
~~4) Satin stainless steel, No. 4 finish~~
~~5) Textured stainless steel~~
~~6) Satin bronze, lacquered.~~

~~g. Door Faces (Interior):~~

~~1) Enameled steel~~
~~2) Primed steel~~
~~3) Polished stainless steel, No. 8 finish~~
~~4) Satin stainless steel, No. 4 finish~~
~~5) Textured stainless steel~~
~~6) Polished bronze, lacquered~~
~~7) Satin bronze, lacquered~~

h. Door Sills:

~~1) Aluminum~~
~~2) Bronze~~
3) Nickel silver

~~i. Ceiling:~~

~~1) Luminous ceiling~~
~~2) Polished stainless steel, No. 8 finish~~
~~3) Satin stainless steel, No. 4 finish~~
~~4) Polished bronze, lacquered.~~

~~j. Handrails: Unless otherwise indicated, at rear of car.~~

~~1) Mirror-polished stainless steel, No. 8 finish~~
~~2) Satin stainless steel, No. 4 finish~~
~~3) Mirror-polished bronze, lacquered~~
~~4) Satin bronze, lacquered~~

k. Floor prepared to receive carpet.
l. Floor prepared to receive resilient flooring (specified in Section "Resilient Flooring").
m. Floor recessed and prepared to receive dimension stone tile or ceramic tile
n. Floor Thickness, Including Setting Materials: Verify thickness above subfloor; coordinate car door sill height with manufacturer.
o. Floor: Stainless steel checkered plate.

22. Hoistway Entrances: As indicated on Drawings

a. Width: Unless otherwise indicated, 42 inches (1050 mm).
b. Height: Unless otherwise indicated, 96 inches (2400 mm).
c. Type:

1) Single-speed side sliding
2) Two-speed side sliding
3) Single-speed center opening
4) Two-speed center opening.

d. Doors and Frames at First Floor:

1) Enameled steel
2) Primed steel
3) Polished stainless steel, No. 8 finish
4) Satin stainless steel, No. 4 finish
5) Polished bronze, lacquered
6) Satin bronze, lacquered
7) Textured stainless steel at doors

e. Doors and Frames at Other Floors:

1) Enameled steel
2) Primed steel
3) Polished stainless steel, No. 8 finish
4) Satin stainless steel, No. 4 finish
5) Polished bronze, lacquered
6) Satin bronze, lacquered
7) Textured stainless steel at doors

f. Sills at First Floor:

1) Aluminum, mill finish
2) Bronze, polished
3) Nickel silver, polished

g. Sills at Other Floors:

1) Aluminum, mill finish
2) Bronze, polished
3) Nickel silver, polished

23. Hall Fixtures: Refer to Drawings

a. ~~Polished stainless steel, No. 8 finish~~
b. ~~Satin stainless steel, No. 4 finish~~
c. ~~Polished bronze, lacquered~~
d. ~~Satin bronze, lacquered~~
e. ~~Recessed type with no exposed-metal surfaces~~

24. Additional Requirements:

a. Provide inspection certificate in each car, mounted under acrylic cover with frame matching adjacent metal finish.
b. Provide hooks for protective pads in all cars and two complete set(s) of full-height protective pads.

## 2.5 TRACTION SYSTEMS

A. Elevator Machines: Variable-voltage, variable-frequency, ac-type hoisting machines and solid-state power converters.

1. Provide non-regenerative system.
2. ~~Provide regenerative system.~~

a. ~~Limit total harmonic distortion of regenerated power to 5 percent per IEEE 519.~~
b. ~~Provide means for absorbing regenerated power when elevator system is operating on standby power.~~
c. ~~Provide line filters or chokes to prevent electrical peaks or spikes from feeding back into building power system.~~

B. Fluid for Hydraulic Buffers: If using hydraulic buffers, use only fire-resistant fluid.

C. Inserts: Furnish required concrete and masonry inserts and similar anchorage devices for installing guide rails, machinery, and other components of elevator work. Device installation is specified in another Section.

D. Machine Beams: Provide framing as indicated in Drawings to support elevator hoisting machine and deflector sheaves from the building structure. Comply with Division 05 Section "Structural Steel Framing" for materials and fabrication.

E. Hoist Beams: Provide framing as indicated in Drawings to support elevator installation. Comply with Division 05 Section "Structural Steel Framing" for materials and fabrication.

F. Car Frame and Platform: Welded-steel units.

G. Guides: Provide guides at top and bottom of car and counterweight frames.

H. Guide Rails: Provide guide rails of structural capacity required to span between available structural supports without additional secondary steel, unless indicated otherwise on Drawings.

## 2.6 OPERATION SYSTEMS

A. General: Provide manufacturer's standard microprocessor operation systems as required to provide type of operation indicated.

B. Group Automatic Operation with Demand-Based Dispatching for Groups of Three or More Cars: Provide reprogrammable group automatic system that assigns cars to hall calls based on a dispatching program designed to minimize passenger waiting time and time to destination. System automatically adjusts to demand changes for different traffic conditions including heavy incoming, heavy two-way, heavy outgoing, and light off-hours as variations of normal two-way traffic.

1. Products: Subject to compliance with requirements, provide one of the following:

   a. KONE Inc.; KCM 831.
   b. Otis Elevator Co.; Elevonic.
   c. Schindler Elevator Corp.; Miconic TX.
   d. ThyssenKrupp Elevator, Traflomatic.

C. Auxiliary Operations: In addition to primary operation system features, provide the following operational features for elevators where indicated:

1. Standby Power Operation: On activation of standby power, cars are returned to a designated floor and parked with doors open. One car is returned at a time, with priority given to loaded cars. If a car cannot be returned, it is removed from the system. When all cars have been returned or removed from the system, one car is automatically placed in service. If car selected for service cannot operate within a predetermined time, the system removes car from service and places another car in service. Cars can be manually put in service on standby power, either for return operation or for regular operation, by switches in control panel located at main lobby or fire command station as indicated. Manual operation causes automatic operation to cease.
2. ~~Battery-Powered Lowering: If power fails, cars that are at a floor remain at that floor, open their doors, and shut down. Cars that are between floors are lowered one at a time to the next floor below, open their doors, and shut down. System includes rechargeable battery and automatic recharging system.~~
3. Automatic Dispatching of Loaded Car: When car load exceeds 80 percent of rated capacity, doors begin closing.
4. Nuisance Call Cancel: When car calls exceed a preset number while car load is less than a predetermined weight, all car calls are canceled. Preset number of calls and predetermined weight can be adjusted.
5. Loaded-Car Bypass: When car load exceeds 80 percent of rated capacity, car responds only to car calls, not to hall calls.
6. Distributed Parking: When cars are not required for response to calls, they are parked with doors closed and distributed in predetermined zones throughout the building. One zone shall include the main floor and adjacent floors; remaining floors shall be divided into approximately equal zones.
7. Independent Service: Keyswitch in car-control station removes car from group operation and allows it to respond only to car calls. Key cannot be removed from keyswitch when car is in independent service. When in independent service, doors close only in response to door close button.
8. Emergency Hospital Service: Service is initiated by card reader at designated floors. One elevator is removed from group operation and directed to the floor where service was initiated. On arriving at the floor, elevator opens its doors and parks. Car is placed in operation by selecting a floor and pressing door close button. After responding to floor selected, car is returned to group operation. If car is not placed in operation within a preset time after being called, it is returned to group operation.

9. Special Emergency Control – Firefighter's Service: Provide Phase I and Phase II Firefighters' Service; comply with requirements of authorities having jurisdiction and applicable provisions of ASME A17.1/CSA B44 "Safety Code for Elevators and Escalators".

    a. Firefighters Emergency Operation – Phase I Emergency Recall: The activation of a key switch at the designated level hall station shall express return all cars in the group to the designated floor and by-pass all car and hall calls. The cars shall park at the designated floor with the doors open and will not respond to car or hall calls unless the Phase II switch in the car is activated.
    b. Firefighters Emergency Operation - Phase II: In-car key switch control of each elevator during the Emergency operation.

D. Security Features: Provide the following security features, where indicated. Security features shall not affect emergency firefighters' service.

1. Card-Reader Operation: System uses card readers at car-control stations to authorize calls. Security system determines which landings and at what times calls require authorization by card reader. Provide required conductors in traveling cable and panel in machine room for interconnecting card readers, other security access system equipment, and elevator controllers. Allow space as indicated for card reader in car.

    a. Coordinate requirements with Security access system equipment specified in "Access Control" unless otherwise indicated.

2. Car-to-Lobby Feature: Feature, activated by keyswitch at main lobby, that causes car or all cars in a group to return immediately to lobby and open doors for inspection. On deactivation by keyswitch, calls registered before keyswitch activation are completed and normal operation is resumed.

E. Electrical Wiring:

1. Furnish and install complete insulated wiring to connect all parts of the equipment. Properly ground all components as required by National Electric Code.
2. Provide 15% spare wires between each controller, selector, hoistway junction box, and control panel; also provide 15% spare conductors in each trail cable; all spares shall be properly tagged or otherwise identified with clear and indelible markings.
3. Provide a total of twelve (12) shielded pairs for communication and security use in the traveling cables for each elevator. The shielded pairs shall be located in a cable which is not used to carry alternating current circuits. The shielded wiring shall extend to a junction box in the elevator controllers in machine room.

## 2.7 DOOR REOPENING DEVICES

A. Infrared Array: Provide door reopening device with uniform array of 36 or more microprocessor-controlled, infrared light beams projecting across car entrance. Interruption of one or more light beams shall cause doors to stop and reopen.

**B.** Nudging Feature: After car doors are prevented from closing for predetermined adjustable time, through activating door reopening device, a loud buzzer shall sound and doors shall begin to close at reduced kinetic energy.

## 2.8 CAR ENCLOSURES

A. General: Provide enameled-steel car enclosures to receive removable wall panels, with removable car roof, access doors, power door operators, and ventilation.

1. Provide standard railings complying with ASME A17.1/CSA B44 on car tops where required by ASME A17.1/CSA B44.
2. Elevator Car Allowance: Provide items not included in the Elevator Car Allowance as needed for finished car.

    a. Car platform sling, shell, canopy, door, door frame and return panel, shall not be included as a part of this allowance.

B. Materials and Finishes: Manufacturer's standards, but not less than the following:

1. Subfloor for Carpet or Resilient Flooring: Exterior, underlayment grade plywood, not less than 5/8 inch (15 mm) nominal thickness.
2. Subfloor for Tile or Stone: Exterior, C-C Plugged grade plywood, not less than 7/8 inch (21 mm) nominal thickness.
3. Floor Finish: As scheduled, or as indicated in "Design Selections"; match sample accepted by Architect.
4. ~~Enameled-Steel Wall Panels: Flush, hollow-metal construction; fabricated from cold-rolled steel sheet. Provide with factory-applied enamel finish; colors as selected by Architect from manufacturer's full range.~~
5. ~~Stainless-Steel Wall Panels: Flush, hollow-metal construction; fabricated from stainless-steel sheet.~~
6. ~~Bronze Wall Panels: Flush, hollow-metal construction; fabricated from bronze sheet.~~
7. ~~Plastic-Laminate Wall Panels: Plastic laminate adhesively applied to 1/2 inch (12 mm) fire-retardant-treated particleboard or manufacturer's standard honeycomb core with plastic-laminate panel backing and manufacturer's standard protective edge trim. Panels have a flame-spread index of 25 or less, when tested according to ASTM E 84. Plastic-laminate color, texture, and pattern as selected by Architect from plastic-laminate manufacturer's full range.~~
8. Fabricate car with recesses and cutouts for signal equipment.
9. Fabricate car door frame integrally with front wall of car.
10. ~~Enameled-Steel Doors: Flush, hollow-metal construction; fabricated from cold-rolled steel sheet. Provide with factory-applied enamel finish; colors as selected by Architect from manufacturer's full range.~~
11. ~~Primed-Steel Doors: Flush, hollow-metal construction; fabricated from cold-rolled steel sheet, with factory-applied, rust-resistant primer for field painting.~~
12. ~~Stainless-Steel Doors: Flush, hollow-metal construction; fabricated from stainless-steel sheet or by laminating stainless-steel sheet to exposed faces and edges of enameled cold-rolled steel doors using adhesive that fully bonds metal to metal without telegraphing or oil-canning.~~
13. ~~Bronze Doors: Flush, hollow-metal construction; fabricated by laminating bronze sheet to exposed faces and edges of enameled cold-rolled steel doors using adhesive that fully bonds metal to metal without telegraphing or oil-canning.~~
14. Sight Guards: Provide sight guards on car doors.
15. Sills: Extruded metal, with grooved surface, 1/4 inch (6 mm) thick.
16. ~~Luminous Ceiling: Fluorescent light fixtures and ceiling panels of translucent acrylic or other permanent rigid plastic.~~
17. ~~Metal Ceiling: Flush panels, with LED downlights in the center of each panel. Align ceiling panel joints with joints between wall panels.~~

18. Handrails: Manufacturer's standard handrails, of shape, metal, and finish indicated.
19. Emergency Exits: Provide emergency exits sized and located in each car in accordance with the Elevator Code.

## 2.9 HOISTWAY ENTRANCES

A. Hoistway Entrance Assemblies: Manufacturer's standard horizontal-sliding, door-and-frame hoistway entrances complete with track systems, hardware, sills, and accessories. Frame size and profile shall accommodate hoistway wall construction.

1. Where gypsum board wall construction is indicated, frames shall be self-supporting with reinforced head sections.

B. Fire-Rated Hoistway Entrance Assemblies: Door and frame assemblies shall comply with NFPA 80 and be listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction.

1. Fire-Protection Rating: 1-1/2 hours.

C. Materials and Fabrication: Manufacturer's standards, but not less than the following:

1. Frames: Not less than 14 gauge.
2. Doors: Not less than 16 gauge.
3. ~~Enameled-Steel Frames: Formed from cold- or hot-rolled steel sheet. Provide with factory-applied enamel finish; colors as selected by Architect from manufacturer's full range.~~
4. ~~Primed-Steel Frames: Formed from cold- or hot-rolled steel sheet. Provide with factory-applied, rust-resistant primer for field painting.~~
5. Stainless-Steel Frames: Formed from stainless-steel sheet.
6. ~~Bronze Frames: Formed from cold- or hot-rolled steel sheet, with enamel finish, and with formed-bronze sheet laminated to steel frames using adhesive that fully bonds metal to metal without telegraphing or oil-canning.~~
7. Star of Life Symbol: Identify emergency elevators with star of life symbol, not less than 3 inches (75 mm) high, on both inside surfaces of hoistway door frames.
8. Entrance Jamb Plates: Cast metal plates complying with Elevator Code and Accessibility requirements.
9. ~~Enameled-Steel Doors and Transoms: Flush, hollow-metal construction; fabricated from cold-rolled steel sheet. Provide with factory-applied enamel finish; colors as selected by Architect from manufacturer's full range.~~
10. ~~Primed-Steel Doors and Transoms: Flush, hollow-metal construction; fabricated from cold-rolled steel sheet. Provide with factory-applied, rust-resistant primer for field painting.~~
11. Stainless-Steel Doors and Transoms: Flush, hollow-metal construction; fabricated from stainless-steel sheet or by laminating stainless-steel sheet to exposed faces and edges of enameled cold-rolled steel doors using adhesive that fully bonds metal to metal without telegraphing or oil-canning.
12. ~~Bronze Doors and Transoms: Flush, hollow-metal construction; fabricated by laminating bronze sheet to exposed faces and edges of enameled cold-rolled steel doors using adhesive that fully bonds metal to metal without telegraphing or oil-canning.~~
13. Sight Guards: Provide sight guards on doors matching door edges.
14. Sills: Extruded metal, with grooved surface, 1/4 inch (6 mm) thick.
15. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107/C 1107M.

D. Architecturally Exposed Hoistways: For hoistway equipment exposed to public view, provide finishes as selected by Architect.

## 2.10 SIGNAL EQUIPMENT

A. General: Provide hall-call and car-call buttons that light when activated and remain lit until call has been fulfilled. Fabricate lighted elements with long-life lamps and acrylic or other permanent, non-yellowing translucent plastic diffusers or LEDs.

B. Swing-Return Car-Control Stations: Provide car-control stations mounted on hinged return panel adjacent to car door and with buttons, switches, controls, and indicator lights projecting through return panel but substantially flush with face of return panel.

1. Unless indicated otherwise, include manufacturer's premium fixture selection and provide full width swing front return and car operating panels. Logos or manufacturer's name are not permitted on exposed surfaces.
2. Mark buttons and switches for function. Use both tactile symbols and Braille.
3. Provide "No Smoking" sign matching car-control station, either integral with car-control station or mounted adjacent to it, with text and graphics as required by authorities having jurisdiction.
4. Mount controls at heights complying with the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines (ADAAG)."
5. Provide two car control stations in each passenger elevator; equip only one with required keyswitches.
6. Provide two car control stations in each elevator with front and rear doors; locating one station at each door; equip only one with required keyswitches.

C. Emergency Communication System: Two-way voice communication system, with visible signal, which dials preprogrammed number of monitoring station and does not require handset use. System is contained in flush-mounted cabinet, with identification, instructions for use, and battery backup power supply.

D. Firefighters' Two-Way Telephone Communication Service: If required by authorities having jurisdiction, provide flush-mounted cabinet or telephone jack in each car and required conductors in traveling cable for firefighters' two-way telephone communication service specified in Division 28 "Fire-Alarm System."

E. Car Position Indicator: Provide illuminated, digital-type car position indicator, located above car-control station. Also, provide audible signal to indicate to passengers that car is either stopping at or passing each of the floors served. Include travel direction arrows if not provided in car-control station.

F. Hall Push-Button Stations: Provide one hall push-button station at each landing for each single elevator or group of elevators, but not less than two stations for each three elevators in a group.

1. Provide units with flat faceplate for mounting with body of unit recessed in wall.
2. Equip units with buttons for calling elevator and for indicating desired direction of travel.
3. Provide Firefighters Emergency Service – Phase I key switch in designated hall station.
4. If required by authorities having jurisdiction, provide telephone jack in each unit for firefighters' two-way telephone communication service.

G. Hall Lanterns: Units with illuminated arrows; but provide single arrow at terminal landings. Provide one of the following:

1. Manufacturer's standard wall-mounted units, for mounting above entrance frames.
2. Units with flat faceplate for mounting with body of unit recessed in wall and with illuminated elements projecting from faceplate for ease of angular viewing.

H. Hall Annunciator: With each hall lantern, provide audible signals indicating car arrival and direction of travel. Signals sound once for up and twice for down.

1. At manufacturer's option, audible signals may be placed on cars.

I. Hall Position Indicators: Provide illuminated, digital-display-type position indicators, located above hoistway entrances at ground floor. Provide units with flat faceplate for mounting and with body of unit recessed in wall.

J. Fire-Command-Center Annunciator Panel: Provide panel containing illuminated position indicators for each elevator, clearly labeled with elevator designation; include illuminated signal that indicates when elevator is operational and when it is at the designated emergency return level with doors open. Provide standby power elevator selector switch(es), as required by ASME A17.1/CSA B44, adjacent to position indicators. Provide illuminated signal that indicates when normal power supply has failed.

K. Emergency Pictorial Signs: Unless otherwise indicated, Fabricate from materials matching hall push-button stations, with text and graphics as required by authorities having jurisdiction, indicating that in case of fire, elevators are out of service and exits should be used instead. Provide one sign at each hall push-button station unless otherwise indicated.

## 2.11 FINISH MATERIALS

A. General: Provide the following materials for exposed parts of elevator car enclosures, car doors, hoistway entrance doors and frames, and signal equipment as indicated.

1. Car Shell: Not less than 14 gauge.
2. Car Canopy: Not less than 12 gauge.

B. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, commercial steel, Type B, exposed, matte finish.

C. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, commercial steel, Type B, pickled.

D. Stainless-Steel Sheet: ASTM A 240/A 240M, Type 304.

~~E. Textured Stainless-Steel Sheet: ASTM A 240/A 240M, Type 304 with embossed texture rolled into exposed surface.~~

~~1. Basis of Design: <Insert Manufacturer and Product>~~

~~a. Surface Finish After Texturing: <Insert Finish>~~

F. Stainless-Steel Bars: ASTM A 276, Type 304.

G. Stainless-Steel Tubing: ASTM A 554, Grade MT 304.

~~H. Bronze Plate and Sheet: ASTM B 36/B 36M, Alloy UNS No. C28000 (muntz metal).~~

I. ~~Bronze Extrusions: ASTM B 455, Alloy UNS No. C38500 (architectural bronze).~~

J. ~~Bronze Tubing: ASTM B 135 (ASTM B 135M), Alloy UNS No. C23000 (red brass, 85 percent copper).~~

K. Aluminum Extrusions: ASTM B 221 (ASTM B 221M), Alloy 6063.

L. Nickel Silver Extrusions: ASTM B 151/B 151M, Alloy UNS No. C74500 or No. C77600.

M. Plastic Laminate: High-pressure type complying with NEMA LD 3, Type HGS for flat applications, Type HGP for post-formed applications and Type BKV for panel backing.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions: Examine substrates and areas to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.

B. Examine hoistways, hoistway openings, pits, and machine rooms as constructed; verify critical dimensions; and examine supporting structure and other conditions under which elevator work is to be installed.

C. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

### 3.2 INSTALLATION

A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:

1. Respective manufacturer's written installation instructions.
2. Accepted submittals.
3. Contract Documents.

B. Welded Construction: Provide welded connections for installing elevator work where bolted connections are not required for subsequent removal or for normal operation, adjustment, inspection, maintenance, and replacement of worn parts. Comply with AWS standards for workmanship and for qualifications of welding operators.

C. Sound Isolation: Mount rotating and vibrating equipment on vibration-isolating mounts to minimize vibration transmission to structure and structure-borne noise due to elevator system.

D. Lubricate operating parts of systems, including ropes, as recommended by manufacturers.

E. Alignment: Coordinate installation of hoistway entrances with installation of elevator guide rails for accurate alignment of entrances with car. Where possible, delay final adjustment of sills and doors until car is operable in shaft. Reduce clearances to minimum, safe, workable dimension at each landing.

F. Leveling Tolerance: 1/8 inch (3 mm), up or down, regardless of load and travel direction.

G. Set sills flush with finished floor surface at landing. Fill space under sill solidly with nonshrink, nonmetallic grout.

H. Locate hall signal equipment for elevators as follows unless otherwise indicated:

1. For groups of elevators, locate hall push-button stations between two elevators at center of group or at location most convenient for approaching passengers.
2. Place hall lanterns either above or beside each hoistway entrance, unless otherwise indicated.
3. Mount hall lanterns at a minimum of 72 inches (1800 mm) above finished floor.

## 3.3 FIELD QUALITY CONTROL

A. Manufacturer/Fabricator's Field Service: Manufacturer/fabricator's qualified technical representative shall periodically inspect Work to ensure installation is proceeding in accordance with manufacturer/fabricator's designs, recommendations, instructions, and warranty requirements. Representative shall submit written reports of each visit indicating observations, findings, and conclusions of inspection.

1. Manufacturer's Technical Representative Qualifications: Direct employee of technical services department of manufacturer with experience in providing recommendations, observations, evaluations, and problem diagnostics.

B. Acceptance Testing: On completion of elevator installation and before permitting elevator use (either temporary or permanent), perform acceptance tests as required and recommended by ASME A17.1/CSA B44 and by governing regulations and agencies.

C. Operating Test: Load elevator to rated capacity and operate continuously for 30 minutes over full travel distance, stopping at each level and proceeding immediately to the next. Record temperature rise of elevator machine during 30-minute test period. Record failure to perform as required.

1. Provide operating test on one elevator of each type, capacity, speed, and travel distance.
2. Damage to car or adjoining structure caused by performance testing shall be repaired or replaced at no cost to Owner.

D. Advise Owner, Architect, and authorities having jurisdiction in advance of dates and times that tests are to be performed on elevators.

## 3.4 PROTECTION

A. Temporary Use: Temporary use of elevators for construction purposes is not allowed unless authorized by Owner. Comply with the following requirements for each elevator used for construction purposes:

1. Provide car with temporary enclosure, either within finished car or in place of finished car, to protect finishes from damage.
2. Provide strippable protective film on entrance and car doors and frames.
3. Provide padded wood bumpers on entrance door frames covering jambs and frame faces.

4. Provide other protective coverings, barriers, devices, signs, and procedures as needed to protect elevator and elevator equipment.
5. Do not load elevators beyond their rated weight capacity.
6. Engage elevator Installer to provide full maintenance service. Include preventive maintenance, repair or replacement of worn or defective components, lubrication, cleanup, and adjustment as necessary for proper elevator operation at rated speed and capacity. Provide parts and supplies same as those used in the manufacture and installation of original equipment.
7. Engage elevator Installer to restore damaged work, if any, so no evidence remains of correction. Return items that cannot be refinished in the field to the shop, make required repairs and refinish entire unit, or provide new units as required.

    a. Restore elevator sill(s) to new condition or replace with new sill(s).

## 3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to operate, adjust, and maintain elevator(s).

1. Review emergency provisions, including emergency access and procedures to be followed at time of operational failure and other building emergencies. Train Owner's personnel in procedures to follow in identifying sources of operational failures or malfunctions. Confer with Owner on requirements for a complete elevator maintenance program.

B. Check operation of each elevator with Owner's personnel present before date of Substantial Completion. Determine that operation systems and devices are functioning properly.

**END OF SECTION**

SECTION 33 3000

SANITARY SEWERAGE UTILITIES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. The work under this section of the Specifications includes all labor, materials, equipment, and services necessary for SANITARY SEWERAGE UTILITIES as shown on the Drawings and herein specified and in accordance with the Contract Documents. All costs for labor, materials, equipment, and services necessary for SANITARY SEWERAGE UTILITIES shall be included in the bid prices for the work.

1.03 SECTION INCLUDES

A. Sanitary Utility Sewerage Piping
B. Sanitary Utility Sewerage Manholes
C. Sanitary Utility Sewerage Clean-outs

1.04 RELATED SECTIONS

A. 31 23 00 Excavation and Fill
B. 31 25 00 Erosion and Sedimentation Controls

1.05 DEFINITIONS

A. AHJ – Authority Having Jurisdiction

1. City of Tahlequah
2. Oklahoma Department of Environmental Quality

1.06 ACTION SUBMITTALS

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

1. Pipe
2. Manholes
3. Manholes Rings and Covers
4. Manhole Coating
5. Fittings
6. Clean-outs
7. Tracer Wire

B. Field quality-control test reports.

1.07 INFORMATIONAL SUBMITTALS

A. Photograph, video, or both the existing trees and plantings, adjoining construction, roadways, utilities, and site improvements to establish preconstruction conditions. Identify preexisting damage to trees, plantings, adjoining construction, pavements, sidewalks, and other site improvements. Include plans and notations to identify and describe any such conditions.

1.08 QUALITY ASSURANCE

A. PRECONSTRUCTION CONFERENCE

1. Conduct a preconstruction conference. Subcontractors that will be performing the work shall attend the preconstruction conference. Notify ENGINEER one week (7 days) prior to the date of the meeting.

B. REGULATORY REQUIREMENTS

1. All materials and methods shall comply with the requirements of the AHJ.
2. If the AHJ has not adopted specifications for materials and methods, the current edition of the City of Oklahoma City's Standard Specifications for Construction of Public Improvements shall be used.

1.09 PERMITS

A. CONTRACTOR shall make application; pay permit fees; provide payment and performance bonds required of the CONTRACTOR by the AHJ.

1.10 TOPOGRAPHIC SURVEY

A. OWNER has or will perform a survey of the site, stake the property limits, and provide a reference benchmark elevation.

1.11 UNDERGROUND UTILITIES

A. CONTRACTOR shall contact OKIE (811 or 1-800-522-OKIE) prior to construction for locating existing utilities.

B. The underground utilities shown on the Drawings have been located from field survey surface information and existing drawings. ENGINEER and Surveyor make no guarantee that the underground utilities shown comprise all such utilities in the area, either in service or abandoned. The underground utilities are located as accurately as possible from information available; however, ENGINEER and Surveyor further do not guarantee that the underground utilities shown are in the exact location indicated either vertically or horizontally. ENGINEER and Surveyor have not physically located the underground utilities by probing, excavating, hydrovac, or by any other means.

C. CONTRACTOR shall notify all utility companies and governmental agencies who may have utility lines on or about the premises or who may be affected by the construction. Notice shall be given no less than twenty-four hours prior to any work that may interfere with a utility.

D. All existing structures, improvement and utilities designated to remain shall be adequately protected from damage that might otherwise occur due to construction operations. Where construction comes in close proximity to existing structures, utilities or appurtenances, or if it becomes necessary to move services, poles, guy wires, pipe lines or other obstructions, CONTRACTOR shall notify and cooperate with the owner of the utility, structure, or appurtenance. The utility lines and other existing structures shown on the plans are for information only and are not guaranteed to be complete or accurate as to location and/or depth. CONTRACTOR shall be liable for damage to any utilities resulting from the CONTRACTOR's operations. During construction, all fire hydrants, valve boxes, fire or police call boxes and other existing utility controls shall be left intact, unobstructed and accessible unless noted on the plan.

E. Contractor shall satisfy themselves as to the actual existing subsurface conditions, including but not limited to the depth, location and sizes of pipe or conduits of various kinds in place prior to beginning work. Where the exact depth of any utility or obstruction is not shown on a plan, excavation shall be made prior to reaching the obstruction in order

to determine adjustments in grade if needed to prevent interference. Redesign to eliminate conflicts may be necessary.

1.12 CONSTRUCTION CONTROL

A. Do not commence work until temporary erosion and sedimentation control measures are in place.

B. CONTRACTOR shall be responsible for properly laying out the work, and for lines and measurements for the work executed under the Contract Documents. Verify the figures shown on the Drawings before ordering any materials and laying out the work, and report errors or inaccuracies in writing to the ENGINEER before commencing work. The ENGINEER or his representative will in no case assume the responsibility for laying out the work.

C. Existing survey points other than those shown on the Drawings shall not be considered as acceptable control points unless approved by the ENGINEER. If approval is secured, CONTRACTOR remains responsible for maintaining them and for their accuracy. Be responsible for preserving all existing iron or metal, and all concrete survey points or monuments for the construction period.

1.13 PROJECT CONDTIONS

A. TRAFFIC

1. Obtain any required Work Zone Permits from the AHJ at least two (2) working days prior to the start of work and/or placing or removing any barricades or modifying existing traffic control devices.
2. CONTRACTOR shall be responsible for erecting and maintaining barricades and other traffic warning devices as necessary around the perimeter of construction and adjacent to any open trenches. Provide and maintain adequate detours around the work under construction. Provide sufficient lights, warning signs, and watchmen for the safety of the public.
3. Any temporary street closure shall be coordinated with and approved by the AHJ. CONTRACTOR shall establish all detour routes while streets are closed during construction. CONTRACTOR shall notify Fire, Police, and EMSA headquarters when any street is temporarily closed.
4. CONTRACTOR is responsible for the prompt replacement and/or repair of all traffic control devices and appurtenances damaged or disturbed due to construction. Any existing traffic signals, signal loops, conduits, cables, and other traffic control devices affected by the work shall be reset or replaced according to AHJ's specifications. Coordinate the work with the AHJ's traffic department.

B. UTILITY INTERRUPTIONS

1. Do not interrupt any utility serving facilities occupied by Owner or others unless permitted by OWNER and the owner(s) of the utility. Temporary utility service shall be provided for any interruption. Notify OWNER and ENGINEER one week (7 days) in advance of proposed interruption of utility.

C. SUBSURFACE CONDITIONS

1. A geotechnical report has been prepared for this Project and is available for information only. The opinions expressed in this report are those of geotechnical engineer and represent interpretations of subsoil conditions, tests, and results of analyses conducted by geotechnical engineer. Owner will not be responsible for interpretations or conclusions drawn from the data.

D. EXCAVATION AND TRENCH SAFETY SYSTEMS

1. CONTRACTOR shall be responsible for complying with State laws and Federal regulations relating to excavation and trench safety, including those which may be enacted during the performance under this Contract. CONTRACTOR is advised that Federal Regulations 29 C.F.R. 1926.650-1926.652 have been, in their most recent version as amended, in effect since January 2, 1990. CONTRACTOR shall fully comply with the U.S. Department of Labor Occupational Safety and Health Administration (OSHA) regulations pertaining to excavations, trenching, and shoring and shall provide and familiarize its employees involved in excavation and trenching with the provisions in OSHA Pamphlet Number 2226, Excavating and Trenching Operations.

1.14 HAZARDOUS CONDITIONS

A. If CONTRACTOR encounters a Hazardous Environmental Condition or if CONTRACTOR or anyone for whom CONTRACTOR is responsible creates a Hazardous Environmental Condition, CONTRACTOR shall immediately: (i) secure or otherwise isolate such condition; (ii) stop all Work in connection with such condition and in any area affected thereby (except in an emergency); and (iii) notify OWNER and ENGINEER (and promptly thereafter confirm such notice in writing). OWNER shall promptly consult with ENGINEER concerning the necessity for OWNER to retain a qualified expert to evaluate such condition or take corrective action, if any.

PART 2 - PRODUCTS

2.01 ADOPTED PRODUCT REQUIRMENTS

A. All materials and products shall comply with the current edition of the AHJ's Standard Specifications.

2.02 DUCTILE-IRON, GRAVITY SEWER PIPE AND FITTINGS

A. Pipe: ASTM A 746, for push-on joints.
B. Standard Fittings: AWWA C110, ductile or gray iron, for push-on joints.
C. Compact Fittings: AWWA C153, ductile iron, for push-on joints.
D. Gaskets: AWWA C111, rubber.

2.03 DUCTILE-IRON, PRESSURE PIPE AND FITTINGS

A. Push-on-Joint Piping:
B. Pipe: AWWA C151.
C. Standard Fittings: AWWA C110, ductile or gray iron.
D. Compact Fittings: AWWA C153.
E. Gaskets: AWWA C111, rubber, of shape matching pipe and fittings.
F. Mechanical-Joint Piping:
G. Pipe: AWWA C151, with bolt holes in bell.
H. Standard Fittings: AWWA C110, ductile or gray iron, with bolt holes in bell.
I. Compact Fittings: AWWA C153, with bolt holes in bells.
J. Glands: Cast or ductile iron; with bolt holes and high-strength, cast-iron or high-strength, low-alloy steel bolts and nuts.
K. Gaskets: AWWA C111, rubber, of shape matching pipe, fittings, and glands.

2.04 POLYVINYL CHLORIDE (PVC) PIPE AND FITTINGS

A. SOLID WALL PVC - All solid wall PVC pipe and fittings shall conform to the requirements of the appropriate ASTM listed below or as modified herein.

1. ASTM D-3034 –
    a. Standard Specification for "Type PSM Poly (Vinyl Chloride) (VC) Sewer Pipe and Fittings". Pipe and fittings shall have a minimum stiffness of forty-six (46 psi) pounds per square inch and a minimum SDR of thirty-five (35). Pipe and fittings may be supplied in sizes ranging from four (4”) inches to fifteen (15”) inches in diameter.
    b. The pipe shall be made of PVC plastic having a cell classification of 12454-B or 12454-C or 12364-C or 13364-B (with minimum tensile modulus of 500,000 psi) as defined in ASTM D-1784. The fittings shall be made of PVC plastic having a cell classification of 12454-B, 12454-C, or 13343-C as defined in ASTM D-1784.
    c. Elastomeric Gasketed Joints shall be used to provide a watertight seal and shall meet the requirements of ASTM D-3212.
2. ASTM F-679 –
    a. Standard Specification for "Poly (Vinyl Chloride) (PVC) Large-Diameter Plastic Gravity Sewer Pipe and Fittings". Pipe and fittings shall have a minimum stiffness of forty-six (46 psi) pounds per square inch and a minimum SDR of thirty-five (35). Pipe and fittings may be supplied in sizes ranging from eighteen (18”) inches to thirty-six (36”) inches in diameter.
    b. The pipe and fitting materials shall be made of PVC plastic having a minimum cell classification of 12364-C or 12454-C as defined in ASTM D-1784. Homopolymer PVC compounds must equal or exceed the requirements of the above listed minimum cell classification number.
    c. Integral Bell Gasket Joint shall be used to provide a watertight seal and shall meet the requirements of ASTM D-3212.
3. ASTM F-789 –
    a. Standard Specification for "Type PS-46 Poly (Vinyl Chloride) (PVC) Plastic Gravity Flow Sewer Pipe and Fittings". Pipe and fittings shall have a minimum stiffness of forty-six (46 psi) pounds per square inch. Pipe and fittings may be supplied in sizes ranging from four (4”) inches to eighteen (18”) inches in diameter.
    b. The pipe shall be made of PVC plastic having a minimum cell classification of 12164-B as defined in ASTM D-1784. The fittings shall be made of PVC plastic having a cell classification of 12454-C or 13343-C as defined in ASTM D-1784.
    c. Elastomeric Gasketed Joints shall be used to provide a watertight seal and shall meet the requirements of ASTM D-3212. Joints shall also be compatible to ASTM D-3034 joint dimensions.

B. PROFILE WALL (PVC) - All profile (open or closed) wall PVC pipe and fittings shall conform to the requirements of the appropriate ASTM listed below and modified herein. Regardless of size, open profile wall pipes will be allowed only on sections of pipe when there are no apparent service connections. Otherwise, open profile wall pipe will not be allowed.

1. ASTM F-794 –
    a. Standard Specification for "Poly (Vinyl Chloride) (PVC) Profile Gravity Sewer Pipe and Fittings Based on Controlled Inside Diameter". Pipe and fittings shall have a minimum stiffness of forty-six (46 psi) pounds per square inch. Pipe and fittings may be supplied in sizes ranging from twelve (12”) inches to forty-eight (48”) inches in diameter.

b. The pipe and fittings shall be made of PVC plastic having a minimum cell classification of 12454-B or 12364-C as defined in ASTM D-1784.
c. Gasketed Joint Systems shall be used. The integral bell gasketed joint, coupling or fitting joints shall be designed so that when assembled, the gasket will be compressed radially on the pipe spigot or in the bell to form a watertight seal. The joints shall be designed to comply with and show no leakage when tested in accordance with ASTM D-3212.
d. Closed profile PVC pipes manufactured with a gasketed joint coupling system, with no bell and spigot, may be used for slip-lining installations.
e. Couplings shall form a watertight seal when assembled with plain end pipe and show no sign of leakage when tested in accordance with ASTM D-3212.

2. ASTM F-949 –
a. Standard Specification for "Poly (Vinyl Chloride) (PVC) Corrugated Sewer Pipe with a Smooth Interior and Fittings". Pipe and fittings shall have a minimum stiffness of fifty (50 psi) pounds per square inch. Pipe and fittings may be supplied in sizes ranging from twelve (12”) inches to thirty-six (36”) inches in diameter.
b. The pipe shall be made of PVC plastic having a minimum cell classification 12454-B or 12454-C as defined in ASTM D-1784. The fittings shall be made of PVC plastic having a cell classification of 12464-B, 12464-C, or 13343-C as defined in ASTM D-1784.
c. Elastomeric Gasketed Joints shall be used to provide watertight seal and shall meet the requirements of ASTM D-3212.

C. SPECIAL PVC PIPE - Special PVC pipe and fittings shall conform to the requirements of the appropriate standards listed below or as modified herein.

1. ASTM D-2241 –
a. Standard Specifications for Polyvinyl Chloride (PVC) Pressure-rated Pipe (SDR Series). Pipe and fittings shall have a minimum SDR of thirty-two and one-half (32-1/2) and may be supplied in sizes ranging from four (4) inches to thirty-six (36) inches in diameter.
b. The pipe and fittings shall be made of PVC compounds having a cell classification of 12454-B, 12454-C, or 14333-D as defined in ASTM D-1784.
c. Elastomeric gasketed joints meeting the requirements of ASTM D-3212 shall be used to provide a watertight seal.

2. AWWA C-900 and AWWA C-905 –
a. Standards for PVC Pressure Pipe from four (4”) inches through twelve (12”) inches, and fourteen (14”) inches through thirty-six (36”) inches, respectively. Pipes shall have a minimum DR rating of eighteen (18) for diameters four (4”) inches through twelve (12”) inches. For pipes greater than twelve (12”) inches in diameter, the minimum DR shall be thirty-two and one-half (32 1/2).
b. The pipe and fittings shall be made of PVC compounds having a cell classification of 12454-A or 12454-B as defined in ASTM D-1784.
c. Elastomeric gasketed joints meeting the requirements of ASTM D-3139, when measured in accordance with ASTM-2122, shall be used to provide a watertight seal.

2.05 BACKWATER VALVES

A. Cast-Iron Backwater Valves:

1. Description: ASME A112.14.1, gray-iron body and bolted cover, with bronze seat.
2. Horizontal type; with swing check valve and hub-and-spigot ends.
3. Combination horizontal and manual gate-valve type; with swing check valve, integral gate valve, and hub-and-spigot ends.
4. Terminal type; with bronze seat, swing check valve, and hub inlet.

B. Plastic Backwater Valves:

1. Description: Horizontal type; with PVC body, PVC removable cover, and PVC swing check valve.

2.06 CLEANOUTS

A. Cast-iron Cleanouts:

1. Manufacturers: Subject to compliance with requirements.
2. Description: ASME A112.36.2M, round, gray-iron housing with clamping device and round, secured, scoriated, gray-iron cover. Include gray-iron ferrule with inside calk or spigot connection and countersunk, tapered-thread, brass closure plug.
3. Top-Loading Classification(s): Heavy Duty.
4. Sewer Pipe Fitting and Riser to Cleanout: ASTM A 74, Service class, cast-iron soil pipe and fittings.

B. PVC Cleanouts:

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

2.07 MANHOLES

A. Standard Precast Concrete Manholes:

1. Description: ASTM C 478, precast, reinforced concrete, of depth indicated, with provision for sealant joints.
2. All concrete for manhole and base shall be Class A concrete with a minimum compressive strength of 4,000 psi.
3. Diameter: 48 inches minimum.
4. Wall Thickness:
    a. The minimum wall thickness shall not less than 5-in and shall not be less than one-twelfth (1/12) of the internal diameter of the largest cone or riser.
    b. Manholes with 60-in and 48-in diameters shall have a 5-inch minimum thickness, and lengths to provide depth indicated.
    c. Manholes with 72-in diameters shall have a 6-inch minimum thickness, and lengths to provide depth indicated.
    d. Manholes with 84-in diameters shall have a 7-inch minimum thickness, and lengths to provide depth indicated.
    e. Manholes with 96-in diameters shall have an 8-inch minimum thickness, and lengths to provide depth indicated.
5. Base section shall have a 9-inch minimum floor slab thickness. Floor slab shall be integral with base section. Increase thickness of precast concrete sections or add concrete to base section as required to prevent flotation.

6. Provided riser sections as needed to achieve the required manhole depth.
7. Top section shall be eccentric-cone type unless flat-slab-top type is indicated, and top of cone of size that matches grade rings.
8. Joint sealant shall meet ASTM C 990, bitumen or butyl rubber.
9. Pipe connectors shall be resilient pipe connectors per ASTM C 923, cast or fitted into manhole walls, for each pipe connection.
10. Steps: Individual FRP steps; FRP ladder; or ASTM A 615/A 615M, deformed, 1/2-inch steel reinforcing rods encased in ASTM D 4101, PP, wide enough to allow worker to place both feet on one step and designed to prevent lateral slippage off step. Cast or anchor steps into sidewalls at 12-inch to 16-inch intervals. Omit steps if total depth from floor of manhole to finished grade is less than 60 inches.
11. Adjusting Rings: Interlocking HDPE rings with level or sloped edge in thickness and diameter matching manhole frame and cover, and of height required to adjust manhole frame and cover to indicated elevation and slope. Include sealant recommended by ring manufacturer.
12. Grade Rings: Reinforced-concrete rings, 6-inch to 9-inch total thickness, to match diameter of manhole frame and cover, and height as required to adjust manhole frame and cover to indicated elevation and slope.

B. Designed Precast Concrete Manholes:

1. Description: ASTM C 913; designed according to ASTM C 890 for A-16 (AASHTO HS20-44), heavy-traffic, structural loading; of depth, shape, and dimensions indicated, with provision for sealant joints.
2. Ballast: Increase thickness of one or more precast concrete sections or add concrete to manhole as required to prevent flotation.
3. Joint Sealant: ASTM C 990, bitumen or butyl rubber.
4. Resilient Pipe Connectors: ASTM C 923, cast or fitted into manhole walls, for each pipe connection.
5. Steps: Individual FRP steps; FRP ladder; or ASTM A 615/A 615M, deformed, 1/2-inch steel reinforcing rods encased in ASTM D 4101, PP, wide enough to allow worker to place both feet on one step and designed to prevent lateral slippage off step. Cast or anchor steps into sidewalls at 12-inch to 16-inch intervals. Omit steps if total depth from floor of manhole to finished grade is less than 60 inches.
6. Adjusting Rings: Interlocking HDPE rings with level or sloped edge in thickness and diameter matching manhole frame and cover, and of height required to adjust manhole frame and cover to indicated elevation and slope. Include sealant recommended by ring manufacturer.
7. Grade Rings: Reinforced-concrete rings, 6-inch to 9-inch total thickness, to match diameter of manhole frame and cover, and of height required to adjust manhole frame and cover to indicated elevation and slope.

C. Frames and Covers

1. Manhole frames and covers shall be to the dimensions and specifications of the current AHJ's Standard Specifications.

D. Manhole Coatings

1. High-Build Epoxy Coatings
    a. The coating material shall be a two (2) part, one hundred (100%) percent solids epoxy-resin with fibrous and flake fillers specifically designed for sanitary sewer applications. The coating material shall have the following minimum properties as listed below:

1) Tensile Strength – Minimum 8,000 psi ASTM D-638 (7 day cure at 25 deg C)
2) Tensile Elongation – Minimum 20% ASTM D-6387 day cure at 25 deg C)
3) Compressive Strength – Minimum 80 Shore D ASTM D-2240 (7 day cure at 25 deg C)
4) 25% Sulfuric Acid – 28 days without deterioration after continuous contact with fresh chemical at 25 deg C ASTM C-267
5) Solids by Volume – 100%

2. Polyurea Coating Systems
   a. The coating material shall be urethane-based one hundred (100%) percent solids resin with chemically resistant fillers specifically designed for sanitary sewer applications. The coating material, tested at 25°C, shall have the following minimum properties as listed below:
      1) Tensile Strength – Minimum 1,800 psi ASTM D-412 (7 day cure at 25 deg C)
      2) Recoverable Elongation – Minimum 300% ASTM D-412 (7 day cure at 25 deg C)
      3) Surface Hardness – Minimum 80 Shore D ASTM D-2240 (7 day cure at 25 deg C)
      4) 20% Sulfuric Acid – 28 days without deterioration after continuous contact with fresh chemical at 25 deg C ASTM C-267
      5) Solids by Volume – 100%

2.08 CONCRETE

A. General: Cast-in-place concrete according to ACI 318, ACI 350/350R, and the following:

1. Cement: ASTM C 150, Type II.
2. Fine Aggregate: ASTM C 33, sand.
3. Coarse Aggregate: ASTM C 33, crushed gravel.
4. Water: Potable.

B. Portland Cement Design Mix: 4000 psi minimum, with 0.45 maximum water/cementitious materials ratio.

1. Reinforcing Fabric: ASTM A 185, steel, welded wire fabric, plain.
2. Reinforcing Bars: ASTM A 615, Grade 60 deformed steel.

C. Manhole Channels and Benches: Factory or field formed from concrete. Portland cement design mix, 4000 psi minimum, with 0.45 maximum water/cementitious materials ratio. Include channels and benches in manholes.

1. Channels: Concrete invert, formed to same width as connected piping, with height of vertical sides to three-fourths of pipe diameter. Form curved channels with smooth, uniform radius and slope.
   a. Invert Slope: 2 percent through manhole.
2. Benches: Concrete, sloped to drain into channel.
   a. Slope: 8 percent.

D. Ballast and Pipe Supports: Portland cement design mix, 4000 psi minimum, with 0.58 maximum water/cementitious materials ratio.

1. Reinforcing Fabric: ASTM A 185, steel, welded wire fabric, plain.

2. Reinforcing Bars: ASTM A 615, Grade 60 deformed steel.

PART 3 - EXECUTION

3.01 ADOPTED PLACEMENT REQUIREMENTS

A. The installation of SANITARY SEWERAGE UTILITIES shall comply with the current edition of the AHJ's Standard Specifications.

3.02 EARTHWORK

A. Excavation, trenching, and backfilling are specified in Section 31 23 00 Excavation and Fill.

3.03 PIPING INSTALLATION

A. General Locations and Arrangements: Drawing plans and details indicate general location and arrangement of underground sanitary sewer piping. Location and arrangement of piping layout take into account design considerations. Install piping as indicated, to extent practical. Where specific installation is not indicated, follow piping manufacturer's written instructions.

B. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions for using lubricants, cements, and other installation requirements.

C. Install manholes for changes in direction unless fittings are indicated. Use fittings for branch connections unless direct tap into existing sewer is indicated.

D. Install proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.

E. When installing pipe under streets or other obstructions that cannot be disturbed, use pipe-jacking process of microtunneling.

F. Install gravity-flow, nonpressure, drainage piping according to the following:

1. Install piping pitched down in direction of flow, at minimum slope of 1 percent unless otherwise indicated.
2. Install piping NPS 6 and larger with restrained joints at tee fittings and at changes in direction. Use corrosion-resistant rods, pipe or fitting manufacturer's proprietary restraint system, or cast-in-place-concrete supports or anchors.
3. Install piping with 36-inch minimum cover.
4. Install ductile-iron, gravity sewer piping according to ASTM A 746.
5. Install PVC pipe according to ASTM D 2321 and ASTM F 1668.

3.04 MANHOLE INSTALLATION

A. General: Install manholes, complete with appurtenances and accessories indicated.

B. Install precast concrete manhole sections with sealants according to ASTM C 891.

C. Where specific manhole construction is not indicated, follow manhole manufacturer's written instructions.

D. Set tops of frames and covers flush with finished surface of manholes that occur in pavements. Set tops 3-inch above finished surface elsewhere unless otherwise indicated.

3.05 CONCRETE PLACEMENT

A. Place cast-in-place concrete according to ACI 318.

3.06 BACKWATER VALVE INSTALLATION

A. Install horizontal-type backwater valves in piping where indicated.

B. Install combination horizontal and manual gate-valve type in piping and in manholes where indicated.

C. Install terminal-type backwater valves on end of piping and in manholes where indicated.

3.07 CLEANOUT INSTALLATION

A. Install cleanouts and riser extensions from sewer pipes to cleanouts at grade. Use cast-iron soil pipe fittings in sewer pipes at branches for cleanouts and cast-iron soil pipe for riser extensions to cleanouts. Install piping so cleanouts open in direction of flow in sewer pipe.

1. Use Light-Duty, top-loading classification cleanouts in earth areas.
2. Use Heavy-Duty, top-loading classification cleanouts in vehicle-traffic service areas.

B. Set cleanout frames and covers in cast-in-place concrete block, 18-inch by 18-inch by 12-inch deep.

C. Set cleanout frames and covers in earth areas with tops 1-inch above surrounding earth grade.

D. Set cleanout frames and covers in concrete pavement and roads with tops flush with pavement surface.

3.08 CONNECTIONS

A. Connect nonpressure, gravity-flow drainage piping to building's sanitary building drains.

B. Make connections to existing piping and underground manholes.

C. Use commercially manufactured wye or saddle fittings with stainless steel bands for piping branch connections. Remove section of existing pipe, install wye or saddle fitting into existing piping, and encase entire wye or saddle fitting with not less than 2 ft depth x 2.2 ft width x 2.0 ft length of concrete with 28-day compressive strength of 3000 psi.

D. Make branch connections from side into existing piping, NPS 4 to NPS 20. Remove section of existing pipe, install wye fitting into existing piping, and encase entire wye with not less than 6 inches of concrete with 28-day compressive strength of 3000 psi.

E. Make branch connections from side into existing piping, NPS 21 or larger, or to underground manholes by cutting opening into existing unit large enough to allow 3 inches of concrete to be packed around entering connection. Cut end of connection pipe passing through pipe or structure wall to conform to shape of and be flush with inside wall unless otherwise indicated. On outside of pipe or manhole wall, encase entering connection in 6 inches of concrete for minimum length of 12 inches to provide additional support of collar from connection to undisturbed ground.

F. Use concrete that will attain a minimum 28-day compressive strength of 3000 psi unless otherwise indicated.

G. Use epoxy-bonding compound as interface between new and existing concrete and piping materials.

H. Protect existing piping and manholes to prevent concrete or debris from entering while making tap connections. Remove debris or other extraneous material that may accumulate.

3.09 MANHOLE COATINGS

A. Surface Preparation

1. The Contractor shall use cleaning methods that are adequate to remove loose material from the manhole. All existing manhole steps or ladder are to be removed. The Contractor shall take all necessary precautions to prevent falling

debris from damaging the manhole trough and/or entering the sewer. Infiltration through existing manhole walls that would adversely affect the material used in the annular space shall be eliminated or reduced to an acceptable level.

2. Mechanical cleaning shall be done to provide a good bond between the epoxy coating and the substrate. Water blasting with a minimum of five thousand (5,000 psi) pounds per square inch shall be done to remove oil, grease and foreign materials from all surfaces to be coated. For brick manholes, use a minimum of six thousand (6,000 psi) pounds per square inch of water pressure. In areas where the concrete has become softened due to chemical attack, several millimeters of the wall surface shall be removed using water pressures of twenty-five thousand (25,000 psi) pounds per square inch to thirty-five thousand (35,000 psi) pounds per square inch, or as recommended by the coating manufacturer, to ensure that a sound substrate is exposed. Surfaces shall be made damp or dry as required by the manufacturer before application of coating system begins.

B. Application

1. The material shall be mixed and applied, in two (2) or three (3) coats, in accordance with the manufacturer's written instructions, using approved equipment. When applying a Polyurea coating, all surfaces to be coated shall be primed as required by the manufacturer. The material shall be applied to all interior surfaces of the manhole with a minimum thickness of one hundred (100) mils.
2. The Contractor shall allow a minimum of two (2) hours cure time before returning the manhole to active flow conditions or as recommended by the manufacturer. After seven (7) day cure, the liner's surface shall be free of runs, sags, and other irregularities that indicate improper application practice. When directed by the Engineer, liner shall be repaired following the manufacturer's recommendation and to the Engineer's satisfaction.

3.10 IDENTIFICATION

A. Comply with requirements in Section 31 23 00 Excavation and Fill for underground utility identification devices. Arrange for installation of green warning tapes directly over piping and at outside edges of underground manholes.
B. Use warning tape or detectable warning tape over ferrous piping.
C. Use detectable warning tape over nonferrous piping and over edges of underground manholes.

3.11 FIELD QUALITY CONTROL

A. Deflection Testing

1. Deflection tests shall be performed not less than thirty (30) days after backfill has been placed. The maximum allowable deflection shall not exceed five (5%) percent of the pipe's base internal diameter (Base ID). Tests must be run using a rigid ball or mandrel with a diameter equal to 95% of the inside diameter of the pipe taking into account manufacturing tolerances. Tests must be performed without mechanical pulling devices. Base ID for PVC pipes shall be calculated from measurements taken in accordance with ASTM D 2122 and according to procedures outlined in Appendix XI of ASTM D 3034. For PE pipes Base ID shall be calculated from measurements taken in accordance with ASTM D 2122 and according to procedures recommended by the manufacturer and approved by

the Engineer. For other flexible pipes, base ID shall be calculated in accordance with the manufacturer's recommended procedures and approved by the Engineer.

2. A mandrel (go/no-go) device cylindrical in shape shall be hand-pulled by the Contractor through all sewer lines. Any sections of pipe not passing the mandrel test shall be uncovered and the Contractor, at no additional cost to the City, shall replace the pipe to the satisfaction of the Engineer. The repaired sections shall be re-tested. All tests for pipes twenty-four inch (24") and larger shall be performed in the presence of the Engineer.
3. In lieu of mechanical measurement of deflection by a mandrel, manual measurement can be performed using an internal micrometer or telescoping gage accurate to plus or minus (±) one-thousandth (0.001") inch. The manual measurement of the vertical internal diameter shall be taken at the centerline of the installed pipe.

B. Leakage Testing

1. After backfilling has been completed, the Contractor shall conduct infiltration, exfiltration or air tests. All tests shall be performed in the presence of the Engineer for pipes twenty-four inches (24") and larger. Immediately prior to conducting a test, the ground water level shall be determined by boring a vertical hole adjacent to the pipe and measuring the distance to the water level, or by the use of a one-inch (1") diameter pipe installed horizontally through the upstream manhole wall with a clear plastic tube connected to the pipe and extending vertically.
2. Infiltration Test
    a. Where sewers are laid under the groundwater, infiltration testing shall be conducted. If at any time the infiltration between two adjacent manholes is observed and measured to exceed ten (10) gallons per inch of nominal pipe diameter per mile of sewer per day. The Contractor shall locate the leakage and shall make such repairs as are necessary to reduce the infiltration. The infiltration shall be measured under the direction of the Engineer by use of a weir or other suitable flow rate-measuring device furnished and installed by the Contractor.
3. Exfiltration Test
    a. Where sewers are laid above the groundwater table, exfiltration testing shall be conducted. Exfiltration tests shall be conducted by blocking off the other openings in the upper manhole and plugging the line where it enters the lower manhole of the reach to be tested, filling the line and the manhole with water at least five foot (5') higher than the top of the pipe or five feet (5') higher than the ground water elevation whichever is higher, and measuring the water required to keep the water level in the manhole at a constant elevation. The test section shall be filled not less than twelve (12) hours prior to testing. The total exfiltration shall not exceed ten (10) gallons per inch of nominal pipe diameter per mile (idm) of pipe per day for each reach tested. For purposes of determining the maximum allowable leakage, manholes shall be considered as sections of pipe having an idm equal to the diameter times depth of the manhole. The exfiltration test shall be maintained on each reach for at least two (2) hours or longer if, in the opinion of the Engineer, this is necessary to locate all leaks.

b. The Contractor shall provide all necessary piping between the reach to be tested and the source of water supply, together with equipment and materials required for the tests. The methods used and the time of conducting the exfiltration tests shall be subject to the approval of the Engineer.

c. If the leakage in any reach exceeds the allowable maximum, the Contractor shall locate the leakage and shall make such repairs as are necessary for the pipe to pass testing. The pipe reach shall be retested after the leaks are repaired.

4. Air Test

a. Air tests shall be conducted on each manhole-to-manhole section of sewer. The air test shall be performed in accordance with the following specifications.

b. Equipment - Cherne Air-Loc Equipment as manufactured by Cherne Industrial of Hopkins, Minnesota or approved equal. Equipment used shall meet the following requirements:

1) Pneumatic plugs shall have a sealing length equal to or greater than the diameter of the pipe to be inspected.

2) Pneumatic plugs shall resist internal test pressure without requiring external bracing or blocking.

c. All air used shall pass through a single control panel.

d. Three (3) individual hoses shall be used for the following connections:

1) From the control panel to pneumatic plugs for inflation;

2) From the control panel to sealed line for introducing the low-pressure air; and

3) From sealed line to control panel for continually monitoring the air pressure rise in the sealed line.

e. Procedures

1) All pneumatic plugs shall be seal-tested before being used in the actual test installation. One length of pipe shall be laid on the ground and sealed at both ends with the pneumatic plugs to be checked. Air shall be introduced into the plugs to twenty-five (25 psi) pounds per square inch gauge. The sealed pipe shall be pressurized to five (5 psi) pounds per square inch gauge. If a ground water level over the top of the pipe is present, the pressure in psig shall be increased by the height of ground water level above top of pipe at upstream manhole divided by two and one third (2 1/3). The plugs shall hold against this pressure without bracing and without movement of the plugs out of the pipe.

2) After a manhole reach of pipe has been backfilled and cleaned, and the pneumatic plugs are checked by the above procedures, the plugs shall be placed in the line at each manhole and inflated to twenty-five (25 psi) pounds per square inch gauge. Low-pressure air shall be introduced into this sealed line until the internal air pressure reaches four (4 psi) pounds per square inch gauge. At least two (2) minutes shall be allowed for the air pressure to stabilize. After the stabilization period (three and one half (3 ½ psi) pounds per square inch gauge minimum pressure in the pipe), the air hose from the control panel to the air supply shall be disconnected.

The portion of the line being tested shall be termed "acceptable" if the time required in minutes for the pressure to decrease from three and one half (3 ½ psi) to two and one half (2 ½ psi) pounds per square inch gauge is not less than that shown in the following table:

| Pipe Nominal Size (Inches) | Minimum Test Time (min:sec) | Length for Minimum Time (Feet) |
|---|---|---|
| 6 | 2:50 | 751 |
| 8 | 3:47 | 564 |
| 10 | 4:43 | 450 |
| 12 | 5:40 | 376 |

3) If the air leakage in any reach exceeds the allowable, it shall be re-tested after the leaks are repaired.

3.12 CLEANING

A. Clean dirt and superfluous material from interior of piping. Flush with potable water.

END OF SECTION 33 3000

SECTION 33 3200

WASTEWATER UTILITY PUMPING STATIONS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. The work under this section of the Specifications includes all labor, materials, equipment, and services necessary for WASTEWATER UTILITY PUMPING STATIONS as shown on the Drawings and herein specified and in accordance with the Contract Documents. All costs for labor, materials, equipment, and services necessary for WASTEWATER UTILITY PUMPING STATIONS shall be included in the bid prices for the work.

1.03 SCOPE OF WORK

A. Contractor shall provide a complete submersible pumping system. The system shall be a complete, fully integrated process system provided by a single Coordinating Supplier who shall furnish all labor, equipment, materials, and incidentals required and shall supervise the installation, start-up, and testing using qualified technicians and other specialists. The supplier shall coordinate the equipment requirements with the mechanical and electrical requirements of the Contract Documents, shall integrate the equipment furnished with the requirements shown on the electrical drawings, and provide complete installation and interconnection drawings and diagrams required for installation, start-up, testing and adjustment.

B. The pumping system for the lift station shall consist of two (2) submersible pumps, the electrical components, check valves, plug valves, access hatch covers, and a level control system as shown on the Contract plans.

1.04 DELIVERY, STORAGE, HANDLING

A. Individual equipment components shall be crated in structurally adequate packing containers to prevent damage during shipping, facilitate ease of handling and to provide suitable protection from weather for extended storage at the jobsite prior to installation. Packing containers shall be permanently labeled with appropriate equipment identification, shipping address and return address. Packing list shall be provided with equipment at time of delivery.

B. Electrical equipment shall be kept thoroughly dry at all times and shall be stored indoors. Equipment storage shall be protected and maintained in accordance with the manufacturer's recommendations. Equipment shall not be stored directly on the ground.

C. Contractor shall utilize equipment and tools of adequate size suitable for unloading, transporting, storing and supporting the equipment during installation. Caution shall be employed to prevent equipment damage resulting from abrupt contact with other materials or equipment.

1.05 RELATED REQUIREMENTS

A. 31 23 00 Excavation and Fill

B. 33 30 00 Sanitary Sewerage Utilities

1.06 DEFINITIONS

A. AHJ – Authority Having Jurisdiction

1. Tahlequah Public Works Authority

2. Oklahoma Department of Environmental Quality (ODEQ)

1.07 ACTION SUBMITTALS

A. Product Data

1. Pumps
2. Motors
3. Controls
4. Wet Well
5. Valve Vault
6. Access Doors
7. Valves

1.08 QUALITY ASSURANCE

A. The Contractor's attention is directed to the fact that the Submersible Pumping System is an integrated system which shall be furnished, factory assembled and integrated by one manufacturer or supplier who shall provide all of the equipment and appurtenances regardless of the manufacturer of the various components all under the Submersible Pumping System pay items. Substitution of functions specified will be subject to approval of the Engineer.

B. The materials or equipment so specified have been selected as being suitable for the service anticipated and will be regarded as standard. The Contractor should prepare his bid on the basis of the particular equipment and materials specified. The awarding of the contract will constitute a contractual obligation on the part of the Contractor to furnish the specified equipment and materials.

C. Pump Substitutions: In order to allow sufficient time for the Engineer to evaluate the type and quality of equipment being offered by the manufacturers or coordinating supplier not specified, the latter shall submit fifteen (15) days prior to the date set for the opening of bids on this project, the following descriptive literature and drawings for all equipment being offered under this item. Failure to provide a complete system and equipment description may result in non-acceptance of the equipment manufacturer if a bidder proposes this alternate equipment with their bid:

1. Specifications and drawings showing the dimensions and detailed description of the equipment offered.
2. General installation, piping and wiring details and arrangements for instruments and accessories.
3. Cost deduct to use the substitution over the specified equipment.

The manufacturer or supplier submitting equipment to be considered as a substitution shall pay the Engineer for his/her time to review the information. Engineering fees and required time to review shall be determined by the reviewing Engineer.

Equipment substitutions that have been deemed acceptable will be listed by addendum no later than five (5) days before the bid date.

D. The entire System shall be designed, coordinated and supplied by a company regularly engaged in the business of designing and fabricating pumping systems for a minimum of fifteen (15) years. Acceptable pump manufacturers are Hydromatic Pump as provided by Haynes Equipment Company, Oklahoma City, Oklahoma.

1.09 WARRANTY

A. The manufacturer shall warrant the equipment to be of quality construction, free from defects in materials and workmanship. The warranty shall become effective upon

acceptance by the Owner or Owner's authorized agent, or six (6) months after date of shipment, whichever occurs first.

B. The equipment, apparatus, and parts furnished shall be warranted for a period of one (1) year, excepting only those items that are normally consumed in service, such as oil, grease, packing gaskets, O-rings, etc. The manufacturer shall be solely responsible for the warranty of the equipment and all components.

C. Upon request from the Engineer and/or the Owner, the manufacturer shall demonstrate proof of financial responsibility with respect to performance and delivery date. In addition, the manufacturer shall provide proof of evidence of facilities, equipment, and skills required to produce the equipment specified herein and provide technical service and replacement parts.

D. Components failing to perform as specified by the Engineer, or as represented by the manufacturer, or proven defective in service during the warranty period, shall be replaced, repaired, or satisfactorily modified by the manufacturer without cost of parts or labor to the Owner.

1.10 TOPOGRAPHIC SURVEY

A. OWNER has or will perform a survey of the site, stake the property limits, and provide a reference benchmark elevation. CONTRACTOR shall be responsible for any additional offset staking or layout survey required to locate improvements and control grade of improvements. Be responsible for the proper location and level of the work and for the maintenance of reference lines and benchmarks. Any re-staking requested by the CONTRACTOR shall be done at his expense.

1.11 UNDERGROUND UTILITIES

A. CONTRACTOR shall contact OKIE (811 or 1-800-522-OKIE) prior to construction for locating existing utilities.

B. The underground utilities shown on the Drawings have been located from field survey surface information and existing drawings. ENGINEER and Surveyor make no guarantee that the underground utilities shown comprise all such utilities in the area, either in service or abandoned. The underground utilities are located as accurately as possible from information available; however, ENGINEER and Surveyor further do not guarantee that the underground utilities shown are in the exact location indicated either vertically or horizontally. ENGINEER and Surveyor have not physically located the underground utilities by probing, excavating, hydrovac, or by any other means.

C. CONTRACTOR shall notify all utility companies and governmental agencies who may have utility lines on or about the premises or who may be affected by the construction. Notice shall be given no less than twenty-four hours prior to any work that may interfere with a utility.

D. All existing structures, improvement and utilities designated to remain shall be adequately protected from damage that might otherwise occur due to construction operations. Where construction comes in close proximity to existing structures, utilities or appurtenances, or if it becomes necessary to move services, poles, guy wires, pipe lines or other obstructions, CONTRACTOR shall notify and cooperate with the owner of the utility, structure, or appurtenance. The utility lines and other existing structures shown on the plans are for information only and are not guaranteed to be complete or accurate as to location and/or depth. CONTRACTOR shall be liable for damage to any utilities resulting from the CONTRACTOR's operations. During construction, all fire hydrants, valve boxes, fire or police call boxes and other existing utility controls shall be left intact, unobstructed and accessible unless noted on the plan.

E. Contractor shall satisfy themselves as to the actual existing subsurface conditions, including but not limited to the depth, location and sizes of pipe or conduits of various

kinds in place prior to beginning work. Where the exact depth of any utility or obstruction is not shown on a plan, excavation shall be made prior to reaching the obstruction in order to determine adjustments in grade if needed to prevent interference. Redesign to eliminate conflicts may be necessary.

1.12 CONSTRUCTION CONTROL

A. Do not commence work until temporary erosion and sedimentation control measures are in place.

B. CONTRACTOR shall be responsible for properly laying out the work, and for lines and measurements for the work executed under the Contract Documents. Verify the figures shown on the Drawings before ordering any materials and laying out the work, and report errors or inaccuracies in writing to the ENGINEER before commencing work. The ENGINEER or his representative will in no case assume the responsibility for laying out the work.

C. Existing survey points other than those shown on the Drawings shall not be considered as acceptable control points unless approved by the ENGINEER. If approval is secured, CONTRACTOR remains responsible for maintaining them and for their accuracy. Be responsible for preserving all existing iron or metal, and all concrete survey points or monuments for the construction period.

1.13 PROJECT CONDTIONS

A. UTILITY INTERRUPTIONS

1. Do not interrupt any utility serving facilities occupied by Owner or others unless permitted by OWNER and the owner(s) of the utility. Temporary utility service shall be provided for any interruption. Notify OWNER and ENGINEER one week (7 days) in advance of proposed interruption of utility.

B. SUBSURFACE CONDITIONS

1. A geotechnical report has been prepared for this Project and is available for information only. The opinions expressed in this report are those of geotechnical engineer and represent interpretations of subsoil conditions, tests, and results of analyses conducted by geotechnical engineer. Owner will not be responsible for interpretations or conclusions drawn from the data.

C. EXCAVATION AND TRENCH SAFETY SYSTEMS

1. CONTRACTOR shall be responsible for complying with State laws and Federal regulations relating to excavation and trench safety, including those which may be enacted during the performance under this Contract. CONTRACTOR is advised that Federal Regulations 29 C.F.R. 1926.650-1926.652 have been, in their most recent version as amended, in effect since January 2, 1990. CONTRACTOR shall fully comply with the U.S. Department of Labor Occupational Safety and Health Administration (OSHA) regulations pertaining to excavations, trenching, and shoring and shall provide and familiarize its employees involved in excavation and trenching with the provisions in OSHA Pamphlet Number 2226, Excavating and Trenching Operations.

1.14 HAZARDOUS CONDITIONS

A. If CONTRACTOR encounters a Hazardous Environmental Condition or if CONTRACTOR or anyone for whom CONTRACTOR is responsible creates a Hazardous Environmental Condition, CONTRACTOR shall immediately: (i) secure or otherwise isolate such condition; (ii) stop all Work in connection with such condition and in any area affected thereby (except in an emergency); and (iii) notify OWNER and ENGINEER (and promptly thereafter

confirm such notice in writing). OWNER shall promptly consult with ENGINEER concerning the necessity for OWNER to retain a qualified expert to evaluate such condition or take corrective action, if any.

PART 2 PRODUCTS

2.01 SUBMERSIBLE PUMPS

A. GENERAL - Furnish and install a quantity of two (2) pull-up submersible pumping units. The pumps shall be clockwise rotation and constructed to automatically connect to the discharge piping when lowered into place.

B. CONDITIONS OF OPERATION - Each pump shall be capable of providing the following hydraulic conditions when pumping domestic sewage:

| | |
|---|---|
| Pump | Hydromatic HPGFH |
| Capacity | 86 GPM |
| Total Dynamic Head | 24 ft |
| Motor HP | 3 HP |
| Maximum Speed | 1750 RPM |
| Minimum Shutoff Head | 35 Feet |

C. The pump volute, motor and seal housing shall be high quality gray cast iron, ASTM A-48, Class 30. The pump discharge shall be fitted with a 4" standard ASA 125 lb. flange, faced and drilled. All external mating parts shall be machined and Nitrile O-ring sealed on a beveled edge. Gaskets shall not be acceptable. All fasteners exposed to the pumped liquids shall be 300 series stainless steel

2.02 ELECTRICAL POWER CORD

A. Electrical power cord shall be SOOW, W, or GGC, water resistant 600V, 90°C, UL and CSA approved and applied dependent on amp draw for size.

B. The power cable entry into the cord cap assembly shall first be made with a compression fitting. Each individual lead shall be stripped down to bare wire at staggered intervals, and each strand shall be individually separated. This area of the cord cap shall then be filled with an epoxy compound potting which will prevent water contamination to gain entry even in the event of wicking or capillary action.

C. The power cord leads shall then be connected to the motor leads with extra heavy connectors with a screwed wire-to-wire connection.

2.03 MOTOR

A. The stator, rotor and bearings shall be mounted in a sealed submersible type housing. The stator windings shall have Class F insulation (155°C or 311°F) or Class H insulation (180°C or 356°F) and a dielectric oil-filled motor, NEMA B design.

B. The pump and motor shall be specifically designed so that they may be operated partially or completely submerged in the liquid being pumped.

C. Stators shall be securely held in place with a removable end ring and threaded fasteners so they may be easily removed. No special tools shall be required for pump and motor disassembly.

D. Pump shall be equipped with heat sensors. The heat sensor shall be a low resistance, bi-metal disc that is temperature sensitive. It shall be mounted directly on the stator windings and sized to open at 120°C and automatically reset at 30–35°C differential. The sensors shall be connected in series with motor starter coil so that the starter is tripped if a heat sensor opens. The motor starter shall be equipped with overload heaters so all normal overloads are protected by an external heater block.

2.04 BEARINGS AND SHAFT

A. An upper radial bearing and a lower thrust bearing shall be required. These shall be lubricated by the dielectric oil that fills the motor housing.

B. The shaft shall be machined from a solid 416 series stainless steel forging and be a design that is of large diameter with minimum overhang to reduce shaft deflection and prolong bearing life..

2.05 SEALS

A. The rotor and stator in the motor housing shall be separated and protected from the pumped liquid by an oil-filled seal housing incorporating two type 21 carbon ceramic mechanical seals mounted in tandem. This seal housing shall be equipped with two moisture sensing probes installed between the seals, and the sensing of moisture in the seal chamber shall be automatic, continuous, and not require the pump be stopped or removed from the wetwell.

2.06 IMPELLER

A. Impeller shall be brass multivane, semi-open, non-overloading design. They can either be factory or field trimmed to meet specific performance conditions. Impellers shall be dynamically balanced at the factory and machined for threading on to the pump shaft.

2.07 GRINDER CUTTERS

A. The combination centrifugal pump impeller and grinder unit shall be attached to the common motor and pump shaft made of 416SS. The grinder unit shall be on the suction side of the pump impeller and discharge directly into the impeller inlet, leaving no exposed shaft to permit packing of ground solids. The grinder shall consist of two stages. The cutting action of the second stage shall be perpendicular to the plane of the first cut for better control of the particle size. The grinder shall be capable of grinding normal domestic sewage. Both stationary and rotating cutters shall be made of 440C stainless steel hardened to Rockwell 60C and ground to close tolerance.

B. The upper(axial) cutter and stationary cutter ring shall be reversible to provide new cutting edges to double life. The stationary cutter ring shall be a slip fit into the suction opening of the volute and held in place by three (3) 300 series stainless steel screws and a retaining ring. The lower(radial) cutter shall macerate the solids against the I.D. of the cutter ring and extrude them through the slots of the cutter ring. The upper(axial) cutter shall cut off the extrusions, as they emerge from the slots of the cutter ring to eliminate any roping effect that may occur in single stage cutting action. The upper(axial) cutter shall fit over the hub of the impeller and the lower(radial) cutter shall be slip fit and secured by means of peg and hole and rotate simultaneously with the rotation of the shaft and impeller. The grinding mechanism shall be locked to the shaft by a 300 series stainless steel countersunk washer in conjunction with a 300 series stainless steel flat head cap screw threaded into the end of the shaft.

~~2.08 CASING~~

~~A. The casing shall be of the end suction volute type having sufficient strength and thickness to withstand all stress and strain from service at full operating pressure and load. The casing shall be of the centerline discharge type equipped with an automatic pipe coupling arrangement for ease of installation and piping alignment. The design shall be such that the pumps will be automatically connected to the discharge piping when lowered into position with the guide rails. The casing shall be accurately machined and bored for register fits with the suction and casing covers.~~

~~B. A volute case wear ring shall be provided to minimize impeller wear. The wear ring shall be 85-5-5-5 red brass or 80-10-10 bronze, ASTMB-43 and held by 300 series stainless steel~~

~~fasteners. The wear ring shall be easily replaceable in the field. Wear rings of any other material shall not be acceptable.~~

2.09 CONTROLS

A. Electrical power to be furnished to the site will be 1 phase, 60 Hertz, 230 volts.

B. The control circuitry shall be designed to operate on 115 +/-10% volts, 60 Hertz, single phase current, and shall control pumps driven by 5 & 7.5HP motors at 1750 RPM. The control panel shall consist of circuit breaker and controls for each pump motor actuated by a liquid level control system with all components mounted in one common enclosure. The control assembly shall provide means to operate each pump manually or automatically. When operated in the automatic mode, the control assembly shall provide means to automatically alternate the position to the "lead", "lag" and spare pumps after each pumping cycle.

C. The pump station controls shall conform to third party safety certification. The panel shall bear a serialized UL label listed for “Enclosed Industrial Control Panels”. The enclosure, and all components shall be mounted on the sub-panel or control cover shall conform to UL descriptions and procedures.

D. PANEL ENCLOSURE

1. The complete control assembly shall be contained in one NEMA 3R steel enclosure.
2. All seams shall be free of burrs and free of open voids to prevent leakage. The enclosure shall be constructed in conformance with applicable sections of the National Electrical Manufacturer's Association (NEMA). Enclosure construction to be NEMA 3 per NEMA Standard ICS-1970, Paragraph ICS1-110.12.
3. The enclosure shall be equipped with a removable inner swing panel fabricated of steel, mounted on lift off hinges. The inner swing panel shall be of adequate size to completely cover all wiring and components mounted on the back panel and shall make provision for the mounting of all basic and optional controls and instruments. The inner swing panel shall have a minimum horizontal swing of 90° and shall be held in the closed position with straight slot screws.
4. The door shall be mounted on a continuous (piano-type), vertical, steel hinge, sealed around its entire perimeter and held in the closed position with a three pad-lockable draw pull latches. The door shall have a minimum horizontal swing of 165°.
5. The enclosure shall be furnished with a removable back panel fabricated of steel, secured to the enclosure on collar studs. The back panel shall be of adequate size to accommodate all basic and optional components.
6. There shall be no holes in the enclosure for mounting the enclosure or mounting within the enclosure.
7. All control wiring shall conform to the National Electric Code. Wires connected to components mounted on the enclosure door shall be bundled and tied in accordance with good commercial practice. Bundles shall be made flexible at the hinged side of the enclosure. Adequate length and flex shall be provided to allow the door to swing to its full open position without undue stress or abrasion on the wire or insulation. Bundles shall be held in place on each side of the hinge by mechanical fastening devices.
8. The motor control shall be completely wired at the factory, except for the power feeder lines, in accordance with applicable wiring standards set forth by the National Electric Code (NEC).
9. All components shall be electrically grounded to a common ground lug mounted on the control panel sub plate. Upon installation of lift station, and before

connection of any power feeder lines, contractor shall extend grounding wire from lug to external ground in accordance with local electrical code.

E. COMPONENTS

1. All motor branch circuit breakers, and control relays shall be securely fastened to the removable back panel with screws. Properly sized NEMA rated Square-D Class 8536 motor contactors shall be provided.
2. A properly sized thermal-magnetic air circuit breaker shall be furnished for each submersible pump motor and shall have a symmetrical rms interrupting rating of 14,000 amperes at 460 volts. All circuit breakers shall be sealed by the manufacturer after calibration to prevent tampering. A mechanical disconnect mechanism shall be installed on each circuit breaker to provide a means of disconnecting power to the pump motors. Operator handles for the disconnect mechanisms shall be located on the exterior of the inner swing panel with interlocks which permit the swing panel to be opened only when the circuit breakers are in the "OFF" position.
3. A padlocking operating mechanism shall be installed on each motor circuit breaker. Operator handles for the mechanism shall be located on the exterior of the control compartment door, with interlocks which permit the door to be opened only when the circuit breakers are in the "off" position.
4. A switch shall be provided to permit the station operator to select automatic alternation of the pumps, to select pump number one to be the lead pump for each pumping cycle or to select pump number two to be the lead pump for each pumping cycle. Selector switch shall be standard duty, rated NEMA 4X, with contacts rated NEMA A600 minimum.
5. Pump mode selector switches shall be connected to permit manual start and manual stop for each pump individually, and to select automatic operation of each pump under control of the liquid level control system. Manual operation shall override the liquid level control system. Selector switch shall be standard duty, rated NEMA 4X, with contacts rated NEMA A600 minimum.
6. A pump alternation shall be provided by either the use of electrical/mechanical relay or a PLC. Pump alternator shall operate after pump shutdown.
7. Control panel shall be equipped with 24 VDC LED pilot light for each pump motor. Light shall be wired in parallel with the related pump motor starter to indicate that the motor is on.
8. The pump control panel shall be equipped to terminate pump operation due to high motor winding temperature or moisture in the motor housing and shall utilize the contacts in the pump motor. If either event should occur, the motor starter will drop out and a mechanical indicator, visible on the inner door, shall indicate the pump motor has been shutdown. The pump motor shall remain locked out until the condition has been corrected and manually reset. Control panel shall be equipped with one 24 VDC LED pilot light for each pump motor to indicate a pump fail condition.
9. The motor control center shall be equipped with a duplex grounding receptacle located on the exterior of the enclosure in weatherproof box. The receptacle circuit shall be protected by a 15 ampere thermal magnetic circuit breaker.
10. Lift station manufacturer shall furnish 115 Volt, A.C. 40-watt, vapor-tight alarm light with red globe, guard and mounting hardware. The contractor shall mount, wire and run conduit to the light as shown on the plans. Wiring shall be connected to the appropriate terminal blocks in the motor control center as shown on the lift station wiring schematic.

11. The control panel shall be equipped to monitor the incoming power and shut down the pump when required to protect the motors from damage caused by phase reversal, phase loss, voltage unbalance greater than 5% or voltage less than 83% of nominal. A time delay shall be provided to minimize nuisance trips. The motors shall automatically restart when power conditions return to normal. Control panel shall be equipped with a 24 VDC LED pilot light to indicate power failure.
12. The control circuit shall contain a pump delay circuit to prevent both pumps from simultaneous starting following a power failure.
13. An adequately sized control transformer in enclosure suitable for mounting outdoors shall be provided to provide single phase 115 volt power for the pump controls, duplex receptacle, and telemetry system. The primary side of the transformer shall be protected by a thermal magnetic air circuit breaker, specifically sized to meet the power requirements of the transformer. A mechanical operating mechanism shall be installed on the circuit breaker to provide a means of disconnecting power to the transformer. The operating handle for the mechanism shall be located on the swing door of the control panel, with interlocks which permit the swing door to be opened only when the circuit breaker is in the “OFF” position.
14. A 120 Volt AC alarm horn in a weatherproof enclosure shall be provided for remote mounting. The horn shall have a sound output of not less than 85 decibels at ten feet. A push to silence button shall also be provided.
15. An alarm silence switch and relay shall be provided to permit maintenance personnel to de-energize the external alarm device while corrective actions are underway. After silencing the alarm device, manual reset of the signal relay shall provide automatic reset of the alarm silence relay.

F. LEVEL CONTROL SYSTEM

1. The level control system shall start and stop the pump motors in response to changes in wet well levels, as set forth herein.
2. The level control system shall be the mercury float switch type, incorporating floats secured to a vertical pipe in the wet well. Rising and falling liquid level in the wet well causes switches within the floats to open and close, providing start and stop signals for the level control components.
3. The level control system shall start the motors for one pump when the liquid level in the wet well rises to the "lead pump start level". When the liquid is lowered to the "pump stop level", the system shall stop this pump. These actions shall constitute one pumping cycle. Should the wet well level rise to the "lag pump start level", the system shall start the second pump so that both pumps are operating to pump down the well. Both pumps shall stop at the same "stop" level. Should either the lead or lag pump or both fail to start, the spare pump shall be started and operate on the float control system.
4. The level control system shall utilize the pump alternator to select first one pump, then the second pump, then the third pump, to run as lead pump for a pumping cycle. Alternation shall occur at the end of a pumping cycle.
5. Pump station manufacturer shall furnish four (4) float switch assemblies for installation by the contractor. Each switch shall contain a mercury-type switch sealed in a polypropylene housing, and with sufficient length of cable, but not less than 20 feet of cable.
6. Pump station manufacturer shall furnish a separate float switch assembly, signal relay, for high water alarm function. Should the wet well level rise to the high water alarm level, the float switch assembly and relay shall energize the signal

relay. The signal relay shall complete a 115-volt AC circuit for an external alarm device. A standard duty, NEMA 4X pilot light mounted in the control panel shall indicate that a high wet well level exists..

G. PRECAST WET WELL BASINS

1. Precast wet well basins shall be constructed of Class A 5,000 psi concrete at 28-days.
2. Reinforcing steel shall be provided per ASTM A-615 / A-185.
3. Reinforcing shall meet AASHTO HS 20-44 loading
4. Base riser section shall be equal to or exceed ASTM C-357.
5. Riser sections shall be equal to or exceed ASTM C-478.
6. Shop drawings of all pre-cast structures shall be submitted to engineer for review and approval prior to structure procurement.
7. Precast wet well basins shall be constructed in accordance with ASTM C-478. All sections shall be installed complete with O-ring gaskets at each joint.
8. Pre-cast dimensions shall meet or exceed the requirements of ASTM C-478. The minimum wall thickness shall not be less than one-twelfth (1/12) of the internal diameter of the largest cone or riser section or 6-in, whichever is greater.
9. First joint in wet well basin wall shall not be less than 4-ft from floor of structure.
10. Wet well basins shall be finished with a pre-cast solid slab top with frames and grates according to the pump manufacturer requirements. Shop drawings to be submitted to engineer for review and approval prior to procurement.
11. All lifting holes shall be repaired with a mixture of cement and sand grout firmly packed.
12. Wet well steps and ladders shall be constructed according to Section 13 of ASTM C-478.
13. Provide neoprene-EPDM blended compound boot that meet the requirements of ASTM C-923 at the manhole/pipe interface unless otherwise indicated on the drawings or required by the pipe manufacturer. Contractor shall establish a water-tight connection at interface.

H. VALVE VAULT

1. Valve vault shall be constructed of Class A 5,000 psi concrete at 28-days.
2. Reinforcing steel shall be provided per ASTM A-615 / A-185.
3. Reinforcing shall meet AASHTO HS 20-44 loading
4. Base riser section shall be equal to or exceed ASTM C-357.
5. Riser sections shall be equal to or exceed ASTM C-478.
6. Shop drawings of all pre-cast structures shall be submitted to engineer for review and approval prior to structure procurement.
7. Valve vault shall be constructed in accordance with ASTM C-478. All sections shall be installed complete with O-ring gaskets at each joint.
8. Dimensions shall meet or exceed the requirements of ASTM C-478. The minimum wall thickness shall not be less than one-twelfth (1/12) of the internal diameter of the largest cone or riser section or 6-in, whichever is greater.
9. Valve vault shall be finished with a pre-cast solid slab top with frames and grates according to the pump manufacturer requirements. Shop drawings to be submitted to engineer for review and approval prior to procurement.
10. All lifting holes shall be repaired with a mixture of cement and sand grout firmly packed.
11. Provide neoprene-EPDM blended compound boot that meet the requirements of ASTM C-923 at the manhole/pipe interface unless otherwise indicated on the

drawings or required by the pipe manufacturer. Contractor shall establish a water-tight connection at interface.

I. CHECK VALVES

1. Swing type check valves shall be constructed with heavy cast iron body (ASTM A-216 Class B) with bronze seat and disc ring. Check valves shall be equipped with outside lever and adjustable weight. The valves must be tight seating and must operate without water hammer or shock. All check valves shall be rated for working pressures of 150 psi except where specifically noted otherwise.
2. Swing type check valves shall meet the requirements of AWWA Standard C5085.
3. Check valves shall be Dezurik/APCO or approved equal.

J. PLUG VALVES

1. Eccentric Plug Valves shall be of the tight-closing, resilient-faced, non-lubricating variety and shall be of eccentric design such that the valve's pressure member (plug) rises off the body seat contact area immediately upon shaft rotation during the opening movement. Valves shall be bubble-tight at the rated pressure (175 PSI through 12", 150 PSI 14" and above) and shall be satisfactory for applications involving throttling service as well as frequent or infrequent on-off service. The valve closing member should rotate approximately 90 degrees from the full-open to full-closed position.
2. The valve body shall be constructed of cast iron conforming to ASTM A126, Class B. Body ends shall be:
    a. Flanged with dimensions, facing, and drilling in full conformance with ANSI B16.1, Class 125.
    b. Mechanical Joint to meet the requirements of AWWA C111/ANSI A21.11.
    c. Grooved ends to meet the requirements of AWWA C606.
3. Eccentric Plug Valves shall have a rectangular shaped port. Port areas for 3"– 20" valves shall be a minimum 80% of full pipe area. Port area for 24" valve shall be a minimum 70% of full pipe area.
4. Valve seat surface shall be welded-in overlay, cylindrically shaped of not less than 95% pure nickel. Seat area shall be raised, with raised area completely covered with weld to ensure proper seat contact. The machined seat area shall be a minimum of .125" thick and .500" wide.
5. The valve plug shall be constructed of cast iron conforming to ASTM A126, Class B. The plug shall have a cylindrical seating surface that is offset from the center of the plug shafts. The plug shafts shall be integral. The entire plug shall be 100% encapsulated with Buna-N rubber in all valve sizes. The rubber compound shall be approximately 70 (Shore A) durometer hardness. The rubber to metal bond must withstand 75 lbs. pull under test procedure ASTM D429-73 Method B.
6. Shaft bearings, upper and lower, shall be sleeve-type metal bearings, sintered, oil impregnated and permanently lubricated Type 316 stainless steel conforming to ASTM A743 Grade CF-8M. Thrust bearings shall be Nylatron.
7. Plug valve shaft seals shall be of the multiple V-ring type (Chevron) and shall be adjustable. All packing shall be replaceable without moving the bonnet or actuator and while the valve is in service. Shaft seals shall be made of Buna-N.
8. Each valve shall be given a test against the seat at the full-rated working pressure and a hydrostatic shell test at 1.5 times the rated working pressure. Certified copies of individual tests shall be submitted when requested. Certified copies of proof-of-design tests shall be submitted upon request.

9. Manual valves shall have lever or worm gear type actuators with hand wheels, 2” square nuts, or chain wheels attached. Lever actuators shall be furnished on valves 8” and smaller where the maximum unseating pressure is 25 PSIG or less. Worm gear type actuators shall be furnished on all 4” or larger valves where the maximum unseating pressure is 25 PSIG or more.
10. All eccentric plug valves shall be Clow F-5412 (flanged), F-5413 (mechanical joint), or Dezurik/APCO or approved equal.

PART 3 EXECUTION

3.01 GENERAL

A. The general contractor shall assume full responsibility for coordination of the entire project, including verification all structures, piping, coating systems and equipment components are compatible. The general contractor shall initially operate each equipment system, and shall make all necessary adjustments so that each system is placed in proper operating condition.
B. Equipment and materials utilized for this project must be approved by the Engineer prior to installation. Approval for installation or incorporation in this project will be made only after submittal or manufacturer's shop and installation drawings, test results or other data as specified herein.
C. Installation of equipment shall be in full conformance with the manufacturer's shop drawings and requirements as approved by the Engineer. Wherever a conflict arises between manufacturer's instructions and the contract documents, the contractor shall follow the Engineer's decision at no additional cost to the Owner.

3.02 WORKMANSHIP

A. Handle carefully and protect the equipment and appurtenances to avoid damage.
B. The equipment shall be safely secured to the wall and floor in accordance with the Engineer's design drawings. All plumbing and electrical shall be in accordance with state and federal codes to ensure proper operation of the pumping system, as-well-as the safety of plant personnel. All piping and tubing shall be sealed for leaks.
C. Any evidence of improper installation shall be corrected by the Contractor. Care during storage, installation and startup shall be in strict accordance with manufacturer's recommendations.

3.03 MANUFACTURER'S SERVICES

A. The Contractor shall require the manufacturer to furnish the services of a qualified field engineer to perform the following functions in the designed periods of time. These services are to be performed at the jobsite.

1. Check-out of installation, start-up of equipment and initial operator instruction. This service shall take place after all mechanical equipment associated with the control system is installed and mechanically operable.
2. After equipment is fully operational, and before Owner will assume responsibility for the operation of the equipment, the equipment manufacturer's representative shall instruct the Owner's operating personnel in the care, maintenance and proper operation of the equipment.

B. Field Test

1. Prior to equipment startup, all equipment described herein shall be inspected for quiet operation, proper connections, and satisfactory performance by means of a functional test.

2. The pump and motor assembly shall be field tested to verify vibration is not in excess of the limits stated in the latest revision of Hydraulic Institute and NEMA MG 1.
3. The pump, motor, and controls shall be given an operational test in accordance with the standards of the Hydraulic Institute. Recordings of the test shall substantiate the correct performance of the equipment at the design head, capacity, speed and horsepower as specified herein.
4. Units apparently failing to meet the Specifications to the satisfaction of the Engineer must be more accurately tested in accordance with Hydraulic Institute Standards. If the pump fails the second test, the unit will be rejected, and the Contractor shall furnish a unit that will perform as specified.

C. Operation and Maintenance Materials

1. The pump manufacturer shall be responsible for supplying written instruction, which shall be sufficiently comprehensive to enable the operator to operate and maintain the pump and all equipment supplied by the manufacturer. Instructions shall assume that the operator is familiar with pumps, motors, piping, valves, and controls, but that he has not previously operated and/or maintained the exact equipment supplied.
2. The instruction shall be prepared as a system manual applicable solely to the pump and equipment supplied by the manufacturer to these specifications, and shall include those devices and equipment supplied by him.
3. Operation and maintenance instruction shall be specific to the equipment supplied in accordance with these specifications. Instruction manuals applicable to many different configurations and pumps, and which require the operator to selectively read portions of the instructions shall not be acceptable.

D. All costs for the above manufacturer functions including travel, lodging, meals, and incidentals shall be considered to have been included in the Contractor's lump sum bid price.

END OF SECTION 33 3200

SECTION 33 4000

STORM DRAINAGE UTILITIES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. The work under this section of the Specifications includes all labor, materials, equipment, and services necessary for STORM DRAINAGE UTILITIES as shown on the Drawings and herein specified and in accordance with the Contract Documents. All costs for labor, materials, equipment, and services necessary for STORM DRAINAGE UTILITIES shall be included in the bid prices for the work.

1.03 SECTION INCLUDES

A. Storm Drainage Utility Piping
B. Storm Drainage Manholes, Frames, and Covers
C. Storm Drainage Inlets and Structures

1.04 RELATED SECTIONS

A. 31 23 00 Excavation and Fill
B. 31 25 00 Erosion and Sedimentation Controls
C. 32 13 00 Rigid Paving

1.05 DEFINITIONS

A. AHJ – Authority Having Jurisdiction

1. City of Tahlequah
2. Oklahoma Department of Environmental Quality

1.06 ACTION SUBMITTALS

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

1. Pipe
2. Manholes and Inlets
3. Manholes Rings and Covers
4. Fittings
5. Clean-outs

B. Field quality-control test reports.

1.07 INFORMATIONAL SUBMITTALS

A. Photograph, video, or both the existing trees and plantings, adjoining construction, roadways, utilities, and site improvements to establish preconstruction conditions. Identify preexisting damage to trees, plantings, adjoining construction, pavements, sidewalks, and other site improvements. Include plans and notations to identify and describe any such conditions.

1.08 QUALITY ASSURANCE

A. PRECONSTRUCTION CONFERENCE

1. Conduct a preconstruction conference. Subcontractors that will be performing the work shall attend the preconstruction conference. Notify ENGINEER one week (7 days) prior to the date of the meeting.

B. REGULATORY REQUIREMENTS

1. All materials and methods shall comply with the requirements of the AHJ.
2. If the AHJ has not adopted specifications for materials and methods, the current edition of the City of Oklahoma City's Standard Specifications for Construction of Public Improvements shall be used.

1.09 PERMITS

A. CONTRACTOR shall make application; pay permit fees; provide payment and performance bonds required of the CONTRACTOR by the AHJ.

1.10 TOPOGRAPHIC SURVEY

A. OWNER has or will perform a survey of the site, stake the property limits, and provide a reference benchmark elevation.

1.11 UNDERGROUND UTILITIES

A. CONTRACTOR shall contact OKIE (811 or 1-800-522-OKIE) prior to construction for locating existing utilities.

B. The underground utilities shown on the Drawings have been located from field survey surface information and existing drawings. ENGINEER and Surveyor make no guarantee that the underground utilities shown comprise all such utilities in the area, either in service or abandoned. The underground utilities are located as accurately as possible from information available; however, ENGINEER and Surveyor further do not guarantee that the underground utilities shown are in the exact location indicated either vertically or horizontally. ENGINEER and Surveyor have not physically located the underground utilities by probing, excavating, hydrovac, or by any other means.

C. CONTRACTOR shall notify all utility companies and governmental agencies who may have utility lines on or about the premises or who may be affected by the construction. Notice shall be given no less than twenty-four hours prior to any work that may interfere with a utility.

D. All existing structures, improvement and utilities designated to remain shall be adequately protected from damage that might otherwise occur due to construction operations. Where construction comes in close proximity to existing structures, utilities or appurtenances, or if it becomes necessary to move services, poles, guy wires, pipe lines or other obstructions, CONTRACTOR shall notify and cooperate with the owner of the utility, structure, or appurtenance. The utility lines and other existing structures shown on the plans are for information only and are not guaranteed to be complete or accurate as to location and/or depth. CONTRACTOR shall be liable for damage to any utilities resulting from the CONTRACTOR's operations. During construction, all fire hydrants, valve boxes, fire or police call boxes and other existing utility controls shall be left intact, unobstructed and accessible unless noted on the plan.

E. Contractor shall satisfy themselves as to the actual existing subsurface conditions, including but not limited to the depth, location and sizes of pipe or conduits of various kinds in place prior to beginning work. Where the exact depth of any utility or obstruction is not shown on a plan, excavation shall be made prior to reaching the obstruction in order to determine adjustments in grade if needed to prevent interference. Redesign to eliminate conflicts may be necessary.

1.12 CONSTRUCTION CONTROL

A. Do not commence work until temporary erosion and sedimentation control measures are in place.

B. CONTRACTOR shall be responsible for properly laying out the work, and for lines and measurements for the work executed under the Contract Documents. Verify the figures shown on the Drawings before ordering any materials and laying out the work, and report errors or inaccuracies in writing to the ENGINEER before commencing work. The ENGINEER or his representative will in no case assume the responsibility for laying out the work.

C. Existing survey points other than those shown on the Drawings shall not be considered as acceptable control points unless approved by the ENGINEER. If approval is secured, CONTRACTOR remains responsible for maintaining them and for their accuracy. Be responsible for preserving all existing iron or metal, and all concrete survey points or monuments for the construction period.

1.13 PROJECT CONDTIONS

A. TRAFFIC

1. Obtain any required Work Zone Permits from the AHJ at least two (2) working days prior to the start of work and/or placing or removing any barricades or modifying existing traffic control devices.
2. CONTRACTOR shall be responsible for erecting and maintaining barricades and other traffic warning devices as necessary around the perimeter of construction and adjacent to any open trenches. Provide and maintain adequate detours around the work under construction. Provide sufficient lights, warning signs, and watchmen for the safety of the public.
3. Any temporary street closure shall be coordinated with and approved by the AHJ. CONTRACTOR shall establish all detour routes while streets are closed during construction. CONTRACTOR shall notify Fire, Police, and EMSA headquarters when any street is temporarily closed.
4. CONTRACTOR is responsible for the prompt replacement and/or repair of all traffic control devices and appurtenances damaged or disturbed due to construction. Any existing traffic signals, signal loops, conduits, cables, and other traffic control devices affected by the work shall be reset or replaced according to AHJ's specifications. Coordinate the work with the AHJ's traffic department.

B. UTILITY INTERRUPTIONS

1. Do not interrupt any utility serving facilities occupied by Owner or others unless permitted by OWNER and the owner(s) of the utility. Temporary utility service shall be provided for any interruption. Notify OWNER and ENGINEER one week (7 days) in advance of proposed interruption of utility.

C. SUBSURFACE CONDITIONS

1. A geotechnical report has been prepared for this Project and is available for information only. The opinions expressed in this report are those of geotechnical engineer and represent interpretations of subsoil conditions, tests, and results of analyses conducted by geotechnical engineer. Owner will not be responsible for interpretations or conclusions drawn from the data.

D. EXCAVATION AND TRENCH SAFETY SYSTEMS

1. CONTRACTOR shall be responsible for complying with State laws and Federal regulations relating to excavation and trench safety, including those which may be enacted during the performance under this Contract. CONTRACTOR is advised that Federal Regulations 29 C.F.R. 1926.650-1926.652 have been, in their most recent version as amended, in effect since January 2, 1990. CONTRACTOR shall fully comply with the U.S. Department of Labor Occupational Safety and Health Administration (OSHA) regulations pertaining to excavations, trenching, and shoring and shall provide and familiarize its employees involved in excavation and trenching with the provisions in OSHA Pamphlet Number 2226, Excavating and Trenching Operations.

1.14 HAZARDOUS CONDITIONS

A. If CONTRACTOR encounters a Hazardous Environmental Condition or if CONTRACTOR or anyone for whom CONTRACTOR is responsible creates a Hazardous Environmental Condition, CONTRACTOR shall immediately: (i) secure or otherwise isolate such condition; (ii) stop all Work in connection with such condition and in any area affected thereby (except in an emergency); and (iii) notify OWNER and ENGINEER (and promptly thereafter confirm such notice in writing). OWNER shall promptly consult with ENGINEER concerning the necessity for OWNER to retain a qualified expert to evaluate such condition or take corrective action, if any.

PART 2 - PRODUCTS

2.01 POLYPROPYLENE PIPE

A. Pipe

1. Polypropylene compound for pipe and fitting production shall be impact modified copolymer meeting the material requirements of ASTM F2736, Section 4, ASTM F2881, Section 5 and AASHTO M330, Section 6.1, for the respective diameters.
2. 12-inch through 30-inch pipe shall have a smooth interior and annular exterior corrugations and meet or exceed ASTM F2736 and AASHTO M330.
3. 36-inch through 60-inch pipe shall have a smooth interior and annular exterior corrugations and meet or exceed ASTM F2881 and AASHTO M330.

B. Pipe Joints

1. Pipe shall be joined with a gasketed integral bell & spigot joint meeting the requirements of ASTM F2736 or F2881, for the respective diameters.
2. 12-inch through 60-inch shall be watertight according to the requirements of ASTM D3212. Spigots shall have gaskets meeting the requirements of ASTM F477. Gasket shall be installed by the pipe manufacturer and covered with a removable, protective wrap to ensure the gasket is free from debris. A joint lubricant available from the manufacturer shall be used on the gasket and bell during assembly.
3. 12-inch through 60-inch diameters shall have a reinforced bell with a polymer composite band installed by the manufacturer.

C. Fittings

1. Fittings shall conform to ASTM F2736, ASTM F2881 and AASHTO M330, for the respective diameters. Bell & spigot connections shall utilize a spun-on, welded or integral bell and spigot with gaskets meeting ASTM F477. Bell & spigot fittings

joint shall meet the watertight joint performance requirements of ASTM D3212. Corrugated couplings shall be split collar, engaging at least 2 full corrugations.

2.02 CORRUGATED POLYETHYLENE PIPE

A. Pipe

1. Virgin material for pipe and fitting production shall be high-density polyethylene conforming with the minimum requirements of cell classification 424420C for 4-inch through 10-inch diameters, and 435400C for 12-inch through 24-inch diameters, as defined and described in the latest version of ASTM D3350, except that carbon black content should not exceed 4%. The 12-inch through 24-inch virgin pipe material shall comply with the notched constant ligament-stress (NCLS) test as specified in Sections 9.5 and 5.1 of AASHTO M294 and ASTM F2306 respectively. Bells shall be manufactured from PVC pipe stock, utilizing a thermo-molding process to reform the pipe stock to the specified coupler. The pipe stock used to manufacture the bell-bell coupler shall meet the performance requirements for fabricated fittings as specified in ASTM D3034.
2. Pipe shall have a smooth interior and annular exterior corrugations.
3. 4–inch through 10-inch shall meet AASHTO M252.
4. 12-inch through 24-inch shall meet AASHTO M294, Type S or ASTM F2306.

B. Pipe Joints

1. Pipe joints shall meeting the requirements of AASHTO M252, M294 or ASTM F2306. The 4-inch through 24-inch pipe shall be watertight according to the requirements of ASTM D3212. Gaskets shall meet the requirements of ASTM F477. Gaskets shall be installed by the pipe manufacturer and covered with a removable wrap to ensure the gasket is free from debris. A joint lubricant available from the manufacturer shall be used on the gasket and bell during assembly. Bells shall be bell-bell couplers manufactured from PVC. Bell-bell couplers shall be installed on one side by the manufacturer.

C. Fittings

1. Fittings shall conform to AASHTO M252, M294 or ASTM F2306. Fabricated fittings shall be welded at all accessible interior and exterior junctions.

2.03 REINFORCED CONCRETE PIPE (RCP)

A. Pipe

1. Round pipe shall meet the requirements of ASTM C76/AASHTO M170, ASTM C361, and AWWA C302.
2. Arch pipe shall meet the requirements of ASTM C506/AASHTO M259.
3. Elliptical pipe shall meet the requirements of ASTM C507/AASHTO M207.

B. Pipe Joints

1. Joints for round pipe shall meet the requirements of ASTM C443/AASHTO M315.
2. Joints for arch pipe shall meet the requirements of ASTM C990.

2.04 CORRUGATED METAL PIPE (CMP)

A. Steel Pipe and Fittings (Type I Round, Type II Arch)

1. Metallic coated corrugated steel culverts: AASHTO M36, Type I Round, Type II Arch, with fittings of similar form and construction as pipe.
    a. Zinc coated (galvanized) sheet steel: AASHTO M218

b. Aluminum coated (Type II) hot-dipped sheet steel: AASHTO M274

2. Externally coated or clad culverts
   a. Bituminous coated corrugated metal culvert pipe and pipe arches: Type A per AASHTO M190
   b. Pre-coated corrugated steel culverts: AASHTO M245
3. Connecting bands shall be corrugated steel with O-ring seals.

2.05 POLYVINYL CHLORIDE (PVC) PIPE AND FITTINGS

A. SOLID WALL PVC - All solid wall PVC pipe and fittings shall conform to the requirements of the appropriate ASTM listed below or as modified herein.

1. ASTM D-3034 –
   a. Standard Specification for "Type PSM Poly (Vinyl Chloride) (VC) Sewer Pipe and Fittings". Pipe and fittings shall have a minimum stiffness of forty-six (46 psi) pounds per square inch and a minimum SDR of thirty-five (35). Pipe and fittings may be supplied in sizes ranging from four (4”) inches to fifteen (15”) inches in diameter.
   b. The pipe shall be made of PVC plastic having a cell classification of 12454-B or 12454-C or 12364-C or 13364-B (with minimum tensile modulus of 500,000 psi) as defined in ASTM D-1784. The fittings shall be made of PVC plastic having a cell classification of 12454-B, 12454-C, or 13343-C as defined in ASTM D-1784.
   c. Elastomeric Gasketed Joints shall be used to provide a watertight seal and shall meet the requirements of ASTM D-3212.
2. ASTM F-679 –
   a. Standard Specification for "Poly (Vinyl Chloride) (PVC) Large-Diameter Plastic Gravity Sewer Pipe and Fittings". Pipe and fittings shall have a minimum stiffness of forty-six (46 psi) pounds per square inch and a minimum SDR of thirty-five (35). Pipe and fittings may be supplied in sizes ranging from eighteen (18”) inches to thirty-six (36”) inches in diameter.
   b. The pipe and fitting materials shall be made of PVC plastic having a minimum cell classification of 12364-C or 12454-C as defined in ASTM D-1784. Homopolymer PVC compounds must equal or exceed the requirements of the above listed minimum cell classification number.
   c. Integral Bell Gasket Joint shall be used to provide a watertight seal and shall meet the requirements of ASTM D-3212.
3. ASTM F-789 –
   a. Standard Specification for "Type PS-46 Poly (Vinyl Chloride) (PVC) Plastic Gravity Flow Sewer Pipe and Fittings". Pipe and fittings shall have a minimum stiffness of forty-six (46 psi) pounds per square inch. Pipe and fittings may be supplied in sizes ranging from four (4”) inches to eighteen (18”) inches in diameter.
   b. The pipe shall be made of PVC plastic having a minimum cell classification of 12164-B as defined in ASTM D-1784. The fittings shall be made of PVC plastic having a cell classification of 12454-C or 13343-C as defined in ASTM D-1784.
   c. Elastomeric Gasketed Joints shall be used to provide a watertight seal and shall meet the requirements of ASTM D-3212. Joints shall also be compatible to ASTM D-3034 joint dimensions.

B. PROFILE WALL (PVC) - All profile (open or closed) wall PVC pipe and fittings shall conform to the requirements of the appropriate ASTM listed below and modified herein. Regardless of size, open profile wall pipes will be allowed only on sections of pipe when there are no apparent service connections. Otherwise, open profile wall pipe will not be allowed.

1. ASTM F-794 –
    a. Standard Specification for "Poly (Vinyl Chloride) (PVC) Profile Gravity Sewer Pipe and Fittings Based on Controlled Inside Diameter". Pipe and fittings shall have a minimum stiffness of forty-six (46 psi) pounds per square inch. Pipe and fittings may be supplied in sizes ranging from twelve (12”) inches to forty-eight (48”) inches in diameter.
    b. The pipe and fittings shall be made of PVC plastic having a minimum cell classification of 12454-B or 12364-C as defined in ASTM D-1784.
    c. Gasketed Joint Systems shall be used. The integral bell gasketed joint, coupling or fitting joints shall be designed so that when assembled, the gasket will be compressed radially on the pipe spigot or in the bell to form a watertight seal. The joints shall be designed to comply with and show no leakage when tested in accordance with ASTM D-3212.
    d. Closed profile PVC pipes manufactured with a gasketed joint coupling system, with no bell and spigot, may be used for slip-lining installations.
    e. Couplings shall form a watertight seal when assembled with plain end pipe and show no sign of leakage when tested in accordance with ASTM D-3212.
2. ASTM F-949 –
    a. Standard Specification for "Poly (Vinyl Chloride) (PVC) Corrugated Sewer Pipe with a Smooth Interior and Fittings". Pipe and fittings shall have a minimum stiffness of fifty (50 psi) pounds per square inch. Pipe and fittings may be supplied in sizes ranging from twelve (12”) inches to thirty-six (36”) inches in diameter.
    b. The pipe shall be made of PVC plastic having a minimum cell classification 12454-B or 12454-C as defined in ASTM D-1784. The fittings shall be made of PVC plastic having a cell classification of 12464-B, 12464-C, or 13343-C as defined in ASTM D-1784.
    c. Elastomeric Gasketed Joints shall be used to provide watertight seal and shall meet the requirements of ASTM D-3212.

C. SPECIAL PVC PIPE - Special PVC pipe and fittings shall conform to the requirements of the appropriate standards listed below or as modified herein.

1. ASTM D-2241 –
    a. Standard Specifications for Polyvinyl Chloride (PVC) Pressure-rated Pipe (SDR Series). Pipe and fittings shall have a minimum SDR of thirty-two and one-half (32-1/2) and may be supplied in sizes ranging from four (4) inches to thirty-six (36) inches in diameter.
    b. The pipe and fittings shall be made of PVC compounds having a cell classification of 12454-B, 12454-C, or 14333-D as defined in ASTM D-1784.
    c. Elastomeric gasketed joints meeting the requirements of ASTM D-3212 shall be used to provide a watertight seal.
2. AWWA C-900 and AWWA C-905 –

a. Standards for PVC Pressure Pipe from four (4”) inches through twelve (12”) inches, and fourteen (14”) inches through thirty-six (36”) inches, respectively. Pipes shall have a minimum DR rating of eighteen (18) for diameters four (4”) inches through twelve (12”) inches. For pipes greater than twelve (12”) inches in diameter, the minimum DR shall be thirty-two and one-half (32 1/2).
b. The pipe and fittings shall be made of PVC compounds having a cell classification of 12454-A or 12454-B as defined in ASTM D-1784.
c. Elastomeric gasketed joints meeting the requirements of ASTM D-3139, when measured in accordance with ASTM-2122, shall be used to provide a watertight seal.

2.06 BACKWATER VALVES

A. Cast-Iron Backwater Valves:

1. Description: ASME A112.14.1, gray-iron body and bolted cover, with bronze seat.
2. Horizontal type; with swing check valve and hub-and-spigot ends.
3. Combination horizontal and manual gate-valve type; with swing check valve, integral gate valve, and hub-and-spigot ends.
4. Terminal type; with bronze seat, swing check valve, and hub inlet.

B. Plastic Backwater Valves:

1. Description: Horizontal type; with PVC body, PVC removable cover, and PVC swing check valve.

2.07 CLEANOUTS

A. Cast-iron Cleanouts:

1. Manufacturers: Subject to compliance with requirements.
2. Description: ASME A112.36.2M, round, gray-iron housing with clamping device and round, secured, scoriated, gray-iron cover. Include gray-iron ferrule with inside calk or spigot connection and countersunk, tapered-thread, brass closure plug.
3. Top-Loading Classification(s): Heavy Duty.
4. Sewer Pipe Fitting and Riser to Cleanout: ASTM A 74, Service class, cast-iron soil pipe and fittings.

B. PVC Cleanouts:

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

2.08 MANHOLES AND JUNCTION BOXES

A. Standard Precast Concrete Manholes:

1. Description: ASTM C 478, precast, reinforced concrete, of depth indicated, with provision for sealant joints.
2. All concrete for manhole and base shall be Class A concrete with a minimum compressive strength of 4,000 psi.
3. Diameter: 48 inches minimum.
4. Wall Thickness:

a. The minimum wall thickness shall not less than 5-in and shall not be less than one-twelfth (1/12) of the internal diameter of the largest cone or riser.
b. Manholes with 60-in and 48-in diameters shall have a 5-inch minimum thickness, and lengths to provide depth indicated.
c. Manholes with 72-in diameters shall have a 6-inch minimum thickness, and lengths to provide depth indicated.
d. Manholes with 84-in diameters shall have a 7-inch minimum thickness, and lengths to provide depth indicated.
e. Manholes with 96-in diameters shall have an 8-inch minimum thickness, and lengths to provide depth indicated.

5. Base section shall have a 9-inch minimum floor slab thickness. Floor slab shall be integral with base section. Increase thickness of precast concrete sections or add concrete to base section as required to prevent flotation.
6. Provided riser sections as needed to achieve the required manhole depth.
7. Top section shall be eccentric-cone type unless flat-slab-top type is indicated, and top of cone of size that matches grade rings.
8. Joint sealant shall meet ASTM C 990, bitumen or butyl rubber.
9. Pipe connectors shall be resilient pipe connectors per ASTM C 923, cast or fitted into manhole walls, for each pipe connection.
10. Steps: Individual FRP steps; FRP ladder; or ASTM A 615/A 615M, deformed, 1/2-inch steel reinforcing rods encased in ASTM D 4101, PP, wide enough to allow worker to place both feet on one step and designed to prevent lateral slippage off step. Cast or anchor steps into sidewalls at 12-inch to 16-inch intervals. Omit steps if total depth from floor of manhole to finished grade is less than 60 inches.
11. Adjusting Rings: Interlocking HDPE rings with level or sloped edge in thickness and diameter matching manhole frame and cover, and of height required to adjust manhole frame and cover to indicated elevation and slope. Include sealant recommended by ring manufacturer.
12. Grade Rings: Reinforced-concrete rings, 6-inch to 9-inch total thickness, to match diameter of manhole frame and cover, and height as required to adjust manhole frame and cover to indicated elevation and slope.

B. Designed Precast Concrete Manholes:

1. Description: ASTM C 913; designed according to ASTM C 890 for A-16 (AASHTO HS20-44), heavy-traffic, structural loading; of depth, shape, and dimensions indicated, with provision for sealant joints.
2. Ballast: Increase thickness of one or more precast concrete sections or add concrete to manhole as required to prevent flotation.
3. Joint Sealant: ASTM C 990, bitumen or butyl rubber.
4. Resilient Pipe Connectors: ASTM C 923, cast or fitted into manhole walls, for each pipe connection.
5. Steps: Individual FRP steps; FRP ladder; or ASTM A 615/A 615M, deformed, 1/2-inch steel reinforcing rods encased in ASTM D 4101, PP, wide enough to allow worker to place both feet on one step and designed to prevent lateral slippage off step. Cast or anchor steps into sidewalls at 12-inch to 16-inch intervals. Omit steps if total depth from floor of manhole to finished grade is less than 60 inches.
6. Adjusting Rings: Interlocking HDPE rings with level or sloped edge in thickness and diameter matching manhole frame and cover, and of height required to adjust manhole frame and cover to indicated elevation and slope. Include sealant recommended by ring manufacturer.

7. Grade Rings: Reinforced-concrete rings, 6-inch to 9-inch total thickness, to match diameter of manhole frame and cover, and of height required to adjust manhole frame and cover to indicated elevation and slope.

C. Frames and Covers

1. Manhole frames and covers shall be to the dimensions and specifications of the current Oklahoma Department of Transportation, City of Oklahoma City, or the jurisdictional utility standards.

2.09 CONCRETE

A. General: Cast-in-place concrete according to ACI 318, ACI 350/350R, and the following:

1. Cement: ASTM C 150, Type II.
2. Fine Aggregate: ASTM C 33, sand.
3. Coarse Aggregate: ASTM C 33, crushed gravel.
4. Water: Potable.

B. Portland Cement Design Mix: 4000 psi minimum, with 0.45 maximum water/cementitious materials ratio.

1. Reinforcing Fabric: ASTM A 185, steel, welded wire fabric, plain.
2. Reinforcing Bars: ASTM A 615, Grade 60 deformed steel.

C. Manhole Channels and Benches: Factory or field formed from concrete. Portland cement design mix, 4000 psi minimum, with 0.45 maximum water/cementitious materials ratio. Include channels and benches in manholes.

1. Channels: Concrete invert, formed to same width as connected piping, with height of vertical sides to three-fourths of pipe diameter. Form curved channels with smooth, uniform radius and slope.
    a. Invert Slope: 2 percent through manhole.
2. Benches: Concrete, sloped to drain into channel.
    a. Slope: 8 percent.

D. Ballast and Pipe Supports: Portland cement design mix, 4000 psi minimum, with 0.58 maximum water/cementitious materials ratio.

1. Reinforcing Fabric: ASTM A 185, steel, welded wire fabric, plain.
2. Reinforcing Bars: ASTM A 615, Grade 60 deformed steel.

2.10 CURB, GUTTER, AND COMBINATION INLETS

A. Curb Inlets: Made with vertical curb opening of materials and dimensions according to the current Oklahoma Department of Transportation, City of Oklahoma City, or the standards of the jurisdictional utility.

B. Gutter Inlets: Made with horizontal gutter opening of materials and dimensions according to the current Oklahoma Department of Transportation, City of Oklahoma City, or the standards of the jurisdictional utility. Include heavy-duty frames and grates.

C. Combination Inlets: Made with vertical curb and horizontal gutter openings of materials and dimensions according to the current Oklahoma Department of Transportation, City of Oklahoma City, or the standards of the jurisdictional utility.

D. Frames and Grates: Heavy duty, according to the current Oklahoma Department of Transportation, City of Oklahoma City, or the standards of the jurisdictional utility.

2.11 OUTLETS

A. Pipe outlet headwalls, wing walls, precast end sections, aprons, and rip-rap shall be according to the current Oklahoma Department of Transportation, City of Oklahoma City, and the standards of the jurisdictional utility.

2.12 CONCRETE CHANNELS, SWALES, AND FLUMES

A. The materials and execution for concrete channels, swales, and flumes shall per the requirements of 32 13 00 Rigid Paving.

PART 3 - EXECUTION

3.01 EARTHWORK

A. Excavation, trenching, and backfilling are specified in Section 31 23 00 Excavation and Fill.

3.02 PIPING INSTALLATION

A. General Locations and Arrangements: Drawing plans and details indicate general location and arrangement of underground storm drainage piping. Location and arrangement of piping layout take into account design considerations. Install piping as indicated, to extent practical. Where specific installation is not indicated, follow piping manufacturer's written instructions.

B. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements.

C. Install manholes for changes in direction unless fittings are indicated. Use fittings for branch connections unless direct tap into existing sewer is indicated.

D. When installing pipe under streets or other obstructions that cannot be disturbed, use pipe-jacking process of microtunneling.

E. Install gravity-flow, nonpressure drainage piping according to the following:

1. Install piping with 36-inch minimum cover.
2. Install corrugated steel piping according to ASTM A 798.
3. Install corrugated aluminum piping according to ASTM B 788.
4. Install PE corrugated sewer piping according to ASTM D 2321.
5. Install PVC sewer piping according to ASTM D 2321 and ASTM F 1668.
6. Install PVC profile gravity sewer piping according to ASTM D 2321 and ASTM F 1668.
7. Install reinforced-concrete sewer piping according to ASTM C 1479 and ACPA's "Concrete Pipe Installation Manual."

3.03 PIPE JOINT CONSTRUCTION

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

1. Join corrugated steel sewer piping according to ASTM A 798.
2. Join corrugated aluminum sewer piping according to ASTM B 788.
3. Join corrugated PE piping according to ASTM D 3212 for push-on joints.
4. Join PVC corrugated sewer piping according to ASTM D 2321 for elastomeric-seal joints.
5. Join PVC sewer piping according to ASTM D 2321 and ASTM D 3034 for elastomeric-seal joints or ASTM D 3034 for elastomeric-gasketed joints.
6. Join PVC profile gravity sewer piping according to ASTM D 2321 for elastomeric-seal joints or ASTM F 794 for gasketed joints.

7. Join reinforced-concrete sewer piping according to ACPA's "Concrete Pipe Installation Manual" for rubber-gasketed joints.

3.04 BACKWATER VALVE INSTALLATION

A. Install horizontal-type backwater valves in piping where indicated.
B. Install combination horizontal and manual gate-valve type in piping and in manholes where indicated.
C. Install terminal-type backwater valves on end of piping and in manholes where indicated.

3.05 CLEANOUT INSTALLATION

A. Install cleanouts and riser extensions from sewer pipes to cleanouts at grade. Use cast-iron soil pipe fittings in sewer pipes at branches for cleanouts and cast-iron soil pipe for riser extensions to cleanouts. Install piping so cleanouts open in direction of flow in sewer pipe.

1. Use Light-Duty, top-loading classification cleanouts in earth areas.
2. Use Heavy-Duty, top-loading classification cleanouts in vehicle-traffic service areas.

B. Set cleanout frames and covers in cast-in-place concrete block, 18-inch by 18-inch by 12-inch deep.
C. Set cleanout frames and covers in earth areas with tops 1-inch above surrounding earth grade.
D. Set cleanout frames and covers in concrete pavement and roads with tops flush with pavement surface.

3.06 DRAIN INSTALLATION

A. Install type of drains in locations indicated.

1. Use Light-Duty, top-loading classification drains in earth areas.
2. Use Heavy-Duty, top-loading classification drains in vehicle-traffic service areas.

B. Embed drains in 4-inch minimum concrete around bottom and sides.
C. Fasten grates to drains if indicated.
D. Set drain frames and covers with tops flush with pavement surface.

3.07 MANHOLE INSTALLATION

A. General: Install manholes, complete with appurtenances and accessories indicated.
B. Install precast concrete manhole sections with sealants according to ASTM C 891.
C. Where specific manhole construction is not indicated, follow manhole manufacturer's written instructions.
D. Set tops of frames and covers flush with finished surface of manholes that occur in pavements. Set tops 3-inch above finished surface elsewhere unless otherwise indicated.

3.08 CATCH BASIN INSTALLATION

A. Construct catch basins to sizes and shapes indicated.
B. Set frames and grates to elevations indicated.

3.09 STORMWATER INLET AND OUTLET INSTALLATION

A. Construct inlet head walls, aprons, and sides of reinforced concrete, as indicated.
B. Construct riprap of broken stone, as indicated.
C. Install outlets that spill onto grade, anchored with concrete, where indicated.

D. Install outlets that spill onto grade, with flared end sections that match pipe, where indicated.

E. Construct energy dissipaters at outlets, as indicated.

3.10 CONCRETE PLACEMENT

A. Place cast-in-place concrete according to ACI 318.

3.11 CONNECTIONS

A. Connect nonpressure, gravity-flow drainage piping in building's storm building drains.

B. Make connections to existing piping and underground manholes.

1. Use commercially manufactured fittings for piping branch connections. Remove section of existing pipe; install fitting into existing piping; and encase entire fitting, plus 6-inch overlap, with not less than 6 inches of concrete with 28-day compressive strength of 3000 psi.
2. Make branch connections from side into existing piping, NPS 4 to NPS 10. Remove section of existing pipe, install fitting into existing piping, and encase entire fitting with not less than 6 inches of concrete with 28-day compressive strength of 3000 psi.
3. Make branch connections to manholes and structures by cutting into existing unit and creating an opening large enough to allow 3 inches of concrete to be packed around entering connection. Cut end of connection pipe passing through pipe or structure wall to conform to shape of and be flush with inside wall unless otherwise indicated. On outside of pipe, manhole, or structure wall, encase entering connection in 6 inches of concrete for minimum length of 12 inches to provide additional support of collar from connection to undisturbed ground.
    a. Use concrete that will attain a minimum 28-day compressive strength of 3000 psi unless otherwise indicated.
    b. Use epoxy-bonding compound as interface between new and existing concrete and piping materials.
4. Protect existing piping, manholes, and structures to prevent concrete or debris from entering while making tap connections. Remove debris or other extraneous material that may accumulate.

3.12 CLOSING ABANDONED STORM DRAINAGE SYSTEMS

A. Removing Piping

1. Pipe indicated to be removed shall be excavated and removed from the project site and legally disposed according to City, State, and Federal regulations.
2. Backfill trench and voids according to 31 23 00 Excavation and Fill.

B. Abandoned Piping

1. Pipe indicated to be abandoned in place shall be completely filled with Portland Cement grout having a minimum twenty-eight (28) day compressive strength of five hundred pounds per square inch (500 psi).

C. Abandoned Manholes and Structures: Excavate around manholes and structures as required and use one procedure below:

1. Remove manhole or structure and close open ends of remaining piping.

2. Remove top of manhole or structure down to at least 48 inches below final grade. Fill to within 12 inches of top with stone, rubble, gravel, or compacted dirt. Fill to top with concrete.
3. Backfill to grade according to 31 23 00 Excavation and Fill.

3.13 IDENTIFICATION

A. Materials and their installation are specified in 31 23 00 Excavation and Fill. Arrange for installation of green warning tape directly over piping and at outside edge of underground structures.

1. Use detectable warning tape over nonferrous piping and over edges of underground structures.

3.14 FIELD QUALITY CONTROL

A. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect at completion of Project.

1. Submit separate reports for each system inspection.
2. Defects requiring correction include the following:
    a. Alignment: Less than full diameter of inside of pipe is visible between structures.
    b. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.
    c. Damage: Crushed, broken, cracked, or otherwise damaged piping.
    d. Infiltration: Water leakage into piping.
    e. Exfiltration: Water leakage from or around piping.
3. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.
4. Re-inspect and repeat procedure until results are satisfactory.

B. Test new piping systems, and parts of existing systems that have been altered, extended, or repaired, for leaks and defects.

1. Do not enclose, cover, or put into service before inspection and approval.
2. Test completed piping systems according to requirements of authorities having jurisdiction.
3. Schedule tests and inspections by authorities having jurisdiction with at least 24 hours' advance notice.
4. Submit separate report for each test.
5. Gravity-Flow Storm Drainage Piping: Test according to requirements of authorities having jurisdiction, UNI-B-6, and the following:
    a. Exception: Piping with soil tight joints unless required by authorities having jurisdiction.
    b. Test plastic piping according to ASTM F 1417.
    c. Test concrete piping according to ASTM C 924.

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

3.15 CLEANING

A. Clean interior of piping of dirt and superfluous materials. Flush with water.

END OF SECTION 33 4000

SECTION 33 4600

SUBDRAINAGE

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. The work under this section of the Specifications includes all labor, materials, equipment, and services necessary for SUBDRAINAGE as shown on the Drawings and herein specified and in accordance with the Contract Documents. All costs for labor, materials, equipment, and services necessary for SUBDRAINAGE shall be included in the bid prices for the work.

1.03 SECTION INCLUDES

A. Perforated-wall pipe and fittings.
B. Drainage conduits.
C. Geotextile filter fabrics.

1.04 RELATED SECTIONS

A. 31 2300 Excavation and Fill
B. 33 4000 Storm Drainage Utilities

1.05 DEFINITIONS

A. AHJ – Authority Having Jurisdiction

1. City of Tahlequah

1.06 ACTION SUBMITTALS

A. Product Data:

1. Drainage conduits, including rated capacities.
2. Drainage aggregates.
3. Geotextile filter fabrics.

1.07 INFORMATIONAL SUBMITTALS

A. Material Test Reports:

1. Source of drainage aggregate material.
2. Classification according to ASTM D-2487.
3. Laboratory Compaction curve according to ASTM D-698.

1.08 DELIVERY, STORAGE, AND HANDLING

1.09 QUALITY ASSURANCE

A. PRECONSTRUCTION CONFERENCE

1. Conduct a preconstruction conference. Subcontractors that will be performing the work shall attend the preconstruction conference.

B. REGULATORY REQUIREMENTS

1. All materials and methods shall comply with the requirements of the AHJ.
2. If the AHJ has not adopted specifications for materials and methods, the Oklahoma Department of Transportation's 2009 Specifications shall be used.

1.10 PERMITS

A. CONTRACTOR shall make application; pay permit fees; provide payment and performance bonds required of the CONTRACTOR by the AHJ.

1.11 TOPOGRAPHIC SURVEY

A. OWNER has or will perform a survey of the site, stake the property limits, and provide a reference benchmark elevation. CONTRACTOR shall be responsible for any additional offset staking or layout survey required to locate improvements and control grade of improvements. Be responsible for the proper location and level of the work and for the maintenance of reference lines and benchmarks. Any re-staking requested by the CONTRACTOR shall be done at his expense.

1.12 UNDERGROUND UTILITIES

A. CONTRACTOR shall contact OKIE (811 or 1-800-522-OKIE) prior to construction for locating existing utilities.

B. The underground utilities shown on the Drawings have been located from field survey surface information and existing drawings. ENGINEER and Surveyor make no guarantee that the underground utilities shown comprise all such utilities in the area, either in service or abandoned. The underground utilities are located as accurately as possible from information available; however, ENGINEER and Surveyor further do not guarantee that the underground utilities shown are in the exact location indicated either vertically or horizontally. ENGINEER and Surveyor have not physically located the underground utilities by probing, excavating, hydrovac, or by any other means.

C. CONTRACTOR shall notify all utility companies and governmental agencies who may have utility lines on or about the premises or who may be affected by the construction. Notice shall be given no less than twenty-four hours prior to any work that may interfere with a utility.

D. All existing structures, improvement and utilities designated to remain shall be adequately protected from damage that might otherwise occur due to construction operations. Where construction comes in close proximity to existing structures, utilities or appurtenances, or if it becomes necessary to move services, poles, guy wires, pipe lines or other obstructions, CONTRACTOR shall notify and cooperate with the owner of the utility, structure, or appurtenance. The utility lines and other existing structures shown on the plans are for information only and are not guaranteed to be complete or accurate as to location and/or depth. CONTRACTOR shall be liable for damage to any utilities resulting from the CONTRACTOR's operations. During construction, all fire hydrants, valve boxes, fire or police call boxes and other existing utility controls shall be left intact, unobstructed and accessible unless noted on the plan.

E. Contractor shall satisfy themselves as to the actual existing subsurface conditions, including but not limited to the depth, location and sizes of pipe or conduits of various kinds in place prior to beginning work. Where the exact depth of any utility or obstruction is not shown on a plan, excavation shall be made prior to reaching the obstruction in order to determine adjustments in grade if needed to prevent interference. Redesign to eliminate conflicts may be necessary.

1.13 CONSTRUCTION CONTROL

A. Do not commence work until temporary erosion and sedimentation control measures are in place.

B. CONTRACTOR shall be responsible for properly laying out the work, and for lines and measurements for the work executed under the Contract Documents. Verify the figures shown on the Drawings before ordering any materials and laying out the work, and report errors or inaccuracies in writing to the ENGINEER before commencing work. The

ENGINEER or his representative will in no case assume the responsibility for laying out the work.

C. Existing survey points other than those shown on the Drawings shall not be considered as acceptable control points unless approved by the ENGINEER. If approval is secured, CONTRACTOR remains responsible for maintaining them and for their accuracy. Be responsible for preserving all existing iron or metal, and all concrete survey points or monuments for the construction period.

1.14 PROJECT CONDTIONS

A. TRAFFIC

1. Obtain any required Work Zone Permits from the AHJ at least two (2) working days prior to the start of work and/or placing or removing any barricades or modifying existing traffic control devices.
2. CONTRACTOR shall be responsible for erecting and maintaining barricades and other traffic warning devices as necessary around the perimeter of construction and adjacent to any open trenches. Provide and maintain adequate detours around the work under construction. Provide sufficient lights, warning signs, and watchmen for the safety of the public.
3. Any temporary street closure shall be coordinated with and approved by the AHJ. CONTRACTOR shall establish all detour routes while streets are closed during construction. CONTRACTOR shall notify Fire, Police, and EMSA headquarters when any street is temporarily closed.
4. CONTRACTOR is responsible for the prompt replacement and/or repair of all traffic control devices and appurtenances damaged or disturbed due to construction. Any existing traffic signals, signal loops, conduits, cables, and other traffic control devices affected by the work shall be reset or replaced according to AHJ's specifications. Coordinate the work with the AHJ's traffic department.

B. UTILITY INTERRUPTIONS

1. Do not interrupt any utility serving facilities occupied by Owner or others unless permitted by OWNER and the owner(s) of the utility. Temporary utility service shall be provided for any interruption. Notify OWNER and ENGINEER one week (7 days) in advance of proposed interruption of utility.

C. SUBSURFACE CONDITIONS

1. A geotechnical report has been prepared for this Project and is available for information only. The opinions expressed in this report are those of geotechnical engineer and represent interpretations of subsoil conditions, tests, and results of analyses conducted by geotechnical engineer. Owner will not be responsible for interpretations or conclusions drawn from the data.

D. EXCAVATION AND TRENCH SAFETY SYSTEMS

1. CONTRACTOR shall be responsible for complying with State laws and Federal regulations relating to excavation and trench safety, including those which may be enacted during the performance under this Contract. CONTRACTOR is advised that Federal Regulations 29 C.F.R. 1926.650-1926.652 have been, in their most recent version as amended, in effect since January 2, 1990. CONTRACTOR shall fully comply with the U.S. Department of Labor Occupational Safety and Health Administration (OSHA) regulations pertaining to excavations, trenching, and shoring and shall provide and familiarize its employees involved in excavation and trenching with the provisions in OSHA Pamphlet Number 2226, Excavating and Trenching Operations.

1.15 HAZARDOUS CONDITIONS

A. If CONTRACTOR encounters a Hazardous Environmental Condition or if CONTRACTOR or anyone for whom CONTRACTOR is responsible creates a Hazardous Environmental Condition, CONTRACTOR shall immediately: (i) secure or otherwise isolate such condition; (ii) stop all Work in connection with such condition and in any area affected thereby (except in an emergency); and (iii) notify OWNER and ENGINEER (and promptly thereafter confirm such notice in writing). OWNER shall promptly consult with ENGINEER concerning the necessity for OWNER to retain a qualified expert to evaluate such condition or take corrective action, if any.

PART 2 PRODUCTS

2.01 PERFORATED-WALL PIPES AND FITTINGS

A. Perforated PE Pipe and Fittings:

1. 3-inch through 24-inch: ASTM F 667, SCS 606, and AASHTO M 252, Type CP; corrugated, for coupled joints.
2. Fittings shall comply with ASTM F 667.
3. Pipe material shall be high density polyethylene conforming with the minimum requirements of cell classification 424410C as defined and described in the latest version of ASTM D3350; or ASTM D1248 Type III, Class C, Category 4, Grade P33.
4. Couplings: Manufacturer's standard, band type.

B. Perforated PVC Sewer Pipe and Fittings: AASHTO M 278, ASTM D 2729, bell-and-spigot ends, for loose joints.

2.02 SOLID WALL PIPES AND FITTINGS

A. Solid Wall Pipes and Fittings shall be PE or PVC pipe according to the requirements of 33 4000 “Storm Drainage Utilities”.

2.03 SOIL MATERIALS

A. Drainage Aggregate: Drainage aggregate shall be composed of hard, durable mineral particle free from organic matter, clay balls, soft particles and other impurities or foreign matter. The material shall conform to the following grading requirements:

| Sieve No. or Size | Percent passing by weight |
|---|---|
| 1-1/2 in. | 100 |
| ¾ in. | 50 to 100 |
| No. 4 | 20 to 40 |
| No. 16 | 7 to 20 |
| No. 50 | 0 to 5 |
| No. 100 | 0 to 2 |

B. Satisfactory Soils shall be according to 31 2300 “Excavation and Fill”.

2.04 GEOTEXTILE FILTER FABRICS

A. Geotextiles for pipe underdrain and drainage systems shall meet the requirements of AASHTO M 288, “Subsurface Drainage Geotextile Requirements.” Geotextile shall be according to AASHTO M 288, Table 2, with from 15 to 50 percent of in-situ soil passing the No. 200 sieve.

B. Geotextiles shall have a flow rate range from 110 to 330 gpm/sq. ft, when tested according to ASTM D 4491.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine surfaces and areas for suitable conditions where subdrainage systems are to be installed.
B. If subdrainage is required for landscaping, locate and mark existing utilities, underground structures, and aboveground obstructions before beginning installation and avoid disruption and damage of services.
C. Verify that drainage panels installed as part of foundation wall waterproofing is properly positioned to drain into subdrainage system.
D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 EARTHWORK

A. Excavating, trenching, and backfilling are specified in Section 31 23 00 Excavation and Fill.

3.03 FOUNDATION DRAINAGE INSTALLATION

A. Place impervious fill material on subgrade adjacent to bottom of footing after concrete footing forms have been removed. Place and compact impervious fill to dimensions indicated, but not less than 6 inches deep and 12 inches wide.
B. Lay flat-style geotextile filter fabric in trench and overlap trench sides.
C. Place supporting layer of drainage course over compacted subgrade and geotextile filter fabric, to compacted depth of not less than 4 inches.
D. Encase pipe with sock-style geotextile filter fabric before installing pipe. Connect sock sections with adhesive or tape.
E. Install drainage piping as indicated on Drawings and manufacturer's requirements.
F. Add drainage course to width of at least 6 inches on side away from wall and to top of pipe to perform tests.
G. After satisfactory testing, cover drainage piping to width of at least 6 inches on side away from footing and above top of pipe to within 12 inches of finish grade.
H. Install drainage course and wrap top of drainage course with flat-style geotextile filter fabric.
I. Place layer of flat-style geotextile filter fabric over top of drainage course, overlapping edges at least 6 inches.
J. Place backfill material over compacted drainage course. Place material in loose-depth layers not exceeding 6 inches. Thoroughly compact each layer. Final backfill to finish elevations and slope away from building.

3.04 UNDERSLAB DRAINAGE INSTALLATION

A. Excavate for underslab drainage system after subgrade material has been compacted but before drainage course has been placed. Include horizontal distance of at least 6 inches between drainage pipe and trench walls. Grade bottom of trench excavations to required slope, and compact to firm, solid bed for drainage system.
B. Lay flat-style geotextile filter fabric in trench and overlap trench sides.
C. Place supporting layer of drainage course over compacted subgrade and geotextile filter fabric, to compacted depth of not less than 4 inches.
D. Encase pipe with sock-style geotextile filter fabric before installing pipe. Connect sock sections with adhesive or tape.
E. Install drainage piping as indicated on Drawings and manufacturer's requirements.
F. Add drainage course to width of at least 6 inches on side away from wall and to top of pipe to perform tests.
G. After satisfactory testing, cover drainage piping with drainage course to elevation of bottom of slab, and compact and wrap top of drainage course with flat-style geotextile filter fabric.

3.05 RETAINING-WALL DRAINAGE INSTALLATION

A. Lay flat-style geotextile filter fabric in trench and overlap trench sides.
B. Place supporting layer of drainage course over compacted subgrade to compacted depth of not less than 4 inches.
C. Encase pipe with sock-style geotextile filter fabric before installing pipe. Connect sock sections with adhesive or tape.
D. Install drainage piping as indicated on Drawings and manufacturer's requirements.
E. Add drainage course to width of at least 6 inches on side away from wall and to top of pipe to perform tests.
F. After satisfactory testing, cover drainage piping to width of at least 6 inches on side away from footing and above top of pipe to within 12 inches of finish grade.
G. Place drainage course in layers not exceeding 3 inches in loose depth; compact each layer placed and wrap top of drainage course with flat-style geotextile filter fabric.
H. Place layer of flat-style geotextile filter fabric over top of drainage course, overlapping edges at least 6 inches.
I. Fill to Grade: Place satisfactory soil fill material over compacted drainage course. Place material in loose-depth layers not exceeding 6 inches. Thoroughly compact each layer. Fill to finish grade.

3.06 PIPING INSTALLATION

A. Install piping beginning at low points of system, true to grades and alignment indicated, with unbroken continuity of invert. Bed piping with full bearing in filtering material. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions and other requirements indicated.

1. Foundation Subdrainage: Install piping level and with a minimum cover of 36 inches unless otherwise indicated.
2. Underslab Subdrainage: Install piping level.
3. Retaining-Wall Subdrainage: When water discharges at end of wall into storm water piping system, install piping level and with a minimum cover of 36 inches unless otherwise indicated.
4. Lay perforated pipe with perforations down.
5. Excavate recesses in trench bottom for bell ends of pipe. Lay pipe with bells facing upslope and with spigot end entered fully into adjacent bell.

B. Use increasers, reducers, and couplings made for different sizes or materials of pipes and fittings being connected. Reduction of pipe size in direction of flow is prohibited.
C. Install thermoplastic piping according to ASTM D 2321.

3.07 PIPE JOINT CONSTRUCTION

A. Join perforated PE pipe and fittings with couplings according to ASTM D 3212 with loose banded, coupled, or push-on joints.
B. Join perforated PVC sewer pipe and fittings according to ASTM D 3212 with loose bell-and-spigot, push-on joints.
C. Special Pipe Couplings: Join piping made of different materials and dimensions with special couplings made for this application. Use couplings that are compatible with and fit materials and dimensions of both pipes.

3.08 BACKWATER VALVE INSTALLATION

A. Comply with requirements for backwater valves specified in Section 33 40 00 Storm Drainage Utilities.
B. Install horizontal backwater valves in header piping downstream from perforated subdrainage piping.
C. Install horizontal backwater valves in manholes or pits where indicated.

3.09 CLEANOUT INSTALLATION

A. Comply with requirements for cleanouts specified in Section 33 40 00 Storm Drainage Utilities.

B. Cleanouts for Subdrainage:

1. Install cleanouts from piping to grade. Locate cleanouts at beginning of piping run and at changes in direction. Install fittings so cleanouts open in direction of flow in piping.
2. In vehicular-traffic areas, use NPS 4 cast-iron soil pipe and fittings for piping branch fittings and riser extensions to clean-out. Set cleanout frames and covers in a cast-in-place concrete anchor, 18 by 18 by 12 inches deep. Set top of cleanout flush with grade.
3. In non-vehicular-traffic areas, use NPS 4 cast-iron pipe and fittings for piping branch fittings and riser extensions to clean-out. Set cleanout frames and covers in a cast-in-place concrete anchor, 12 by 12 by 4 inches deep. Set top of cleanout 1 inch above grade.
4. Comply with requirements for concrete specified in Section 32 13 00 Rigid Paving.

C. Cleanouts for Underslab Subdrainage:

1. Install cleanouts and riser extensions from piping to top of slab. Locate cleanouts at beginning of piping run and at changes in direction. Install fittings so cleanouts open in direction of flow in piping.
2. Use NPS 4 cast-iron soil pipe and fittings for piping branch fittings and riser extensions to cleanout flush with top of slab.

3.10 CONNECTIONS

A. Comply with requirements for piping specified in Section 33 40 00 Storm Drainage Utilities. Drawings indicate general arrangement of piping, fittings, and specialties.

3.11 IDENTIFICATION

A. Arrange for installation of green warning tapes directly over piping. Comply with requirements for underground warning tapes specified in specified in 31 23 00 Excavation and Fill.

1. Install PE warning tape or detectable warning tape over ferrous piping.
2. Install detectable warning tape over nonferrous piping and over edges of underground structures.

3.12 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. After installing drainage course to top of piping, test drain piping with water to ensure free flow before backfilling.
2. Remove obstructions, replace damaged components, and repeat test until results are satisfactory.

B. Drain piping will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

3.13 CLEANING

A. Clear interior of installed piping and structures of dirt and other superfluous material as work progresses. Maintain swab or drag in piping and pull past each joint as it is completed. Place plugs in ends of uncompleted pipe at end of each day or when work stops.

END OF SECTION 33 4600