

**GEOTECHNICAL ENGINEERING REPORT  
CHEROKEE NATION OSU BUILDING  
TAHLEQUAH, OKLAHOMA**

Prepared for:

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PPI PROJECT NUMBER: 255932

April 4, 2019, Rev. 1

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Attn: Mr. Shane Boren, AIA, LEED AP  
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RE: Geotechnical Engineering Report  
New Cherokee Nation OSU Building  
Tahlequah, Oklahoma  
PPI Project Number: 255932

Dear Mr. Boren:

Attached, please find the report summarizing the results of the Geotechnical Investigation conducted for the proposed new Cherokee Nation OSU Building in Tahlequah, Oklahoma. We appreciate this opportunity to be of service. If you have any questions, please don't hesitate to contact this office.

PALMERTON & PARRISH, INC.

By:



Brandon R. Parrish, P.E.  
Vice-President



PALMERTON & PARRISH, INC.

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BRP/BRP/jrh

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## EXECUTIVE SUMMARY

A Geotechnical Investigation was performed at the site planned for construction of the new Cherokee Nation Oklahoma State University (OSU) Building located to the west of S. Bliss Avenue on the existing W.W. Hastings Hospital campus in Tahlequah, Oklahoma. This project is anticipated to include construction of a new building and access drive to the south. The new structure is anticipated to be three (3) to four (4) stories in height with a partial walk out basement to the south, steel framed, utilize a slab-on-grade floor system (north half) and a basement slab-on-grade (south half), exhibit light to moderate foundation loads, with a footprint measuring approximately 20,000 sq. ft. in plan view. Up to approximately 12 ft. of cut and 8 ft. of fill is anticipated within the building footprint on the south and north sides, respectively, to provide finish subgrade elevation. Based upon project plans, new pavement for an access drive will be located on the south side of the new building.

The existing Physical Therapy Building is located within the footprint of the proposed new structure. This building consists of a single-story, slab-on-grade structure and is anticipated to be demolished prior to construction of the new building. This building was present during drilling of Borings 1 through 10, while Borings 11 through 13 were drilled within the previous building footprint following demolition.

A total of twelve (12) borings were drilled within or immediately adjacent to the proposed building footprint during this Geotechnical Investigation. It should be noted that the original Boring 4 was omitted due to the unknown location of buried utilities. All borings were discontinued in natural overburden soils or chert at depths ranging from 9.4 to 30 ft. below the existing ground surface.

Based upon the information obtained from the borings and subsequent laboratory testing, the site is suitable for construction of the proposed new Cherokee Nation OSU Building. Important geotechnical considerations for the project are summarized below. However, users of the information contained in the report must review the entire report for specific details pertinent to geotechnical design considerations.

## EXECUTIVE SUMMARY CONTINUED

- The project site primarily consists of the footprint of the existing Physical Therapy Building or grass covered lawn areas;
- Existing fill depths ranging from 1 to 5 feet were encountered within the Borings drilled. Deeper existing fill depths, up to approximately 8 ft., are anticipated at the southwest corner of the previous Physical Therapy building footprint based upon current site topography and existing finish floor elevation. However, most of the existing fill is anticipated to be removed during site grading;
- The existing fill consisted of chert gravels and sands or gravelly clays. **The origin and method of placement of the existing fill is unknown and for the purposes of this report should be considered uncontrolled;**
- Thin topsoil (~3 inches or less) was encountered within the majority of the borings located in grass covered areas;
- Overburden soils generally consisted of chert gravels and sands or gravelly clays with zones of solid chert, or chert boulders and cobbles, as typically found in the Tahlequah area. These soils were primarily logged as very stiff or very dense and exhibit significant drilling difficulty when using standard drilling methods;
- Voids underlying and within dense chert zones have been encountered at the project site, primarily along Hospital Drive and Visitors Drive located to the south and southeast of the proposed project site. Loss of drilling fluid return was noted within most borings drilled for the Cherokee Nation OSU Building, indicating fractures and possible voids within the chert stratum. These zones typically ranged from 0.5 to 1 ft. in thickness. However, large voids or caverns, were not noted during the subsurface exploration;

## EXECUTIVE SUMMARY CONTINUED

- Foundation loads for the new Cherokee Nation OSU Building may be supported upon shallow foundations bearing upon very stiff or dense natural overburden soils, or controlled fill. All existing fill below proposed new foundations/slabs should be removed and replaced. These recommendations are further discussed in Section 9.0 of this report;
- Foundation loads may also be supported upon deep foundations bearing in very stiff/very dense natural overburden soils/chert or bedrock, although only **one (shallow or deep) foundation type** is recommended for the structure. Deep foundation recommendations are further discussed in Section 10.0 of this report. **However, due to the potential presence of voids within the subsurface and associated potential concrete loss during construction, shallow foundations are the recommended foundation alternate;**
- Due to the stiff and/or dense nature of the existing subgrade soils, sufficient support is anticipated to be provided for any slabs or pavements;
- The project site classifies as a Site Class C in accordance with Section 1613 of the 2015 International Building Code (IBC), as determined by shear wave velocity testing performed at the site during this investigation;
- Excavation and mass earth moving at this project site is anticipated to generally be difficult and variable. Excavation difficulty and rippability of the existing overburden soils at the site is further discussed in Section 8.6 of this report;
- Once basement excavation and undercutting of the existing fill has been performed, it is recommended that the building footprint be scanned using Ground Penetrating Radar (GPR) in search for large shallow subsurface voids. PPI has performed a similar investigation using GPR in the past to the south of the site with success; and

- Palmerton & Parrish, Inc. should be retained for construction observation and construction materials testing. Close monitoring of subgrade preparation work is considered critical to achieve adequate foundation and subgrade performance.

**GEOTECHNICAL ENGINEERING REPORT**  
**NEW CHEROKEE NATION OSU BUILDING**  
**TAHLEQUAH, OKLAHOMA**

**1.0 INTRODUCTION**

This is the report of the Geotechnical Investigation performed at the site planned for construction of the new Cherokee Nation OSU Building located west of S. Bliss Avenue on the existing W.W. Hastings Hospital campus in Tahlequah, Oklahoma. This investigation was authorized by a letter proposal prepared by Palmerton & Parrish, Inc. (PPI) dated January 7, 2019 and signed by Mr. Breck Childers, AIA, representing Childers Architect. The approximate site location is shown below for reference.



The purpose of the Geotechnical Investigation was to provide recommendations for foundation design and construction planning, and to aid in site development. Palmerton & Parrish Inc.'s (PPI) scope of services included field and laboratory investigation of the subsurface conditions in the vicinity of the proposed project site, engineering analysis of the collected data, development of recommendations for foundation design and construction planning, and preparation of this engineering report.

## 2.0 PROJECT DESCRIPTION

Item	Description
Site Layout	See Figure 1: Boring Location Plan
New Cherokee Nation OSU Building	<ul style="list-style-type: none"><li>• Three to four-stories in height;</li><li>• Slab-on-grade (north half) &amp; walk out basement (south half);</li><li>• Steel framed;</li><li>• Finish Floor Elevation (ground level) = 908.67;</li><li>• Basement Elevation = 892.67;</li><li>• Column loads ranging from 5 to 600 kips;</li><li>• Wall loads ranging from 0.5 to 3 kips per foot; and</li><li>• Measure approximately 20,000 sq. ft. in plan view.</li></ul>
Pavement	New pavement for an access drive is also anticipated at the south end of the proposed new structure at the walk out basement elevation.
Anticipated Grading	<ul style="list-style-type: none"><li>• 8 ft. fill – North Half; and</li><li>• 12 ft. cut – South Half.</li></ul>
Retaining Wall	A below grade foundation (retaining) wall will be constructed along the east side (south half) and within the center of the structure separating the slab-on-grade and basement structure.

## 3.0 SITE DESCRIPTION

Item	Description
Latitude/Longitude (± Center of Project Site)	35.909978° / -94.951009°
Available Historic Aerial Photography	The north half of the existing Physical Therapy Building is believed to have been constructed in approximately 2007 with the southern addition constructed in 2011. The project site is believed to have consisted of grass/wooded areas since prior to construction of the existing Physical Therapy Building. The W.W. Hastings Hospital is believed to have been constructed around the early 1980's.
Current Ground Cover	Building or grass/gravel covered.
Existing Topography	Sloping to the southwest
Drainage Characteristics	Fair to Good.



## **4.0 BACKGROUND INFORMATION**

PPI performed the geotechnical investigation for currently under construction Cherokee Nation Outpatient Health Clinic located to the east of the proposed project site. During this investigation, only minor voids at significant depth were noted in the borings drilled. However, during mass grading for the project, significant voids were noted to the south and southeast of the proposed project site during construction of Hospital and Visitors Drive.

## **5.0 SUBSURFACE INVESTIGATION**

Subsurface conditions were investigated through completion of twelve (12) subsurface borings and subsequent laboratory testing. One (1) boring, Boring 4, was omitted as discussed below. In addition, shear wave velocity testing was also performed for seismic site classification purposes.

### **5.1 Subsurface Borings**

All borings were located within or adjacent to the proposed structure footprint. As previously mentioned, the existing Physical Therapy Building is presently located at the site, which limited the area in which could be accessed during drilling of Borings 1 through 10. Following building demolition, Borings 11 through 13 were drilled within the demolished building footprint. Borings were identified as Borings 1 through 13 and are shown on Figure 1: Boring Location Plan. Boring locations were selected by PPI based upon recommendations by the Design Team and adjusted to areas accessible by a drill rig. Boring 4 was not drilled due to the unknown location of buried utilities within this area.

Borings drilled were discontinued in chert or natural overburden soils at depths ranging from 9.4 to 30 ft. below the existing ground surface. The Oklahoma One-Call System, as well as hospital maintenance personnel, were notified prior to the investigation to assist in locating buried public and private utilities, respectively. Logs of the borings showing descriptions of soil and rock units encountered, as well as results of field and laboratory tests and a “Key to Symbols” are presented in Appendix I. Surface elevations for each boring are noted on each boring log.

Surface elevations were surveyed in the field using the existing Physical Therapy finish floor elevation as a benchmark and are anticipated to be within +/- 0.5 ft. of actual elevations.

Borings were drilled January 21 through 24, and March 27 and 28, 2019 using a 3.625-inch tricone with wash rotary methods or 4.25" I.D. hollow stem augers. All borings were drilled by an ATV-mounted CME-1050 drill-rig. Soil samples were collected at 2.5 to 5-ft. centers during drilling using a split spoon sampler while performing the Standard Penetration Test (SPT) in general accordance with ASTM D1586. Please refer to Appendix II for general notes regarding boring logs and additional soil sampling information.

## **5.2 Laboratory Testing**

Collected samples were sealed and transported to the laboratory for further evaluation and visual examination. Laboratory soil testing included the following:

- Moisture Content (ASTM D2216);
- Grain Size Analysis (ASTM D6913);
- Atterberg Limits (ASTM D4318); and
- Pocket Penetrometers.

Laboratory test results are shown on each boring log in Appendix I and are summarized in the following table and grain size analysis results are also presented in Appendix III.



Boring	Depth (ft.)	Liquid Limit (LL)	Plastic Limit (PL)	Plasticity Index (PI)	Moisture Content (%)	USCS Symbol	% Passing No. 200 Sieve
1	3	-	-	-	15.2	GC	18
2	3.5	-	-	-	19.1	GC	19
3	13.5	-	-	-	21.5	GC	25
6	13.5	86	26	60	40.0	CH	-
8	3.5	-	-	-	12.9	GC	27
9	18	-	-	-	19.2	SC	30
9	23	89	26	63	40.8	CH	-
10	8.5	-	-	-	-	GC	14
10	23.5	65	21	44	28.2	CH	-
11	3.5	-	-	-	18.5	SC	23
12	3.5	-	-	-	11.4	GC	32
13	3.5	-	-	-	12.0	GC	41
13	28.5	-	-	-	19.3	GC	40

Note: Sample classification sometimes differs from general strata description on the boring logs due to relatively small sample size & coarse nature of the strata. See individual boring logs for description of general strata.

## 6.0 SITE GEOLOGY

According to the United States Geologic Survey's Geological Map of Oklahoma, the general site is underlain at depth by Mississippian Age deposits primarily of the Keokuk and Reeds Spring formation and the St. Joe Group. Within the site area, the primary rock type is chert with other rock types consisting of limestone and shale. Overburden soils at the site are typically residual having developed through chemical and physical weathering of the underlying parent bedrock, consisting primarily of chert fragments, boulders and clay layers. The boundary between overburden soils and relatively unweathered limestone is usually abrupt.

## 7.0 GENERAL SITE & SUBSURFACE CONDITIONS

Based upon subsurface conditions encountered within the borings drilled at the project site, generalized subsurface conditions are fairly consistent across the project site, and similar to typical overburden soils found within the Tahlequah area. Surficial materials primarily consist of thin (approximately 3-inches or less) topsoil, overlying very stiff to very dense chert laden lean or fat clays. Oftentimes the percentage of clay is less than 50 percent, and the soils classify as chert gravels or sands. Zones of relatively chert

free very stiff fat clays were encountered, but are believed to be isolated. These conditions are presented on each boring log attached in Appendix I. Soil stratification lines on the boring logs indicate approximate boundary lines between different types of soil and rock units based upon observations made during drilling. In-situ transitions between soil and some rock types are typically gradual.

### **7.1 Existing Fill**

As previously mentioned, approximately 1 to 5 ft. of existing fill was noted within the borings drilled. However, based upon site topography and the previous building finish floor elevation, existing fill depths up to 8 ft. are possible at the southwest building corner. Within the proposed new basement area (south half), most if not all of the existing fill is anticipated to be removed. Within the north half, additional fill is required to achieve proposed finish grade. The existing fill primarily classified as clayey gravel or sand, similar to the surrounding natural soils. Due to the undocumented nature of this fill material, all existing fill material should be removed if not already required to be removed to achieve plan grades. The existing fill removed will most likely be satisfactory for re-use within most areas, but material classification confirmation with Section 8.1 below should be confirmed by PPI prior to use.

### **7.2 Groundwater**

Shallow groundwater was not noted within the borings on the date drilled. However, it should be noted that water-based drilling methods were used during field drilling. As a result, obtaining groundwater levels below a couple feet in depth was not possible. Groundwater levels should be expected to fluctuate with changes in site grading, precipitation, and regional groundwater levels. Groundwater may be encountered at shallower depths during wetter periods.

## **8.0 EARTHWORK**

As previously mentioned, up to approximately 8 ft. of fill and 12 ft. of cut is anticipated within the north and south half of the proposed structure footprint, respectively, to provide finish subgrade elevations.

The initial phase of site preparation should include the following:

- Removal of the existing physical therapy building (performed March 2019) and any existing foundations or slabs within the proposed building footprint. In addition, clearing and grubbing of all vegetative matter should be performed within current lawn/landscape areas. All vegetative matter, including trees/root bulbs and topsoil should be removed from areas scheduled to receive new fill and/or slab/pavement construction;
- Topsoil/vegetative matter stripping on the order of 3-inches should be anticipated in grass covered areas. Topsoil should either be hauled off-site or stockpiled for reuse in lawn and landscape areas only;
- **Much of the existing fill material is anticipated to be removed to achieve finish subgrade elevations at the project site. However, several feet of existing fill material is anticipated to be present near the center and north end of the proposed structure, located on the north side of the future basement area. Any existing fill remaining after initial site grading should be removed, and properly replaced in accordance with Section 8.0 of this report; and**
- Areas scheduled to receive controlled fill should be proof-rolled and approved in accordance with the following section of this report.

After the initial phase is complete, it is recommended that all building, pavement and undercut bottoms be proof-rolled to assure a stable subgrade. Proof-rolling consists essentially of rolling the ground surface with a fully loaded tandem axle dump truck or similar heavy rubber-tired construction equipment and noting any areas which rut or deflect during rolling. All soft subgrade areas, if any, identified during proof-rolling should be undercut and replaced with compacted fill as outlined below. Proof-rolling, undercutting and replacement should be monitored by a representative of PPI. **Although anticipated to be minimal, the depth and areal extent of undercutting soft subgrade areas will be largely dependent upon the time of year and related soil moisture conditions. If construction is initiated during or**

**immediately following wetter months, the requirement for undercutting soft surficial soils below planned cut depths should be anticipated and reflected in the contract documents.**

After evaluation by proof-rolling and approval, the subgrade should be scarified to a depth of at least 8 inches, adjusted to within the optimum moisture content ranges and compacted to specified density, provided below (See Section 8.3). Placement of controlled fill may then proceed.

## 8.1 Fill Material Types

Fill Type <sup>1</sup>	USCS Classification	Acceptable Location for Placement
On-Site Soils / Imported Fill	GC, SC, SW or GW	<b>Required</b> beneath building footprint ( <b>below foundation elements</b> ), extending outside perimeter walls a horizontal distance equal to the height of fill embankment. Also acceptable for all other areas/elevations not requiring LVC material.
Low Volume Change (LVC) Engineered Fill <sup>2</sup>	CL, GC, or SC (LL < 50)	<b>Required</b> beneath slabs for a depth of 2 ft., CL materials should be placed <b>above foundation elements only</b> . May be used below foundations if classifying as a GC or SC <u>only</u> . Acceptable for all other areas/elevations outside the building footprint as well.
On-Site Natural Soils	ML <sup>3</sup>	All locations and elevations
On-Site Natural Soils	CH	Should <b>not</b> be placed within the upper 2 ft. beneath foundations, floor slabs and pavements.
<ol style="list-style-type: none"> <li>Controlled, compacted fill should consist of approved materials that are free of organic matter and debris and contain maximum rock size of 12 inches, or the lift thickness, whichever is less. Frozen material should not be used and fill should not be placed on a frozen subgrade. A sample of each material type should be submitted to the Geotechnical Engineer for evaluation prior to its use.</li> <li>Low plasticity cohesive soil or granular soil having a liquid limit of less than 50%, contain at least 15% fines retained on the No. 200 sieve, and preapproved by the Geotechnical Engineer.</li> <li>ML soils are only considered suitable as controlled fill, if containing at least 35% gravel sized particles.</li> </ol>		

## 8.2 Acceptable LVC Material

LVC material is recommended within 2 ft below bottom of floor slab elevation. Potential sources of LVC material are as follows:

- Import from an off-site borrow area complying with Table 8.1; and

- On-site soils, classifying as CL, SC or GC may be segregated during footing or floor slab undercutting procedures or general earthwork procedures.

**Most soil types present at the project site classify as LVC fill material, except CH material.** Topsoil strippings or material containing organics should not be used as LVC material.

### 8.3 Compaction Requirements

Item	Description
Subgrade Scarification Depth	At least 8 inches
Fill Lift Thickness	12-inches (loose) using the minimum compactor referenced below
Compaction Requirements <sup>1</sup>	Six (6) passes (3 each direction) minimum using a self-propelled vibratory compactor with a minimum drum diameter of 48-inches for granular soils, or 95% Standard Proctor Density (ASTM D698) for materials containing sufficient fines content allowing for accurate field nuclear density testing.
Moisture Content	<ul style="list-style-type: none"> <li>• <math>\pm 2\%</math> optimum moisture for CL, SC, GC, GW &amp; SW Soil Types; and</li> <li>• 0 to 4% above optimum for CH Soil Types.</li> </ul>
Field Density Testing Frequency (if material type allows)	<ul style="list-style-type: none"> <li>• Building Areas – One (1) test every 2500 sq. ft. per fill lift;</li> <li>• Pavement Areas – One (1) test every 5000 sq. ft. per fill lift; and</li> <li>• No less than three (3) tests per each fill lift.</li> </ul>
<sup>1</sup> . We recommend that engineered fill (including scarified compacted subgrade) be tested for moisture content and compaction during placement. Should the results of the in-place density tests indicate the specified moisture or compaction limits have not been met, the area represented by the test should be reworked and retested as required until the specified moisture and compaction requirements are achieved.	

### 8.4 Site Drainage

Discharge from roof downspouts should be collected and diverted well away from the building perimeter. Rapid, efficient runoff away from the building should also be provided. In addition, landscaping requiring frequent watering should be prohibited adjacent to building foundations.

### 8.5 Excavations

Based upon the subsurface conditions encountered during this investigation, the on-site soils typically classify as Type B in accordance with OSHA regulations. Temporary excavations in soils classifying as Type B with a total height of less

than 20 ft. should be cut no steeper than 1H:1V in accordance with OSHA guidelines. **Confirmation of soil classification during construction, as well as construction safety (including shoring, if required), is the responsibility of the contractor.**

## **8.6 Rippability**

As mentioned throughout this report, the overburden soils at the project site primarily consist of very dense clayey gravels with chert cobbles and boulders with isolated areas consisting of clays with a reduced chert content. Significant difficulty was experienced when drilling the geotechnical borings within this chert laden material. Based upon this information, the overburden soils are anticipated to be rippable with dozers, but with difficulty. In addition, areas resistant to ripping consisting of large chert boulders, requiring other removal methods (pneumatic breakers) should be anticipated. The Earthwork Contractor should review the attached boring logs when assessing excavation difficulty at this site. Mass grading at this site is anticipated to occur at a slower rate as compared to sites where overburden soils are primarily fine grained (silts and clays).

## **8.7 Expansive Soils**

Due to the overburden soils primarily consisting of clayey gravels and gravelly clays, significant shrink/swell behavior is not anticipated. If relatively chert free fat clay zones are encountered at footing bottom and finish subgrade elevation, they should be undercut 2 ft., or to gravelly clays/clayey gravels, whichever is shallower, and replaced with LVC fill material. Although isolated zones of fat clays were encountered during drilling, they are not the primary material anticipated within footing, floor slab and pavement subgrades. In any event, soil subgrades should not be allowed to become dry and dessicate prior to concrete placement.

## **8.8 Utility Trenches**

New utility trenches servicing the new structures are anticipated to be required. These trenches are often times sources of moisture migration into the structure. A relatively impervious material (clay with little rock, etc.) should be placed within the

utility trench, surrounding the utility immediately outside the structure to reduce the potential for moisture migration into the structure via utility trenches. The “trench plug” should extend out from the structure a minimum of 5 ft. horizontally, and be placed in a controlled manner in accordance with Section 8.3 above.

## 9.0 FOUNDATIONS

As previously mentioned, the new Cherokee Nation OSU Building is anticipated to exhibit light to moderate foundation loads (column loads ranging from approximately 5 to 600 kips with wall loads ranging from 0.5 to 3 kips per foot). Recommendations for both shallow foundations and deep foundations are provided in the following sections. Due to primarily dense/stiff consistency of the existing overburden soils, as well as the potential concrete loss during placement of deep foundation elements due to potential deeper subsurface voids, shallow foundations are the preferred foundation alternate. **Regardless, only one foundation type is recommended to reduce the potential for differential settlement.**

### 9.1 Shallow Foundations

Foundation loads at this project site may be supported upon stiff or dense natural overburden soils or controlled fill placed in accordance with Section 8.0 of this report, **following removal and replacement of the existing fill within the building footprint placed in accordance with Sections 8.1 and 8.3 above.** Recommendations for shallow foundation design and construction are provided in the following table.



Description	Column (Spread Footing)	Wall (Continuous Footing)
Net Allowable Bearing Pressure <sup>1</sup>	5,000 psf	4,500 psf
Minimum Dimensions	2.5 ft.	1.5 ft.
Recommended Bearing Depth (Natural Soils or Controlled Fill) <sup>2</sup>	Depth sufficient to achieve minimum frost protection	
Minimum Embedment Below Finished Grade for Frost Protection & Variation in Soil Moisture <sup>3</sup>	2.0 ft.	
Passive Pressure <sup>4</sup>	<u>Allowable</u> = 230 pcf (equivalent fluid pressure) <u>Ultimate</u> = 460 pcf (equivalent fluid pressure)	
Coefficient of Sliding Friction <sup>5</sup>	<u>Allowable</u> = 0.26 (natural soils/controlled fill) <u>Ultimate</u> = 0.52 (natural soils/controlled fill)	
<div>1. The recommended net allowable bearing pressure is the pressure in excess of the minimum surrounding overburden pressure at the footing base elevation. The recommended pressure considers that all unsuitable and/or soft or loose soils, if encountered, are undercut and replaced with tested and approved new engineered fill. Footing excavations should be free of loose and disturbed material, debris, and water when concrete is placed. <b>This bearing pressure assumes stiff or dense material is present below footing bottoms and any fill material placed below foundations consists of properly placed clayey gravels or gravelly clays.</b></div> <div>2. PPI should be retaining to observe footing bottoms prior to placing concrete.</div> <div>3. For perimeter footings and footings beneath unheated areas.</div> <div>4. <u>Allowable</u> passive pressure value considers a Factor of Safety of approximately 2, while the <u>Ultimate</u> value does not include a factor of safety. Passive pressure value applies to undisturbed natural overburden soils or properly compacted fill. If formed footings are constructed, the space between the formed side of a footing and excavation sidewall should be cleaned of all loose material, debris, and water and backfilled with tested and approved fill compacted to at least 95% of the material's Standard Proctor dry density.</div> <div>5. <u>Allowable</u> coefficient of friction value assumes a Factor of Safety equal to approximately 2, while the <u>Ultimate</u> value does not include a factor of safety. This value is applicable for on-site clayey gravels and gravelly clays.</div>		

### 9.1.1 Uplift Capacity of Shallow Foundations

Resistance of shallow spread footings to uplift ( $U_p$ ) may be based upon the dead weight of the concrete footing structure ( $W_c$ ) and the weight of soil backfill contained in an inverted cone or pyramid directly above the footings ( $W_s$ ). The following parameters may be used in design:

Description	Weights
Weight of Concrete ( $W_c$ )	150 pcf
Weight of Soil Resistance ( $W_s$ )	100 pcf

The base of the cone or pyramid should be the top of the footing and the pyramid or cone sides should form an angle of 30 degrees with the vertical. Allowable uplift capacity ( $U_p$ ) should be computed as the lesser of the two (2) equations listed below:



$$U_P = (W_S/2.0) + (W_C/1.25) \text{ or } U_P = (W_S + W_C)/1.5$$

### 9.1.2 Construction Considerations for Shallow Foundations

It is essential that footing bottoms should not be allowed to become dry and desiccate prior to concrete placement to help reduce the potential for shrink/swell behavior. Footings should be clean and free of standing water, debris, and loose soil at the time of concrete placement. Footing/mat excavations should be observed by a representative of PPI prior to placement of reinforcing steel and concrete placement.

### 9.1.3 Ground Improvement

Due to the dense to very dense overburden soils at the project site, ground improvement using aggregate piers is not believed to be an economic foundation system. Due to the significant drilling difficulties associated with very dense and large size chert, installation of aggregate piers is anticipated to be costly, as well as time consuming and provide little increase in allowable bearing capacity.

## 9.2 **Deep Foundations**

Deep foundations are also considered a viable foundation alternate. Several methods of deep foundation support were evaluated for this site. However, due to site specific conditions such as deep bedrock, potential for deeper subsurface voids and very dense overburden soils consisting of chert that are resistant to typical drilling methods, only two (2) deep foundation alternates have been recommended. The two (2) deep foundation system alternates include:

- Drilled piers bearing in dense natural overburden soils/chert or limestone bedrock; or
- Predrilled driven piling bearing in dense natural overburden soils/chert or limestone bedrock.

### 9.2.1 Drilled Piers

Foundation recommendations for each alternate are provided in the following sections. As previously mentioned, bedrock (limestone) was not encountered

within a depth of 30 ft. at the project site. Previous borings drilled by PPI for the adjacent Cherokee Nation Outpatient Health Center did not encounter limestone within 50 and possibly greater than 90 ft. at the project site. Since limestone is not anticipated to be encountered within a practical depth, drilled piers bearing in dense natural overburden soils/chert are recommended, if utilized for building support. Based upon the borings drilled at the project site, a minimum drilled pier depth of at least 25 ft. is recommended. Drilled pier depth will also be dictated by the required compressive load at each drilled pier and the amount of skin friction utilized in the design. The following subsections provide drilled pier recommendations.

## 9.2.2 Drilled Pier Design Recommendations

Description	Value
<b>Foundation Type</b>	Straight shaft drilled piers
<b>Bearing Material<sup>1</sup></b>	Dense to very dense natural clayey chert or very stiff cherty clay overburden soils
<b>Minimum Pier Penetration</b>	25 ft. below existing finish grade elevation
<b>Maximum Net Allowable Bearing Pressure<sup>2</sup></b>	20 ksf (overburden soils)
<b>Maximum Allowable Skin Friction – Axial Compression<sup>3</sup></b>	1.0 ksf (overburden soils)
<b>Maximum Allowable Skin Friction – Uplift<sup>4</sup></b>	1.0 ksf (overburden soils)
<b>Group Effects – Axial Capacity</b>	Piers should be installed with a center-to-center spacing of at least three (3) pier diameters. Group effects can be neglected and the total capacity of the pier group taken as the sum of the individual per capacities, provided that the adjacent piers are spaced at least three (3) pier diameters (center-to-center).
<b>Group Effects – Lateral Capacity</b>	When piers are installed close together, the lateral capacity of the group is not equivalent to the lateral capacity of an isolated individual pier times the number of piers in the group. Only those piers that are unobstructed by the other piers in the direction of the force develop full capacity. For pier groups with a pier spacing of three (3) pier diameters center-to-center, a multiplier of 0.8 should be used for the lead row of piers, 0.4 for the 2 <sup>nd</sup> row and 0.3 for the 3 <sup>rd</sup> and subsequent rows. The efficiency of the pier group is dependent upon the pier layout in the group, but would typically be on the order of 75 percent of a single pier for a pier spacing of three (3) pier diameters. The pier group effect increases significantly for closer spacing, resulting in lower efficiency.
<b>Minimum Shaft Diameter<sup>5</sup></b>	30-inches
<b>Minimum Grade Beam Bearing Depth</b>	24-inches below final exterior adjacent grade
<b>Estimated Total Settlement</b>	1-inch or less
<b>Estimated Differential Settlement</b>	1/2-inch or less
<p>1. Due to variations in the depth and quality of the dense to very dense overburden soils across the site, the Geotechnical Engineer or his representative should be present during pier drilling to verify that unsuitable bearing strata is <u>not</u> present within the pier bottom.</p> <p>2. This is the pressure at the base of the foundation in excess of the adjacent overburden pressure. The allowable bearing pressure has a Factor of Safety of approximately 3.</p> <p>3. The allowable skin friction has a Factor of Safety of approximately 2.</p> <p>4. The allowable skin friction values have a Factor of Safety of approximately 2.</p> <p>5. Sufficient steel reinforcement should be placed to provide adequate structural integrity.</p>	

### 9.2.3 Lateral Loading for Drilled Piers

It is anticipated that resistance of the foundations to lateral loading and the associated lateral deflection will be evaluated using finite difference computer models based on the horizontal modulus of subgrade reaction ( $K_h$ ). The following values may be used in the analysis for this site.

Please note that the table states to ignore lateral support for the depth of 0 to 1 pier diameter or 2.5 ft., whichever is shallower. This notation is intended to account for the fact that near surface soils are significantly disturbed during drilled shaft excavation, which generally reduces the lateral support provided. Designers should use their judgment and make an appropriate reduction of soil strength parameters in this zone.

Values summarized in the table below are based upon published correlations and field and laboratory data collected during this subsurface investigation. **Values shown below are ultimate values representative of in-situ soil properties, and do not include a Factor of Safety.** These values may be used to compute resistance to lateral loading of the overburden soils. The appropriate Factor of Safety should be chosen by the designer.

Pier Depth	Unit Weight (pcf)	Static $K_h$ (pci)	Cyclic $K_h$ (pci)	$e_{50}$
*0-1 Pier Diameter	Ignore	-	-	-
*1 Pier Diameter to Bottom of Pier	125	1000	400	0.005
*Lateral parameters for the upper 1 pier diameter, or 2.5 ft., whichever is shallower, should be ignored.				

The above values were measured or based upon published correlations with anticipated soil strength and classification tests. **PPI can perform a site/structure specific lateral loading analysis once foundation type and loading has been determined, if desired.**

### 9.2.4 Drilled Pier Construction Recommendations

Drilled piers should have a straight shaft and should be founded at least 25 ft. below the existing ground surface bearing in dense to very dense natural

overburden soils/chert. **Overburden soils/chert are considered very resistant to typical auger methods. In any event, the drilled pier contractor should anticipate the use of rock augers, rock core barrels and potentially down the hole hammers with a heavy-duty drill rig in order to excavate the drilled piers to a minimum depth of at least 25 ft.**

Based upon the results of this investigation, the drilled pier contractor should be prepared to mobilize casing due to potential caving gravel and boulder sidewalls. Casing may be extracted as the shaft concrete is placed. Drilled pier bottoms should be well cleaned of all loose soil and rock fragments at the time of concrete placement. No more than 2 to 3 inches of water should be present in the bottom of piers when concrete is introduced into the shaft. **The drilled pier contractor should also anticipate minor to moderate concrete loss in small voids/cracks within the boulders and cobbles within the overburden soils, and/or possible large voids. Concrete over-run related to sloughing or caving of the shaft sidewalls should also be anticipated.**

#### 9.2.5 Drilled Pier Load Test

An on-site load test of a production drilled pier is not considered a requirement. Isolated piers or pier groups may encounter differing conditions as compared to this report. It is recommended that the contractor bid form include a cost to perform such a load test in the event differing subsurface conditions are encountered during drilled pier installation. Pier load tests, if required, should be performed in accordance with ASTM D1143 and ASTM D3689 for compressive and tensile capacity.

### **9.3 Driven Piles**

Another deep foundation alternate considered applicable at the project site is driven piling. Design recommendations for driven H-Piles are presented in the table below.

Description	Value
<b>Foundation Type<sup>1</sup></b>	Steel H Piles w/End Protection
<b>Bearing Material</b>	Dense to very dense or stiff natural overburden soils/chert
<b>Minimum Pile Penetration<sup>2</sup></b>	25 ft. below existing ground surface
<b>Allowable Pile Capacity – Axial Compression</b>	If driven to practical refusal, the allowable stress of the pile cross section controls the pile capacity. Compressive stress developed in the steel section should <u>not</u> exceed 9 kips per square inch (ksi) for 36 ksi grade steel and 12.5 ksi for 50 ksi grade steel sections.
<b>Allowable Skin Friction – Uplift<sup>3</sup></b>	0.5 ksf (overburden soils)
<b>Group Effects – Axial Capacity</b>	Driven piles should be installed with a center-to-center spacing of at least three (3) pile widths. Group effects can be neglected and the total capacity of the pile group taken as the sum of the individual pile capacities provided that adjacent piles are spaced at least three (3) pile widths (center-to-center). Design of the piling as structural members should be in accordance with applicable building codes.
<b>Group Effects – Lateral Capacity</b>	When piles are installed close together, the lateral capacity of the group is <u>not</u> equivalent to the lateral capacity of an isolated individual pile times the number of piles in that group. Only those piles that are unobstructed by the other piles in the direction of the force develop full capacity. For pile groups with a pile spacing of three (3) pile widths center-to-center, a multiplier of 0.8 should be used for the lead row of piles, 0.4 for the 2 <sup>nd</sup> row, and 0.3 for the 3 <sup>rd</sup> and consecutive rows. The efficiency of the pile group is dependent upon the pile layout in the group, but would typically be on the order of 75 percent of a single pile for a pile spacing of three (3) pile widths. The pile group effect increases significantly for closer spacing, resulting in a lower efficiency.
<b>Minimum Pile Cap &amp; Grade Beam Bearing</b>	24-inches below final exterior adjacent grade.
<b>Estimated Total Settlement</b>	1-inch or less
<b>Estimated Differential Settlement</b>	1/2-inch or less
<ol style="list-style-type: none"> <li>1. Because of the relatively high driving resistance expected from the overburden soils/chert, steel H-piles with end protection are recommended so that the anticipated high driving stresses can be endured. Driven piles will develop their capacity from end bearing and side resistance in the very dense overburden soils below the pre-bore depth.</li> <li>2. The pile should be driven to practical refusal, which should occur after penetrations of 1 to several feet into very dense overburden soils below the minimum 25 ft. of depth. We recommend that the pile installation be monitored by a representative of PPI.</li> <li>3. The allowable skin friction has a Factor of Safety of approximately 2 and applies to the non-pre-bored depth <u>only</u>. Skin friction within the pre-bore depth should be ignored.</li> </ol>	

### 9.3.1 H-Pile Driving Criteria & Pre-Boring

Specifications for end bearing H-Piles should clearly state that end-bearing piles should be driven to refusal. Prior to driving structural steel piles, the contractor should review the boring logs to determine the depth at which impenetrable overburden soils may be anticipated. In addition, the contractor should submit a hammer wave equation to be evaluated and used during PDA testing (see below). The contractor should be attentive to the physical conditions associated with pile refusal. Pile refusal should be determined by on-site PDA testing. Pile refusal depth is anticipated to be highly variable. Pile refusal is anticipated to occur within approximately 5 ft. or less below the prebore depth due to very dense gravels encountered within the borings.

As stated above, pile driving refusal should be defined during PDA testing with an approved hammer. An approved hammer shall be defined as a hammer that develops the minimum hammer energy that is no less than any of the following:

1. 3.0 ft-lb/lb times the total pile weight in pounds, including mandrel, if used;
2. 32 ft-lb/kip times the minimum nominal axial compressive resistance in kips, divided by the pile batter factor,  $\beta$ , if applicable; and
3. 8,000 ft-lb.

In order to achieve full pile development and to ensure the pile reaches the intended very dense bearing stratum, pre-boring pile locations to a minimum depth of 25 ft. minimum is recommended. The pre-bored hole may be filled with sand prior to or following pile driving.

### 9.3.2 Driven Pile Construction Observation & PDA Testing

Construction surveillance activities should be provided throughout pile installation. Specific information regarding pile driving should be maintained in daily log form. The daily log form should include hammer type, energy, operating characteristics, driving time, delays, and other pertinent information. Complete pile driving records should be kept for the Project. Care should be exercised to monitor pile hammer operation to verify actual hammer energy.

In addition, PDA Testing (or dynamic load testing using a Pile Driving Analyzer) is recommended to confirm that damage to the pile has not occurred during driving, **and that the pile will carry the design load.** It is possible for piles to be driven down the side of a large chert boulder, resulting in pile deflection and subsequent damage. PDA testing would be especially useful in this case. A minimum of five (5) PDA tests or piles within a footprint of 50,000 sq. ft. is recommended spread over the structure footprint prior to production pile installation. A firm that has significant experience in PDA testing and that PPI has significant work experience with is listed below for your use, if desired.

**Foundation Testing & Consulting, LLC**

Mr. Casey Jones, P.E., P.G. - President

16500 Lucille Street

Overland Park, Kansas 66221

Ph: 913-626-8499

Email: [cj@FTandC.com](mailto:cj@FTandC.com)

**9.3.3 Lateral Loadings for Driven Piles**

The lateral loading parameters provided in Section 9.2.3 above may be used during foundation design utilizing driven piling.

**9.4 Settlement Potential**

Due to the overburden soils primarily consisting of dense to very dense chert sands, gravels, and occasional gravelly clays, settlement potential of the natural overburden soils is anticipated to be minimal. To essentially eliminate the potential for foundation settlement, foundations should bear in bedrock. However, due to the deep depth of limestone bedrock anticipated at this site, bearing upon bedrock is not considered practical. If shallow or deep foundations are constructed using the above foundation design parameters provided, total settlements on the order of 1-inch or less and differential settlements on the order of 0.5-inches or less are anticipated.



## 10.0 SEISMIC CONSIDERATIONS

Code Used	Site Classification
2015 International Building Code (IBC) <sup>1</sup>	C <sup>2</sup>
1. In general accordance with the <i>2015 International Building Code</i> , Section 1613 2. Based upon an average Shear Wave Velocity of 1,772 feet per second within the top 100 ft. of depth computed during site shear wave velocity testing performed on 1/15/19 by PPI.	

According to the 2015 IBC, the Mapped Spectral Response Acceleration parameters for short period ( $F_a$ ) and the 1-second period ( $F_v$ ) for the project site are presented below.

Mapped Spectral Response Parameter	$F_a$	$F_v$
Value	1.2	1.7
Values are based upon a Site Class C, $S_s = 15.2\%$ , $S_1 = 8.1\%$ using Tables 11.4 (1 & 2) from ASCE 7-10		

The seismic site classification presented above was determined using shear wave velocity testing. Shear wave velocity testing was performed along one (1) array, or line, situated within the southeast corner of the proposed building footprint. Shear wave velocity testing was performed in substantial conformance with industry standards using surface seismic methods, more specifically Multi-Channel Analysis of Surface Waves (MASW).

Surface waves are a type of seismic wave whose propagation is confined to the near surface medium. The depth of subsurface penetration of a surface wave is directly proportional to its wavelength. In a non-homogeneous medium, surface waves are dispersive, meaning each wavelength has a characteristic velocity resulting from subsurface heterogeneities.

MASW Combined Active and Passive method was utilized to obtain the average shear wave velocity for the top 100 ft. ( $V_s 100$ ) at the project site. This method was selected to increase the range of frequency to be analyzed therefore increasing the depth of investigation. Active method captures a dispersion curve at relatively higher frequencies than the Passive method. Combining the dispersion curves for each method allows for a more reliable identification of the fundamental mode dispersion curve utilized in

calculating the shear wave velocity. Please refer to Figure 3 for the graphical shear wave velocity vs. depth output.

## 11.0 FLOOR SLABS

A slab-on-fill floor system is considered appropriate at the **north half** of the project site based upon subsurface conditions encountered and future site grading. Listed below are key considerations for design purposes of the floor slab.

- Prior to placement of controlled fill, if any, natural soils should be scarified, moisture content adjusted and re-compacted in accordance with Sections 8.0 of this report;
- Any fat clays containing little to no sand/gravel content present at slab subgrade elevation, if present, should be undercut and replaced in accordance with Section 8.7 above; and
- Prior to slab placement, soil moisture should be adjusted and maintained within the parameters specified in Section 8.0 of this report.

Placement of 4 or more inches of compacted free-draining granular base course below slabs is recommended to limit moisture rise through slabs and to improve slab support, particularly at joints. An impervious moisture barrier consisting of 6-mil plastic sheeting or equivalent should be provided in accordance with the 2012 IBC. Use of a 10-mil vapor barrier is recommended below all slab areas with an intended use sensitive to slab moisture.

### 11.1 Modulus of Subgrade Reaction

The floor slab by be designed with the modulus of subgrade reaction presented in the table below.

Bearing Material	Bearing Material Thickness (inches)	Modulus of Subgrade Reaction (pci)
LVC Fill Material and Natural Soils	N/A	175
Dense Graded Aggregate Base	6	275
Dense Graded Aggregate Base	12	350
Dense Graded Aggregate Base	18	425

## 12.0 BELOW GRADE SLABS

All slabs that are below exterior grade are considered below grade slabs. This condition is anticipated within the south half of the project site within the basement area. **In addition, any elevator pits, recessed mats, floor depressions, etc., are considered below grade slabs and the following recommendations do apply to these areas.**

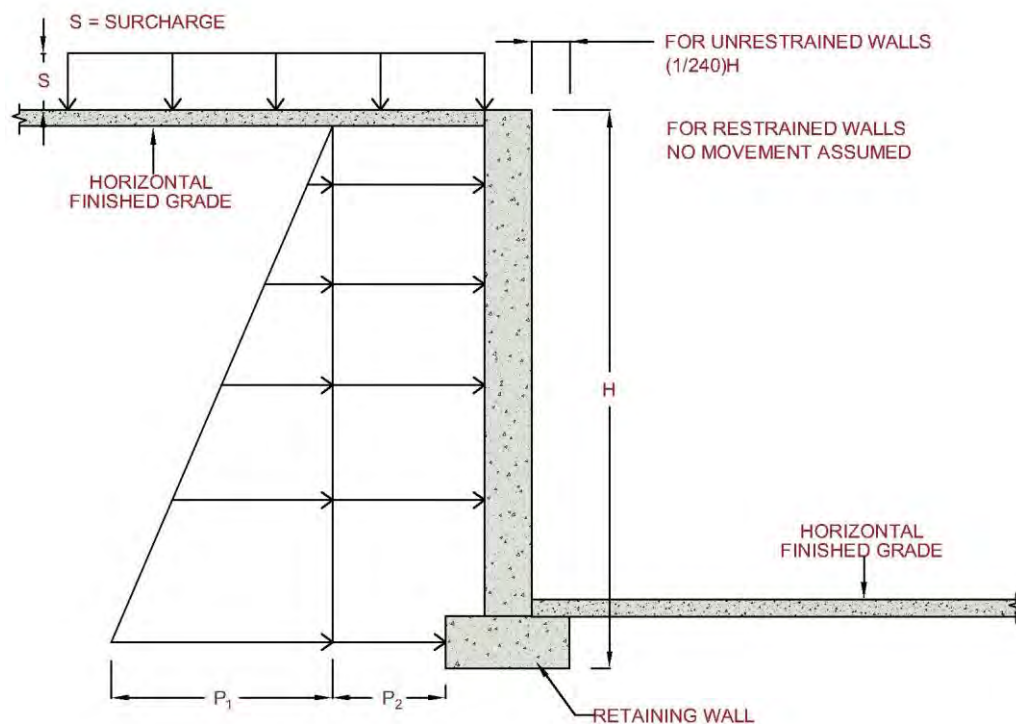
Although shallow groundwater was not encountered within the borings drilled, site earthwork can, and often does, manipulate the shallow groundwater regime. In view of the possibility for perched groundwater at the project site, it is recommended that any portions of the structure below exterior grade, as described above, be designed and constructed recognizing the possibility of shallow groundwater. A French drain system should be installed under the below grade floor slabs to limit hydrostatic pressure below the slab. A drainage system constructed with coarse free-draining gravel with a minimum 6-inch thickness and perforated pipes wrapped in filter fabric and installed on 30-ft. centers below the free draining gravel is considered adequate. Groundwater collected by these perforated pipe drains should be removed to free discharge by gravity flow. If gravity flow cannot be provided a sump and pump system consisting of a wet well with a duplex pump arrangement is recommended. At least one (1) pump should turn on when groundwater levels are more than 24-inches below finish floor elevation.

A French drain should be installed underneath all below grade slabs. Lateral drain pipes installed on 30-ft. centers should be at least 4-inches in diameter, with perimeter collector pipes at least 6-inches in diameter. An impervious moisture barrier consisting of 6-mil. plastic sheeting or equivalent should be provided below all slab areas. A minimum 10-mil plastic sheeting is recommended beneath all slab areas with an intended use sensitive to slab moisture. Soil moisture should not be allowed to dry and desiccate or be saturated by inundation prior to slab placement.

### 12.1 Retaining Wall Backfill & Drainage

A foundation drain is recommended to be installed around the portion of the perimeter where the below grade slab is at or below exterior grade level in

accordance with Section 1805 of the 2015 IBC. Below grade wall backfill should consist of free-draining crushed stone or alternatively, may consist of gravelly clays or clayey gravels. Crushed stone, if selected, must be imported from a quarry source whereas on-site soils suitable for wall backfill could probably be segregated and stockpiled during excavation. Depending upon the type of backfill selected and degree of wall restraint, the following table of lateral earth pressures are considered appropriate for wall design. **If a building floor slab is planned over the wall backfill, use of an imported free draining stone should be separated from the earth face of the excavation by using a nonwoven filter fabric.**



<b>EQUIVALENT FLUID PRESSURES, <math>P_1</math> (Drained Backfill Only)</b>				
<b>Type of Backfill</b>	<b>Level Backfill</b>		<b>Sloped Backfill (2H:1V)*</b>	
	<b>Restrained Walls (Using <math>K_o</math>)</b>	<b>Unrestrained Walls (Using <math>K_a</math>)</b>	<b>Restrained Walls (Using <math>K_o</math>)</b>	<b>Unrestrained Walls (Using <math>K_a</math>)</b>
<b>Compacted On-Site GC, GW, SC &amp; CL Soils</b>	70 pcf	45 pcf	80 pcf	55 pcf
<b>Clean Crushed Stone</b>	50 pcf	35 pcf	60 pcf	45 pcf
<b>Rock Fill (Free-Draining)</b>	50 pcf	35 pcf	60 pcf	45 pcf
*For backfill sloped other than 2H:1V, interpolate between values presented above for level and sloped backfill. NOTE: Structural design of unrestrained walls should permit wall rotation at top of wall equal to 1/240th of wall height.				

<b>SURCHARGE PRESSURE, <math>P_2</math></b>		
<b>Type of Backfill</b>	<b>Level Backfill</b>	
	<b>Restrained Walls (Using <math>K_o</math>)</b>	<b>Unrestrained Walls (Using <math>K_a</math>)</b>
<b>Compacted On-Site GC, GW, SC &amp; CL Soils</b>	0.58 (S)	0.38 (S)
<b>Clean Crushed Stone</b>	0.42 (S)	0.29 (S)
<b>Rock Fill (Free-Draining)</b>	0.42 (S)	0.29 (S)

If crushed stone backfill is selected and wall design in accordance with the above equivalent fluid pressures, the crushed stone backfill should be placed within a boundary projecting 30 degrees from the vertical commencing at a point 1 ft. out from the base of wall. Regardless of the backfill type selected, an impervious moisture barrier should be applied to the below grade wall. In addition, if lean clay backfill is selected, a geosynthetic drainage mat should be applied to the wall to assure removal of subsurface water. A perforated pipe should be laid at the base of wall to collect and remove subsurface water either from free-draining crushed stone or drainage mats. Flow line of the perforated pipe should be laid below partial basement finished floor. Again, groundwater collected should be removed by gravity

flow to free discharge. If this is not possible, groundwater may be removed by pumping. An exterior sump pit with dual pumping arrangement is recommended.

**Please refer to Section 9.1 above for retaining wall foundation design parameters constructed in natural overburden soils or controlled fill material placed in accordance with Section 8.0 of this report.**

### 13.0 SOIL CORROSIVITY

Bulk samples collected during drilling of previous borings adjacent to the site were tested for Oxidation Reduction Potential, Resistivity, Percent Solids, Sulfide, Chloride, Sulfate, Conductivity and pH were performed to determine corrosivity and resistivity of the soils at the project site. Results of this testing are presented in the table below:

Test	Results (2.5' to 6.5')	Method
Oxidation Reduction Potential (mV)	127	SM 2580 B-(2009)
Resistivity (ohm/cm)	3860	SM 2510 B-(1997)
Percent Solids (%)	89.1	SM 2540 G-(1997)
Sulfide	Absent	Commission Analytical Reactions
Chloride (mg/L)	Not Detected	EPA 300.0
Sulfate (mg/L)		EPA 300.0
Conductivity (μS/cm)	259	SM 2510 B-(1997)
pH (SU)	5.48	SM 4500-H+B-(2011)

Based upon the results of the corrosion and resistivity testing, the risk of sulfate and chloride exposure to concrete, reinforcing steel and other steel elements is minimal according to ACI guidelines. In general, the on-site soils are considered only slightly corrosive, mainly due to resistivity. Standard-of-practice regarding general protection against corrosion of buried metallic elements from slightly corrosive soils at this site is recommended. Based upon the above results, Type I or II cement is considered satisfactory for use at the project site.

### 14.0 PAVEMENT

It is anticipated that any new pavements associated with this project will be constructed of either an asphaltic concrete wearing surface placed over a base or a rigid Portland

Cement Concrete pavement over a granular base. Prior to pavement placement, preparation of the pavement subgrade should be performed in accordance with Section 8.0 of this report.

#### **14.1 Flexible Pavement**

If asphaltic paving is selected, the aggregate base may be a granular compacted crushed limestone with a gradation and quality conforming to the requirements of the Oklahoma Department of Transportation (ODOT), Standard Specification 703.01 for Type A aggregate. The maximum lift thickness for the granular base is 4 in. Granular base thicknesses in excess of 4 inches should be placed in multiple lifts with each lift being of approximately equal thickness. The granular base should be compacted to at least 100% of Standard Proctor Compaction (ASTM D-698).

Asphaltic concrete, both base and surface, should conform to the applicable requirements of ODOT Standard Specification 708. Asphaltic concrete should be compacted to 92 to 96% of Maximum Theoretical Specific Gravity (ASTM D-2041). Substitution of an appropriate Superpave Mix Design, SP 190C or SP 250C, can be used in place of the bituminous base. SP 190C or SP 125C may be used for the surface. All bituminous mix designs should have been prepared or verified within 6 months of the date of placement on the project.

#### **14.2 Rigid Pavement**

If rigid concrete paving is selected, a minimum 4-in. thickness granular base compacted to 100% of Standard Proctor should be placed on the prepared subgrade. The Portland Cement Concrete (PCC) mix should have a minimum 28-day compressive strength of 4000 pounds per square inch (psi). Concrete should be placed at a low slump (1 to 3 inches) and have an entrained air content of 5 to 7%. If an increased slump is desired, use of Super Plasticizer is recommended.

#### **14.3 Pavement Subgrade CBR**

Based upon the relatively high SPT-N values obtained during drilling, the natural soil deposits, as well as controlled fill originating from on-site should exhibit stiff



subgrades for pavement construction. A CBR value equal to 6.0 for the natural subgrade soils, or natural overburden soils that have been properly recompacted is recommended to be used in pavement design.

#### 14.4 Pavement Thickness

Typical pavement design for this type of development would generally generate a Structural Number of 3.0 to 3.5 within heavy duty areas and 2.4 to 2.6 within light duty areas, depending on the subgrade conditions. The following table presents corresponding typical flexible and rigid pavement thickness using the general Structural Numbers.

Pavement Type	Anticipated Traffic Frequency	Asphaltic Surface (in.)	Asphaltic Base (in.)	Concrete Thickness (in.)	Aggregate Base (in.)
Flexible Pavement	Heavy Duty	3.0	4.0	-	6.0
	Medium Duty	2.0	3.0	-	6.0
	Light Duty	2.0	2.0	-	6.0
Rigid Pavement	Heavy Duty	-	-	7.0	4.0
	Medium Duty	-	-	6.0	4.0
	Light Duty	-	-	5.0	4.0

#### 15.0 GROUND PENETRATING RADAR

As previously mentioned, subsurface voids have been documented immediately south and southeast of the project site encountered during construction of Hospital and Visitors Drive. In addition to the borings drilled during this investigation, performing ground penetrating radar (GPR) within the footprint of the proposed building footprint is recommended to potentially locate large shallow subsurface voids, if present. GPR should be performed following excavation within the building footprint as required to achieve proposed basement elevation and following removal of the existing fill material. PPI can perform these additional services if requested.

#### 16.0 CONSTRUCTION OBSERVATION & TESTING

The construction process is an integral design component with respect to the geotechnical aspects of a project. Since geotechnical engineering is influenced by



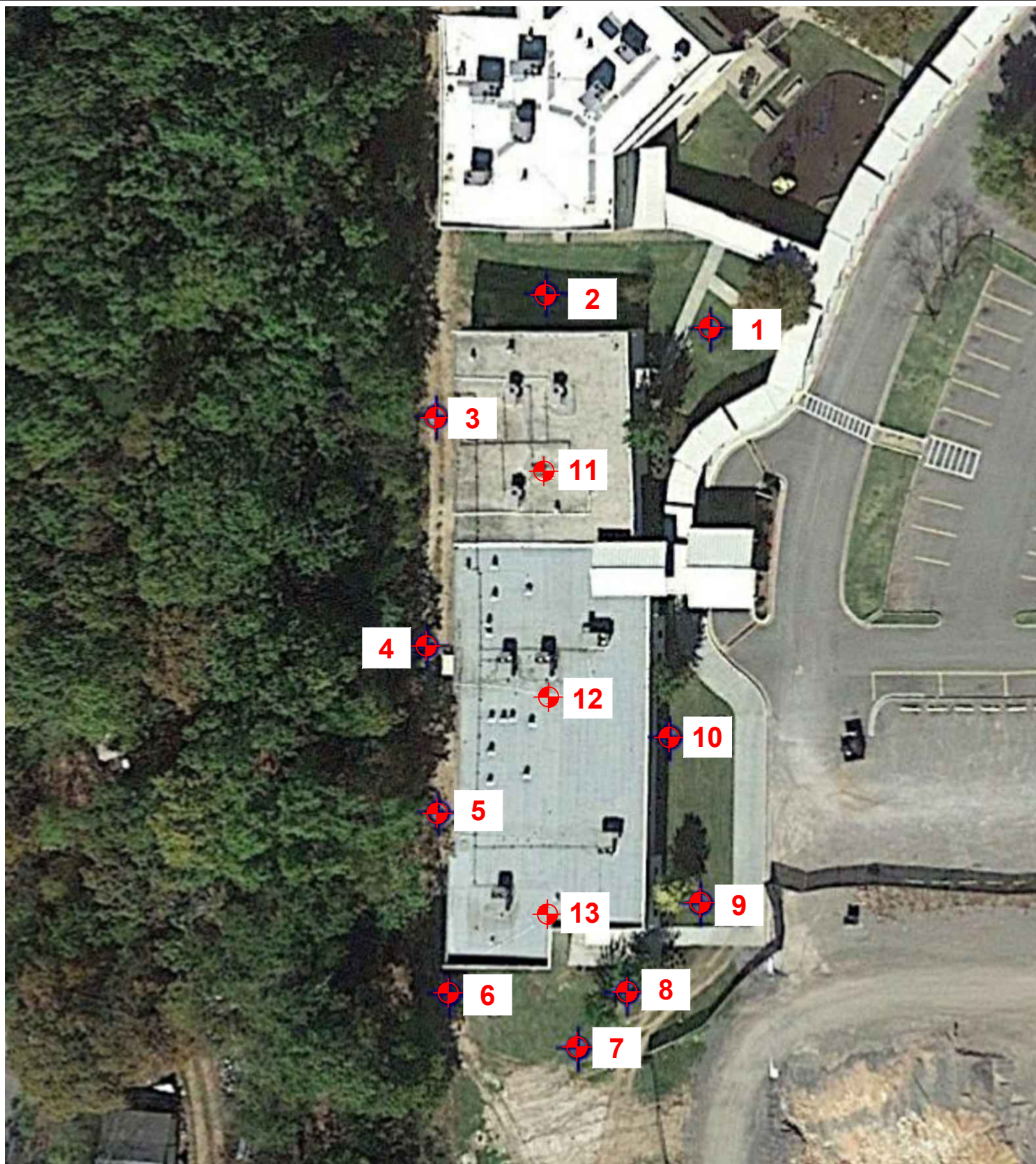
variable depositional and weathering processes and because we sample only a small portion of the soils affecting the performance of the proposed structures, unanticipated or changed conditions can be disclosed during grading. Proper geotechnical observation and testing during construction is imperative to allow the Geotechnical Engineer the opportunity to evaluate assumptions made during the design process. Therefore, we recommend that PPI be kept apprised of design modifications and construction schedule of the proposed project to observe compliance with the design concepts and geotechnical recommendations, and to allow design changes in the event that subsurface conditions or methods of construction differ from those assumed while completing this study. We recommend that during construction all earthwork be monitored by a representative of PPI, including site preparation, placement of all engineered fill and trench backfill, and all foundation excavations as outlined below.

- An experienced Geotechnical Engineer or Engineering Technician of PPI should observe the subgrade throughout the proposed project site immediately following stripping to evaluate the native clay, identify areas requiring additional undercutting, and evaluate the suitability of the exposed surface for fill placement;
- An experienced Engineering Technician of PPI should monitor and test all fill placed within the building and pavement areas to determine whether the type of material, moisture content, and degree of compaction are within recommended limits. **Refer to Section 8.3 for recommendations regarding Field Density (compaction) testing frequency;**
- An experienced Technician or Engineer of PPI should observe and test all footing excavations. Where unsuitable bearing conditions are observed, remedial procedures can be established in the field to avoid construction delays; and
- The condition of the subgrade should be evaluated immediately prior to construction of the building floor slabs to determine whether the moisture content and relative density of the subgrade soils are as recommended.

## **17.0 REPORT LIMITATIONS**

This report has been prepared in accordance with generally accepted practices of other consultants undertaking similar studies at the same time and in the same geographical area. Palmerton & Parrish, Inc. observed that degree of care and skill generally exercised by other consultants under similar circumstances and conditions. Palmerton & Parrish's findings and conclusions must be considered not as scientific certainties, but as opinions based on our professional judgment concerning the significance of the data gathered during the course of this investigation. Other than this, no warranty is implied or intended.

## FIGURES



Note: Boring 4 not drilled due to unknown location of buried utilities



**LEGEND**



Boring Location

NTS

Project: Cherokee Nation OSU Building - Tahlequah, Oklahoma  
Client: Childers Architect

**Boring Location Plan**

DATE: April 4, 2019

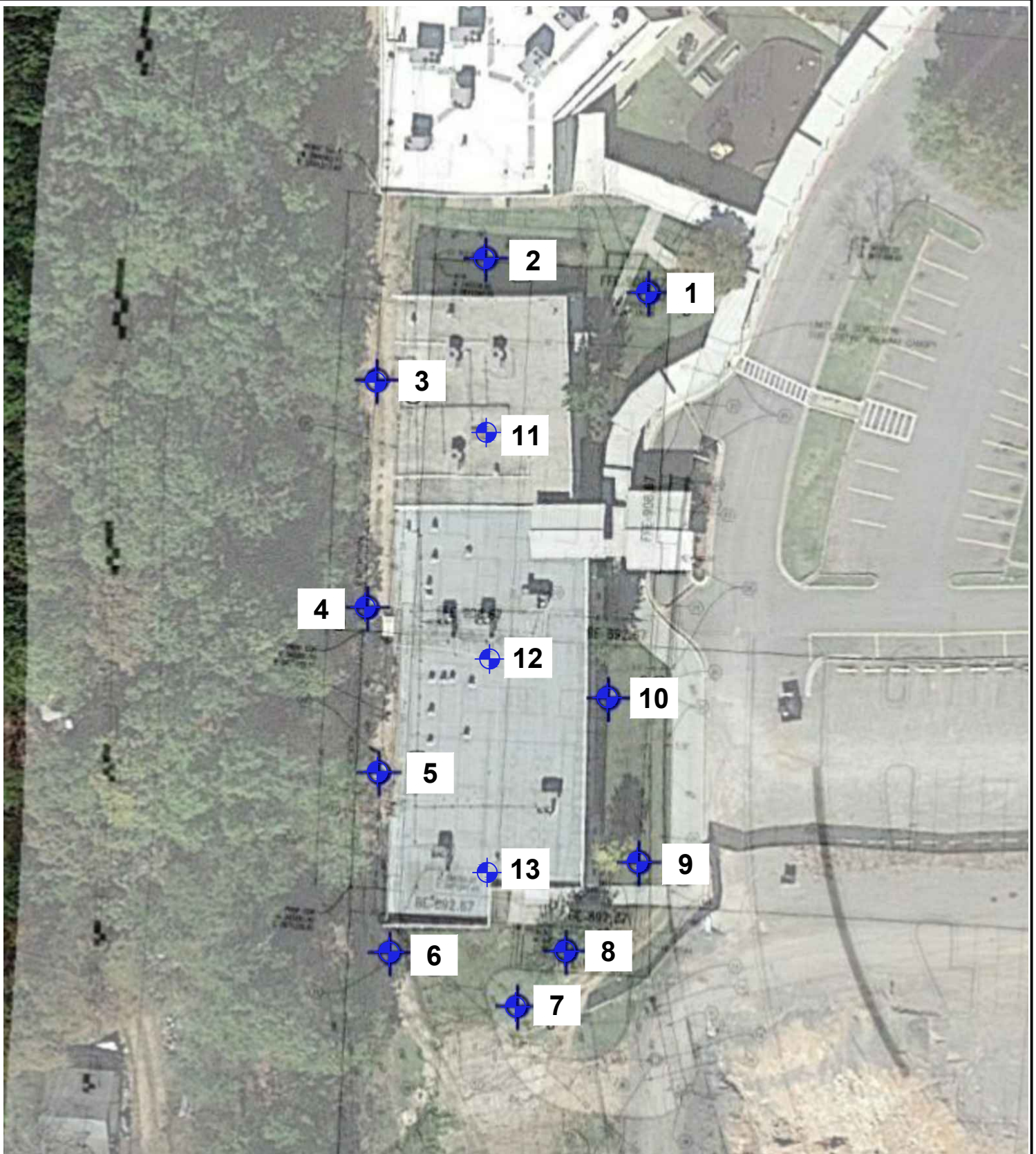
Project Number: 255932



**PALMERTON & PARRISH, INC.**  
GEOTECHNICAL AND MATERIALS ENGINEERS/  
MATERIALS TESTING LABORATORIES / ENVIRONMENTAL SERVICES

**FIGURE 1**





Note: Boring 4 not drilled due to unknown location of buried utilities



LEGEND



Boring Location

NTS

Project: Cherokee Nation OSU Building - Tahlequah, Oklahoma  
Client: Childers Architect

**Boring Location Plan - w/ Building Footprint**

DATE: April 4, 2019

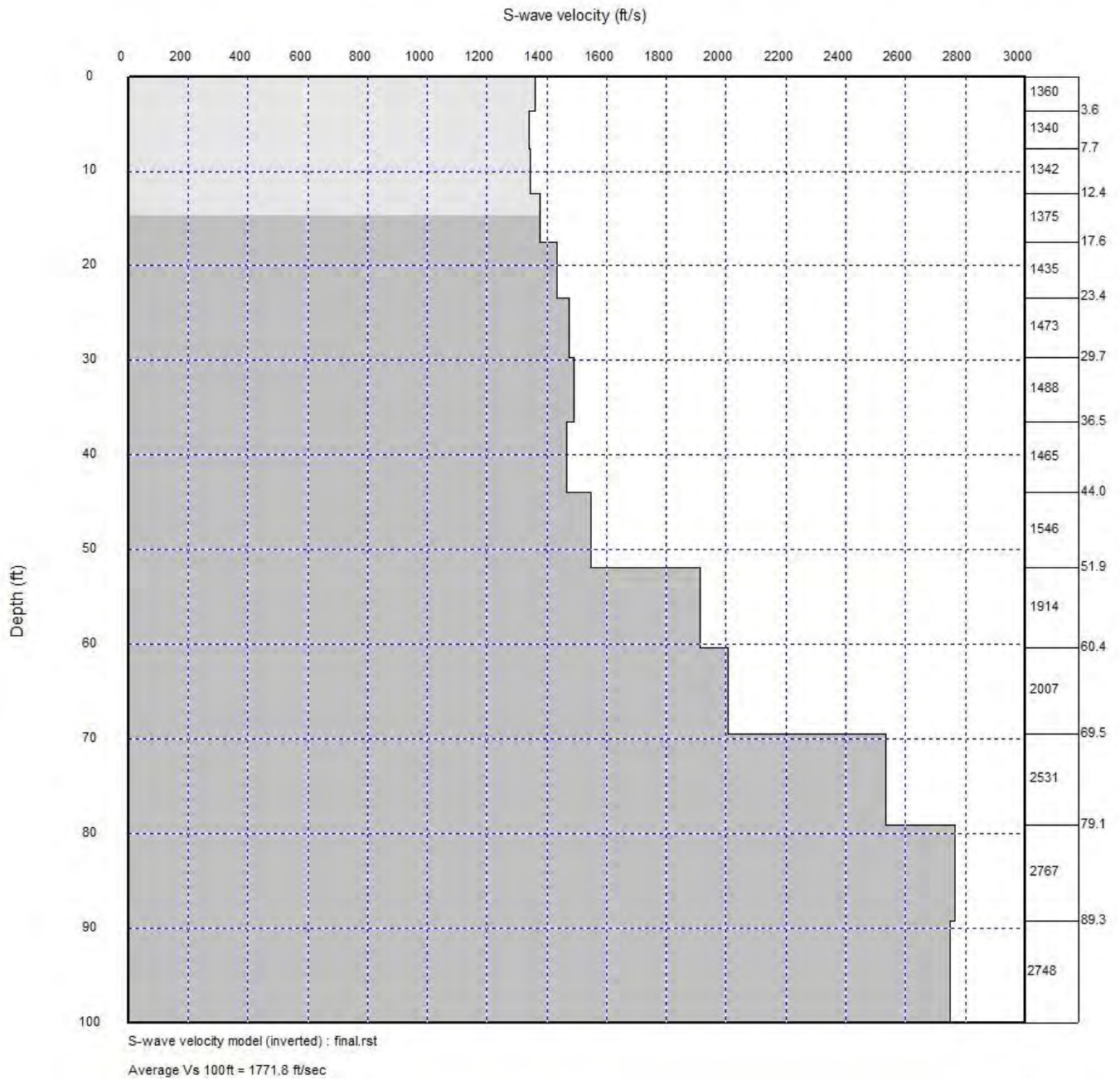
Project Number: 255932



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**FIGURE 2**

Figure 3 - 1D Shear Wave Velocity Profile



**APPENDIX I**  
**BORING LOGS & KEY TO SYMBOLS**





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Springfield, MO  
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# GEOTECHNICAL BORING LOG

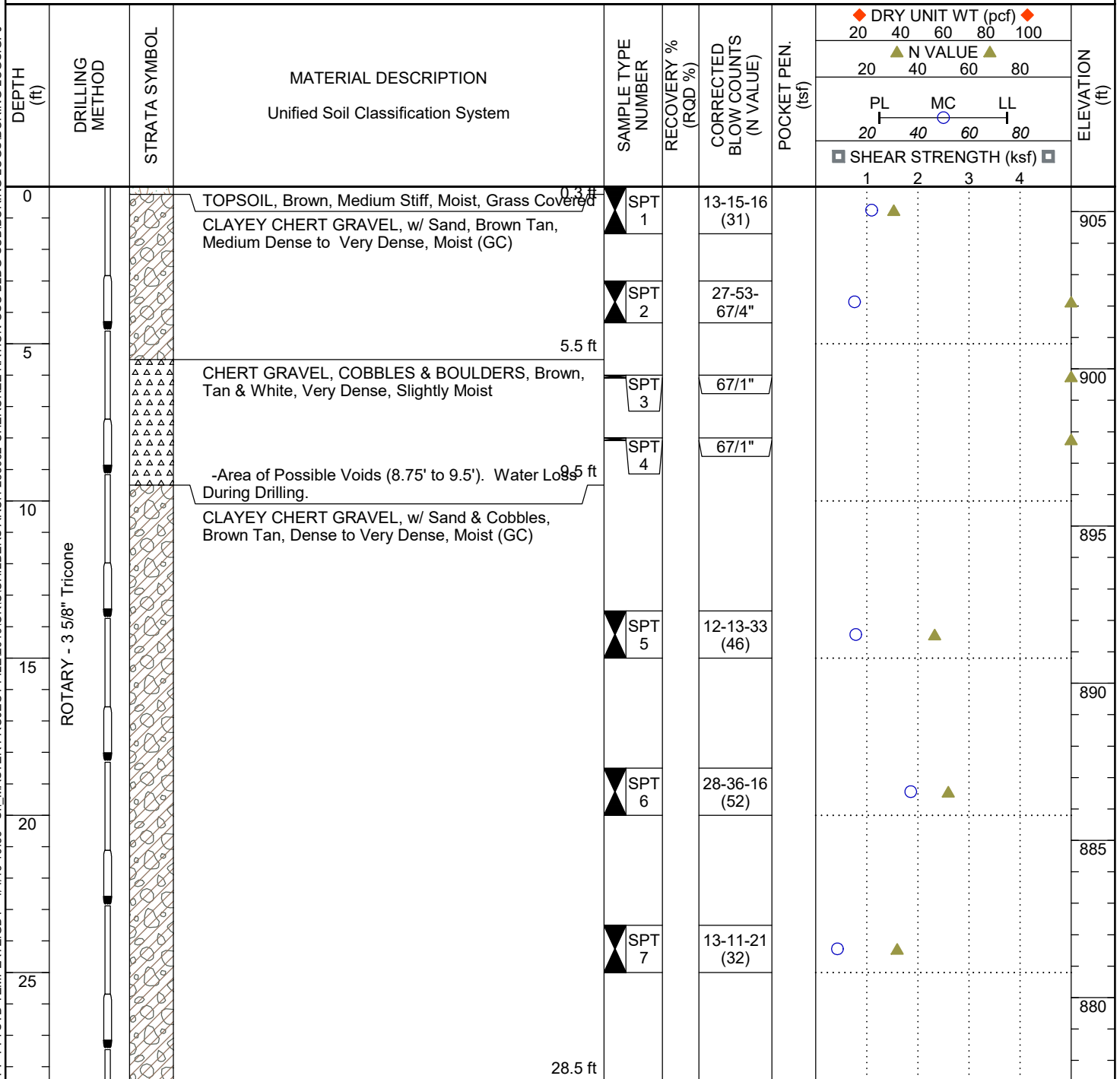
BORING NUMBER

1

PAGE 1 OF 1

<b>CLIENT</b> <u>Childers Architect</u>	<b>PROJECT NAME</b> <u>Cherokee Nation OSU Building</u>
<b>PROJECT NO.</b> <u>255932</u>	<b>PROJECT LOCATION</b> <u>Tahlequah, OK</u>
<b>DATE STARTED</b> <u>1/23/19</u> <b>COMPLETED</b> <u>1/23/19</u>	<b>SURFACE ELEVATION</b> <u>905.8 ft</u> <b>BENCHMARK EL.</b> _____
<b>DRILLER</b> <u>MR</u> <b>DRILL RIG</b> <u>CME 1050</u>	<b>GROUND WATER LEVELS</b>
<b>HAMMER TYPE</b> <u>Auto</u>	<b>AT TIME OF DRILLING</b> <u>None</u>
<b>LOGGED BY</b> <u>BC</u> <b>CHECKED BY</b> <u>BP</u>	<b>AT END OF DRILLING</b> _____
<b>NOTES</b> _____	

BORING LOG - PPI - PPI STD TEMPLATE.GDT - 4/4/19 10:39 - S:\MASTER PROJECT FILE\2019\OK\CHILDERS ARCH-255932-CHEROKEE NATION OSU BLDG-SUBBORING LOGS.GPJ



Bottom of borehole at 28.5 feet.



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CLIENT Childers Architect

PROJECT NAME Cherokee Nation OSU Building

PROJECT NO. 255932

PROJECT LOCATION Tahlequah, OK

DATE STARTED 1/24/19

COMPLETED 1/24/19

SURFACE ELEVATION 903.3 ft

BENCHMARK EL. \_\_\_\_\_

DRILLER MR

DRILL RIG CME 1050

GROUND WATER LEVELS

HAMMER TYPE Auto

AT TIME OF DRILLING None

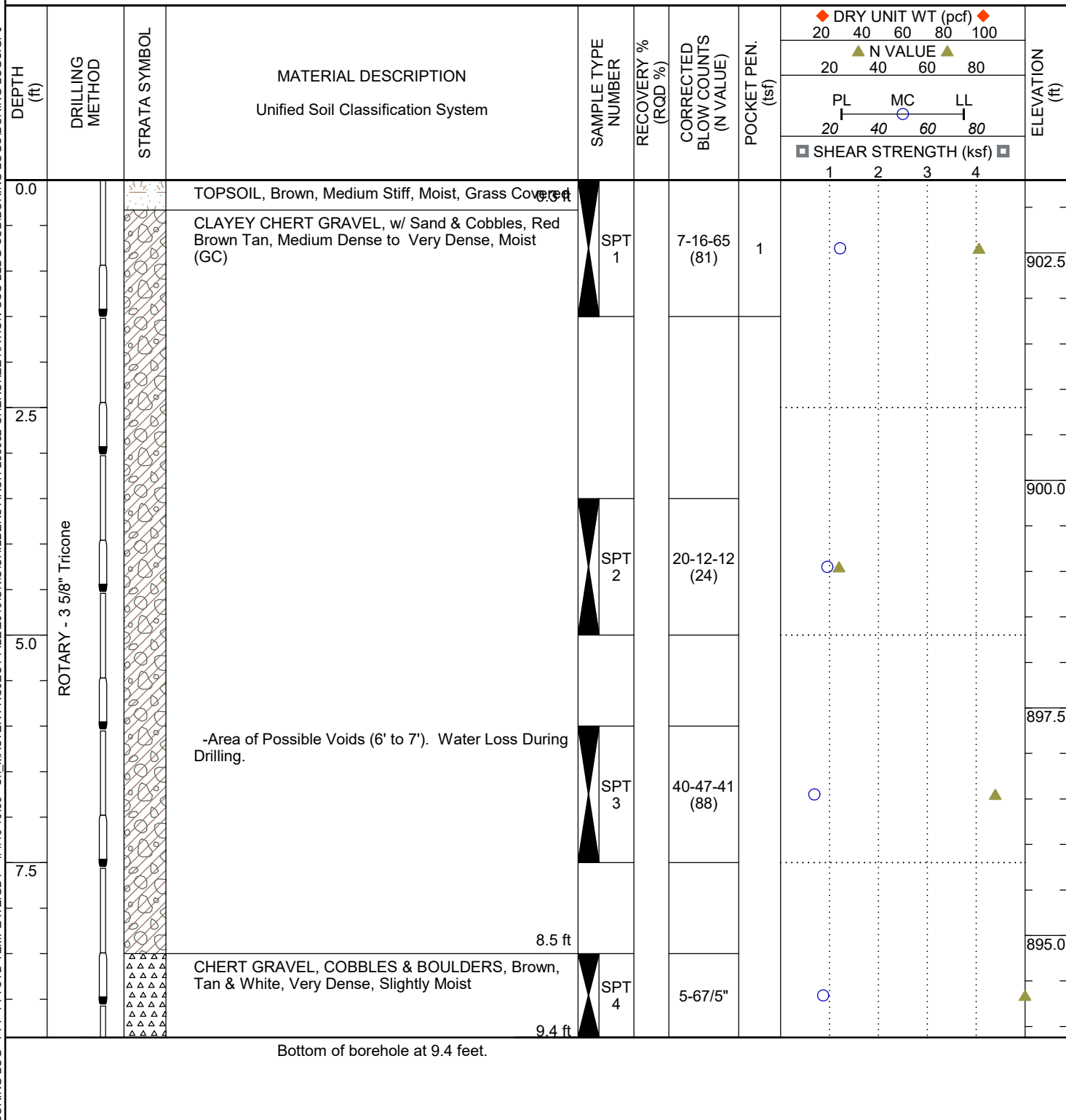
LOGGED BY BC

CHECKED BY BP

AT END OF DRILLING \_\_\_\_\_

NOTES \_\_\_\_\_

BORING LOG - PPI - PPI STD TEMPLATE.GDT - 4/4/19 10:39 - S:\MASTER PROJECT FILE\2019\OK\CHILDERS ARCH-255932-CHEROKEE NATION OSU BLDG-SUBBORING LOGS.GPJ





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# GEOTECHNICAL BORING LOG

BORING NUMBER

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CLIENT Childers Architect

PROJECT NAME Cherokee Nation OSU Building

PROJECT NO. 255932

PROJECT LOCATION Tahlequah, OK

DATE STARTED 1/24/19

COMPLETED 1/24/19

SURFACE ELEVATION 900.9 ft

BENCHMARK EL. \_\_\_\_\_

DRILLER MR

DRILL RIG CME 1050

GROUND WATER LEVELS

HAMMER TYPE Auto

AT TIME OF DRILLING None

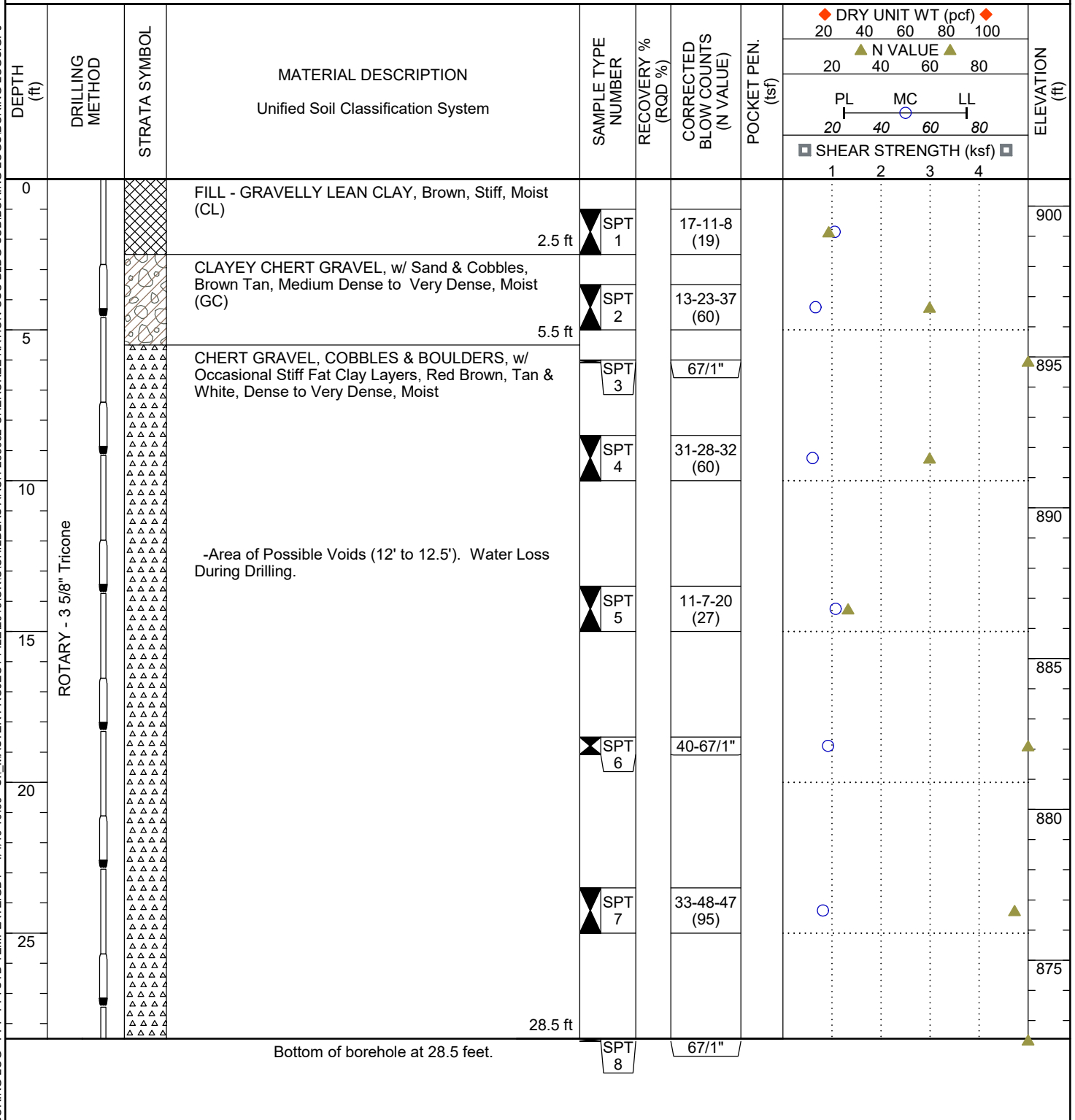
LOGGED BY BC

CHECKED BY BP

AT END OF DRILLING \_\_\_\_\_

NOTES \_\_\_\_\_

BORING LOG - PPI - PPI STD TEMPLATE.GDT - 4/4/19 10:39 - S:\MASTER PROJECT FILE\2019\OK\CHILDERS ARCH-255932-CHEROKEE NATION OSU BLDG-SUBBORING LOGS.GPJ



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# GEOTECHNICAL BORING LOG

**BORING NUMBER**

5

PAGE 1 OF 1

**CLIENT** Childers Architect

**PROJECT NAME** Cherokee Nation OSU Building

**PROJECT NO.** 255932

**PROJECT LOCATION** Tahlequah, OK

DATE STARTED 1/24/19

**COMPLETED** 1/24/19

**SURFACE ELEVATION** 896.21 ft

BENCHMARK EL.

DRILLER MRDRILL RIG CME 1050

## GROUND WATER LEVELS

**HAMMER TYPE** Auto

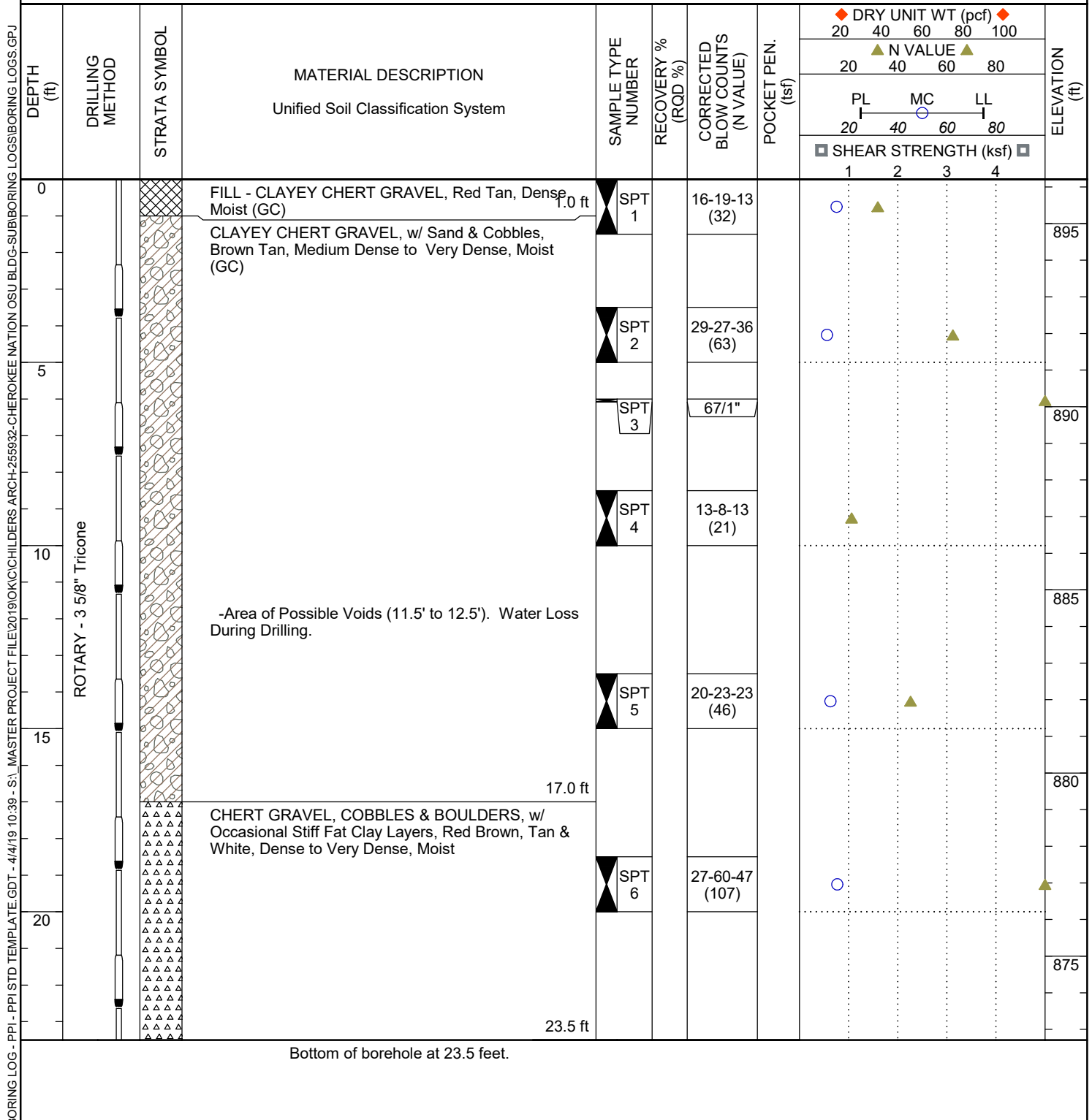
**AT TIME OF DRILLING** None

LOGGED BY BC

**CHECKED BY** BP

### AT END OF DRILLING

## NOTES





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# GEOTECHNICAL BORING LOG

BORING NUMBER

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PAGE 1 OF 1

CLIENT Childers Architect

PROJECT NAME Cherokee Nation OSU Building

PROJECT NO. 255932

PROJECT LOCATION Tahlequah, OK

DATE STARTED 1/24/19

COMPLETED 1/24/19

SURFACE ELEVATION 895.03 ft

BENCHMARK EL. \_\_\_\_\_

DRILLER MR

DRILL RIG CME 1050

GROUND WATER LEVELS

HAMMER TYPE Auto

AT TIME OF DRILLING None

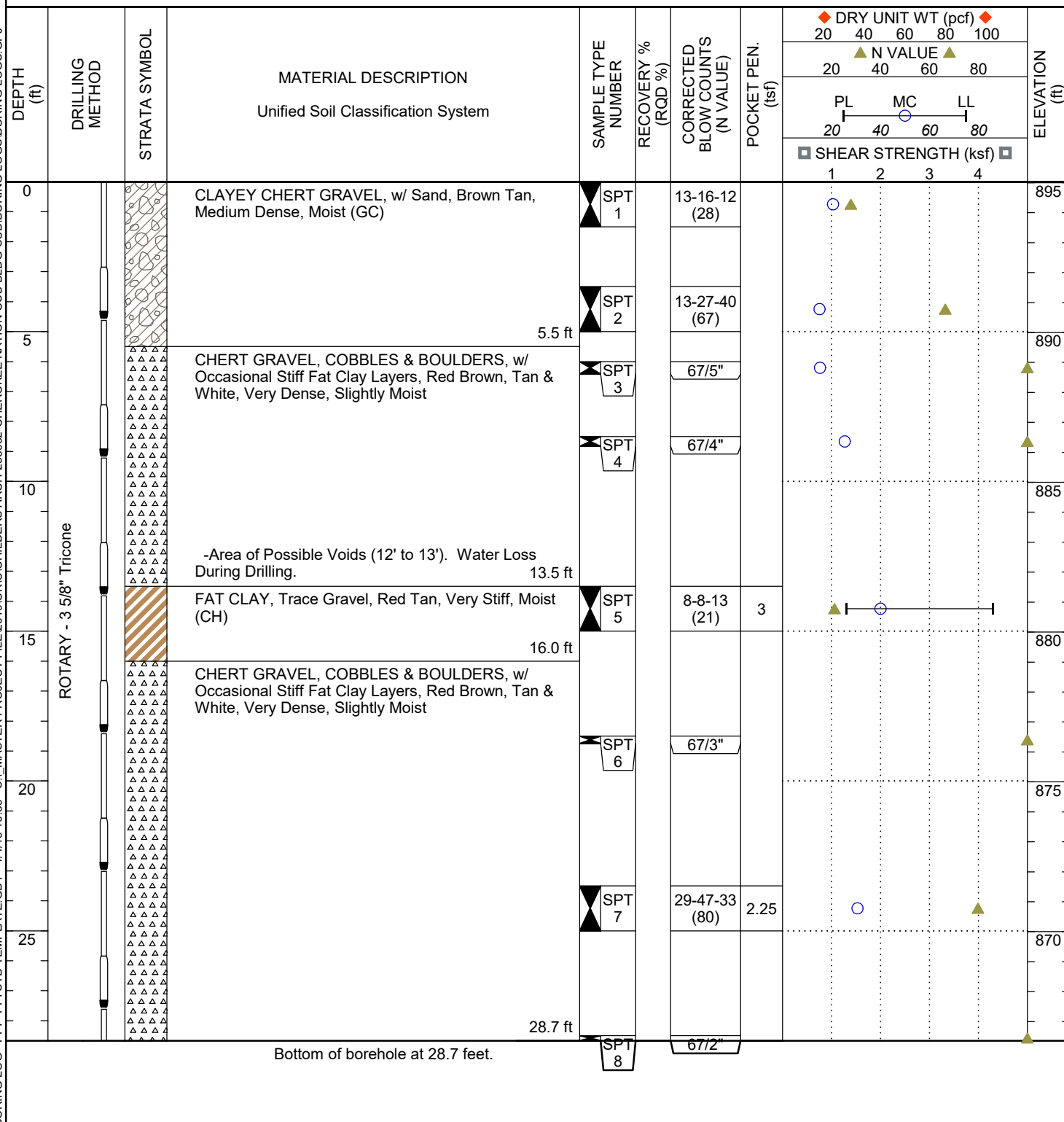
LOGGED BY BC

CHECKED BY BP

AT END OF DRILLING \_\_\_\_\_

NOTES \_\_\_\_\_

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# GEOTECHNICAL BORING LOG

BORING NUMBER

7

PAGE 1 OF 1

CLIENT Childers Architect

PROJECT NAME Cherokee Nation OSU Building

PROJECT NO. 255932

PROJECT LOCATION Tahlequah, OK

DATE STARTED 1/23/19

COMPLETED 1/23/19

SURFACE ELEVATION 900.7 ft

BENCHMARK EL. \_\_\_\_\_

DRILLER MR

DRILL RIG CME 1050

GROUND WATER LEVELS

HAMMER TYPE Auto

AT TIME OF DRILLING None

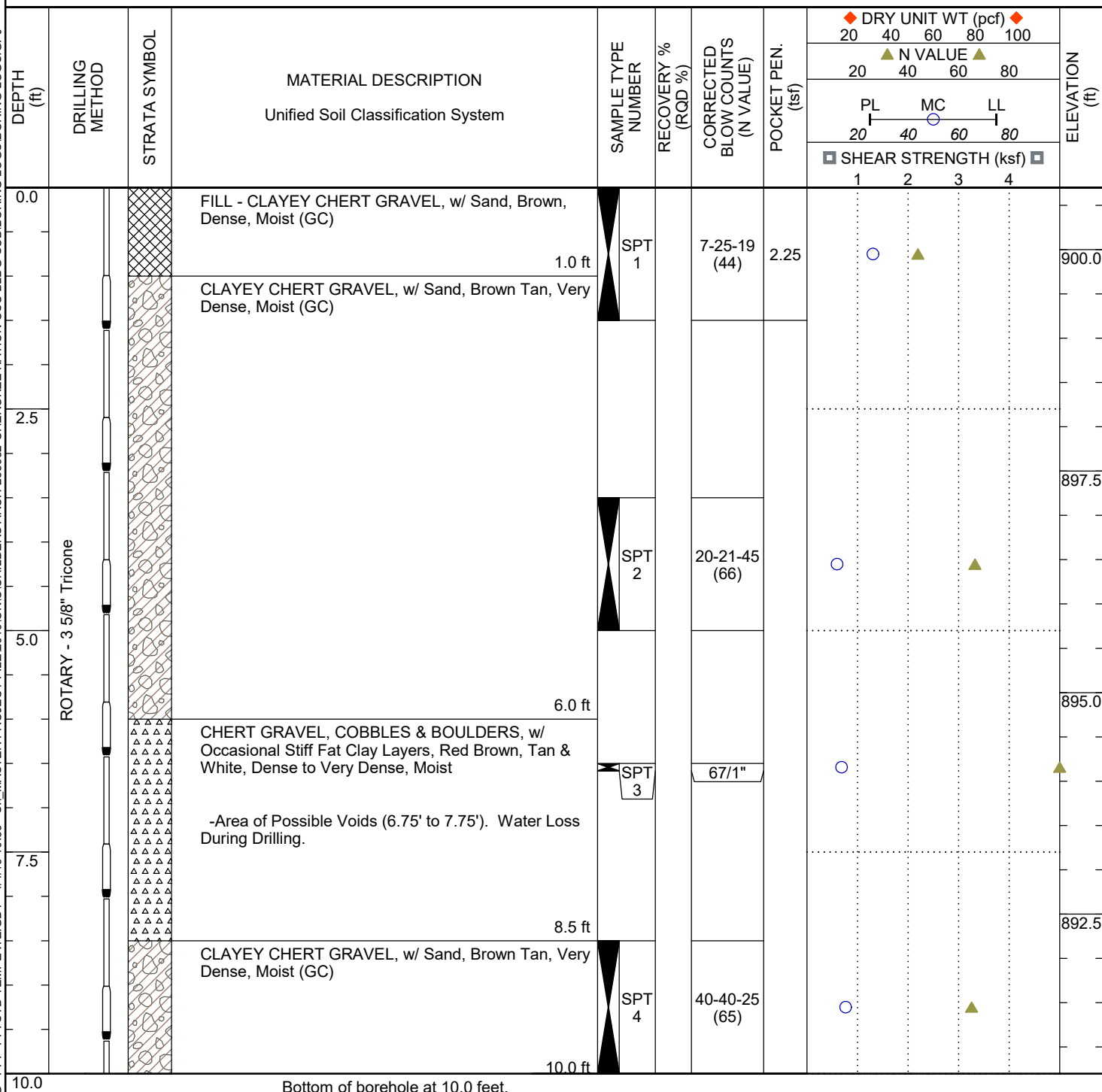
LOGGED BY BC

CHECKED BY BP

AT END OF DRILLING \_\_\_\_\_

NOTES \_\_\_\_\_

BORING LOG - PPI - PPI STD TEMPLATE.GDT - 4/4/19 10:39 - S:\MASTER PROJECT FILE\2019\OK\CHILDERS ARCH-255932-CHEROKEE NATION OSU BLDG-SUBBORING LOGS.GPJ





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# GEOTECHNICAL BORING LOG

BORING NUMBER

8

PAGE 1 OF 1

CLIENT Childers Architect

PROJECT NAME Cherokee Nation OSU Building

PROJECT NO. 255932

PROJECT LOCATION Tahlequah, OK

DATE STARTED 1/23/19

COMPLETED 1/23/19

SURFACE ELEVATION 903.3 ft

BENCHMARK EL. \_\_\_\_\_

DRILLER MR

DRILL RIG CME 1050

GROUND WATER LEVELS

HAMMER TYPE Auto

AT TIME OF DRILLING None

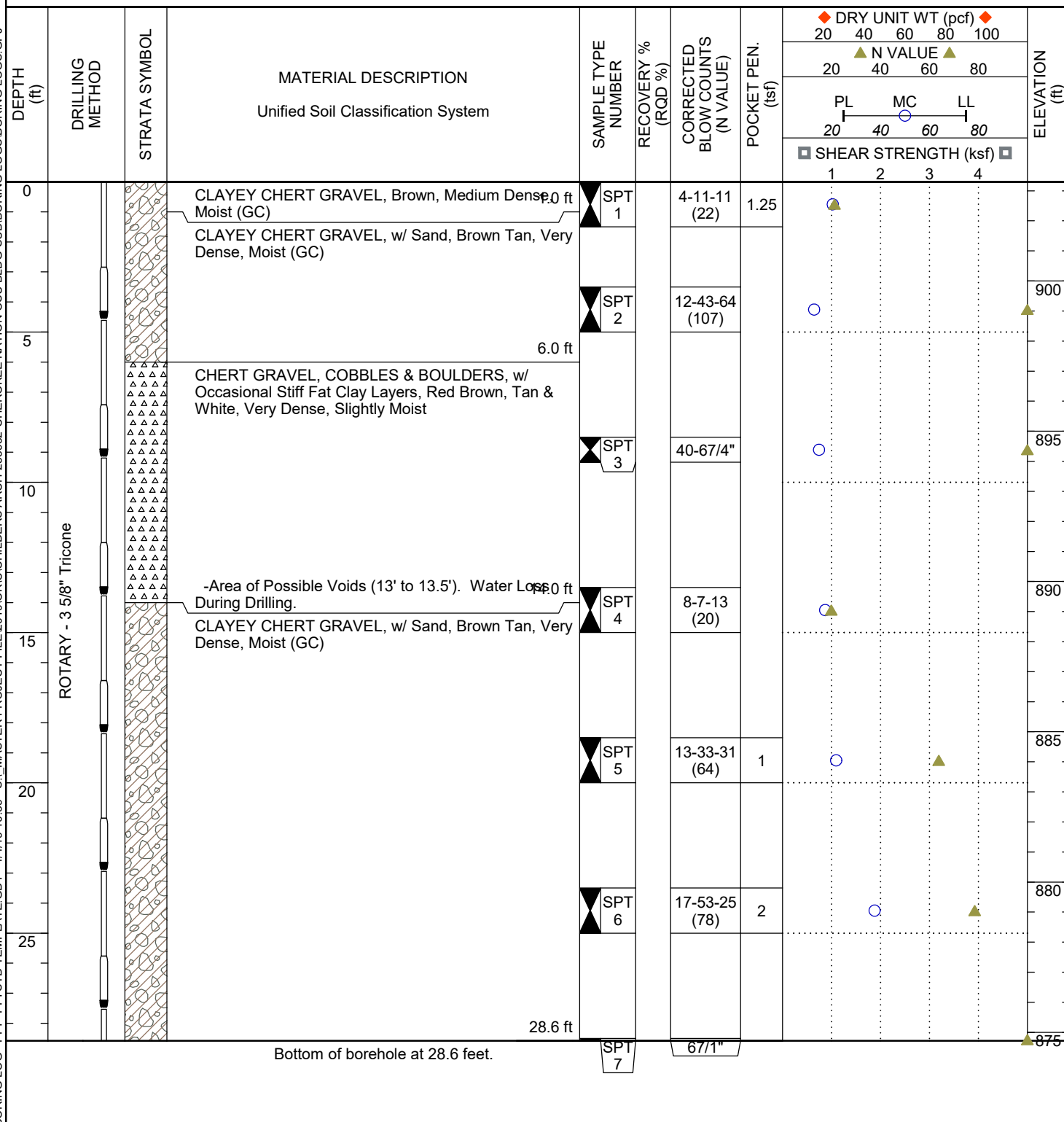
LOGGED BY BC

CHECKED BY BP

AT END OF DRILLING \_\_\_\_\_

NOTES \_\_\_\_\_

BORING LOG - PPI - PPI STD TEMPLATE.GDT - 4/4/19 10:39 - S:\MASTER PROJECT FILE\2019\OK\CHILDERS ARCH-255932-CHEROKEE NATION OSU BLDG-SUBBORING LOGS.GPJ







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# GEOTECHNICAL BORING LOG

BORING NUMBER

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CLIENT Childers Architect

PROJECT NAME Cherokee Nation OSU Building

PROJECT NO. 255932

PROJECT LOCATION Tahlequah, OK

DATE STARTED 1/22/19

COMPLETED 1/22/19

SURFACE ELEVATION 903.0 ft

BENCHMARK EL. \_\_\_\_\_

DRILLER MR

DRILL RIG CME 1050

GROUND WATER LEVELS

HAMMER TYPE Auto

AT TIME OF DRILLING None

LOGGED BY BC

CHECKED BY BP

AT END OF DRILLING \_\_\_\_\_

NOTES \_\_\_\_\_

BORING LOG - PPI - PPI STD TEMPLATE.GDT - 4/4/19 10:39 - S:\MASTER PROJECT FILE\2019\OK\CHILDERS ARCH-255932-CHEROKEE NATION OSU BLDG-SUBBORING LOGS\BORING LOGS.GPJ

DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL	MATERIAL DESCRIPTION  Unified Soil Classification System	SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	<div> <div>◆ DRY UNIT WT (pcf) ◆</div> <div>20 40 60 80 100</div> <div>▲ N VALUE ▲</div> <div>20 40 60 80</div> <div> <div>PL</div> <div>MC</div> <div>LL</div> </div> <div>20 40 60 80</div> <div>■ SHEAR STRENGTH (ksf) ■</div> <div>1 2 3 4</div> </div>	ELEVATION (ft)
0	ROTARY - 3 5/8" Tricone		FILL - LEAN CLAY, w/ Gravel, Brown, Stiff, Moist (CL)	SPT 1		20-13-1 (14)			
			CLAYEY CHERT GRAVEL, w/ Sand, Brown Tan, Very Dense, Moist (GC)	SPT 2		17-40-21 (61)			
5			5.5 ft						900
			CHERT GRAVEL, COBBLES & BOULDERS, w/ Occasional Stiff Fat Clay Layers, Red Brown, Tan & White, Very Dense, Slightly Moist	SPT 3		67/1"			
			-Area of Possible Voids (7.75' to 8'). Water Loss During Drilling.	SPT 4		23-17-9 (26)			895
10				SPT 5		67/4"			890
15			17.0 ft						
			CLAYEY CHERT SAND, w/ Gravel, Red Tan, Very Dense, Moist (SC)	SPT 6		40-64-40 (104)			885
20			22.0 ft						
			FAT CLAY, Scattered Chert Layers, Red Tan, Stiff, Moist (CH)	SPT 7		7-4-8 (12)	1		880
25				SPT 8		4-5-4 (9)			875
29.5			29.5 ft						

Bottom of borehole at 29.5 feet.



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# GEOTECHNICAL BORING LOG

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CLIENT Childers Architect

PROJECT NAME Cherokee Nation OSU Building

PROJECT NO. 255932

PROJECT LOCATION Tahlequah, OK

DATE STARTED 1/21/19

COMPLETED 1/22/19

SURFACE ELEVATION 904.2 ft

BENCHMARK EL. \_\_\_\_\_

DRILLER MR

DRILL RIG CME 1050

GROUND WATER LEVELS

HAMMER TYPE Auto

AT TIME OF DRILLING None

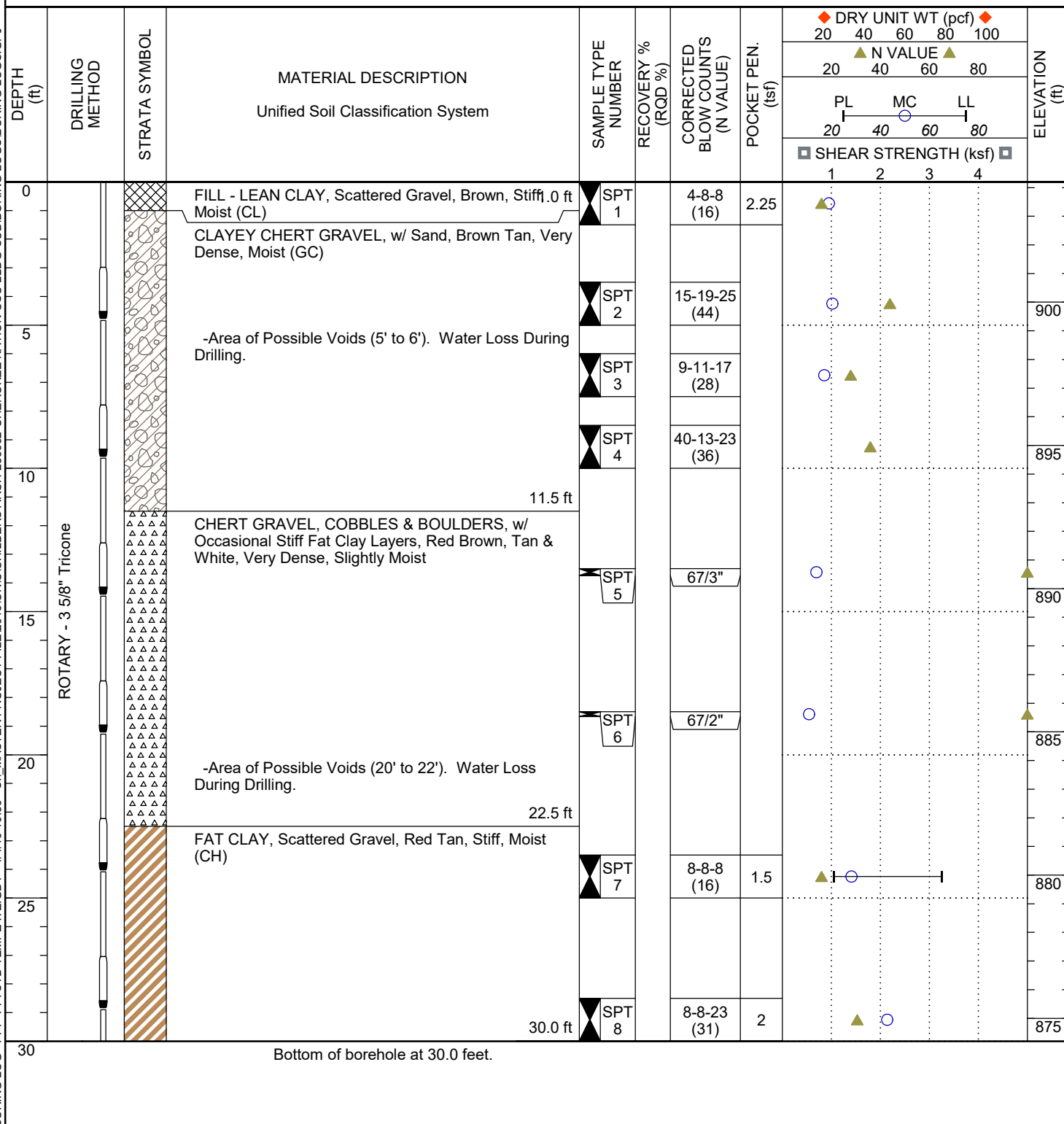
LOGGED BY BC

CHECKED BY BP

AT END OF DRILLING \_\_\_\_\_

NOTES \_\_\_\_\_

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BORING NUMBER

11

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CLIENT Childers Architect

PROJECT NAME Cherokee Nation OSU Building

PROJECT NO. 255932

PROJECT LOCATION Tahlequah, OK

DATE STARTED 3/27/19

COMPLETED 3/27/19

SURFACE ELEVATION 904.7 ft

BENCHMARK EL. \_\_\_\_\_

DRILLER MR

DRILL RIG CME 1050

GROUND WATER LEVELS

HAMMER TYPE Auto

AT TIME OF DRILLING None

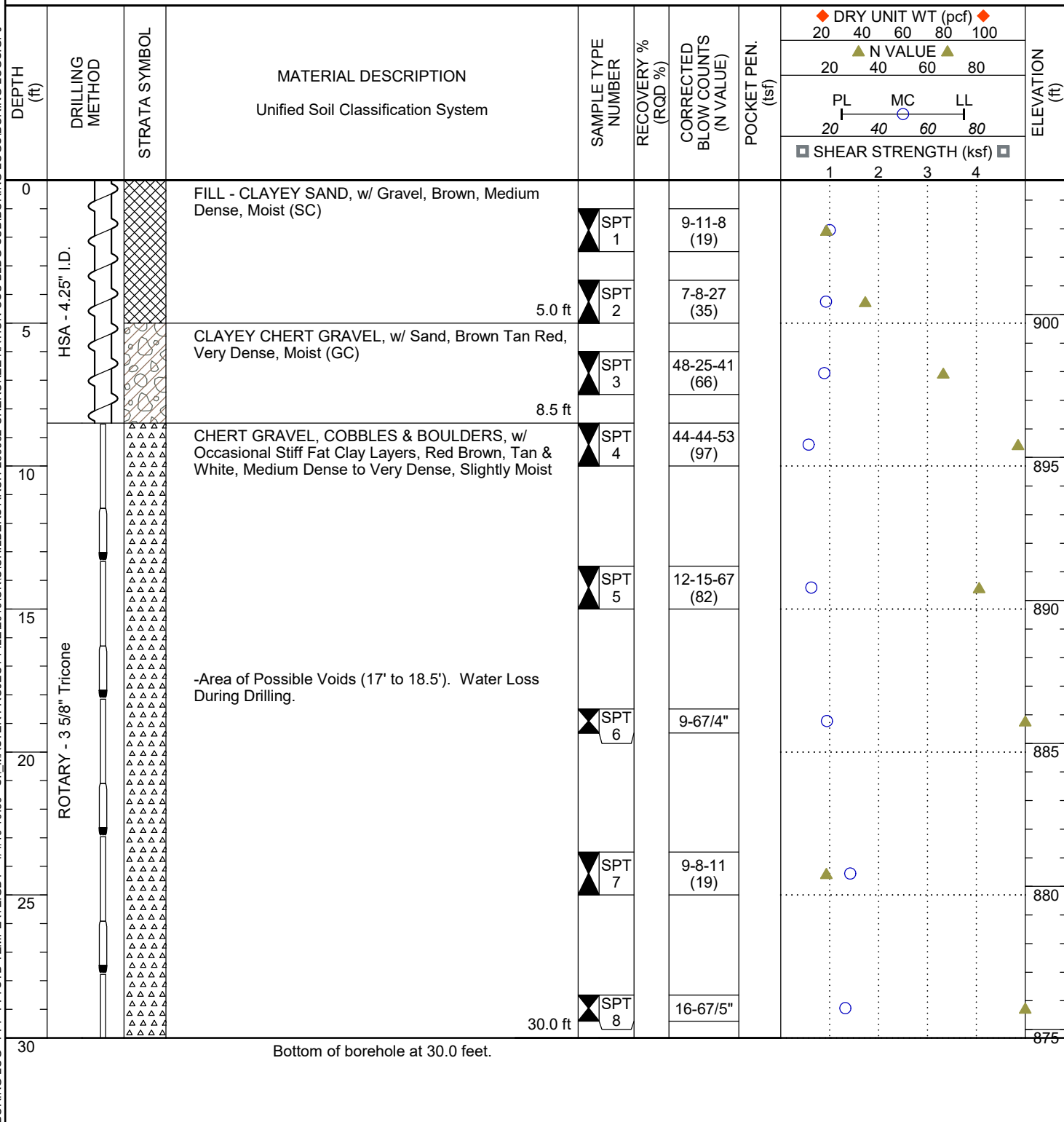
LOGGED BY TB

CHECKED BY BP

AT END OF DRILLING \_\_\_\_\_

NOTES \_\_\_\_\_

BORING LOG - PPI - PPI STD TEMPLATE.GDT - 4/4/19 10:39 - S:\MASTER PROJECT FILE\2019\OK\CHILDERS ARCH-255932-CHEROKEE NATION OSU BLDG-SUBBORING LOGS.GPJ





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# GEOTECHNICAL BORING LOG

BORING NUMBER

12

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CLIENT Childers Architect

PROJECT NAME Cherokee Nation OSU Building

PROJECT NO. 255932

PROJECT LOCATION Tahlequah, OK

DATE STARTED 3/27/19

COMPLETED 3/28/19

SURFACE ELEVATION 905.1 ft

BENCHMARK EL. \_\_\_\_\_

DRILLER MR

DRILL RIG CME 1050

GROUND WATER LEVELS

HAMMER TYPE Auto

AT TIME OF DRILLING None

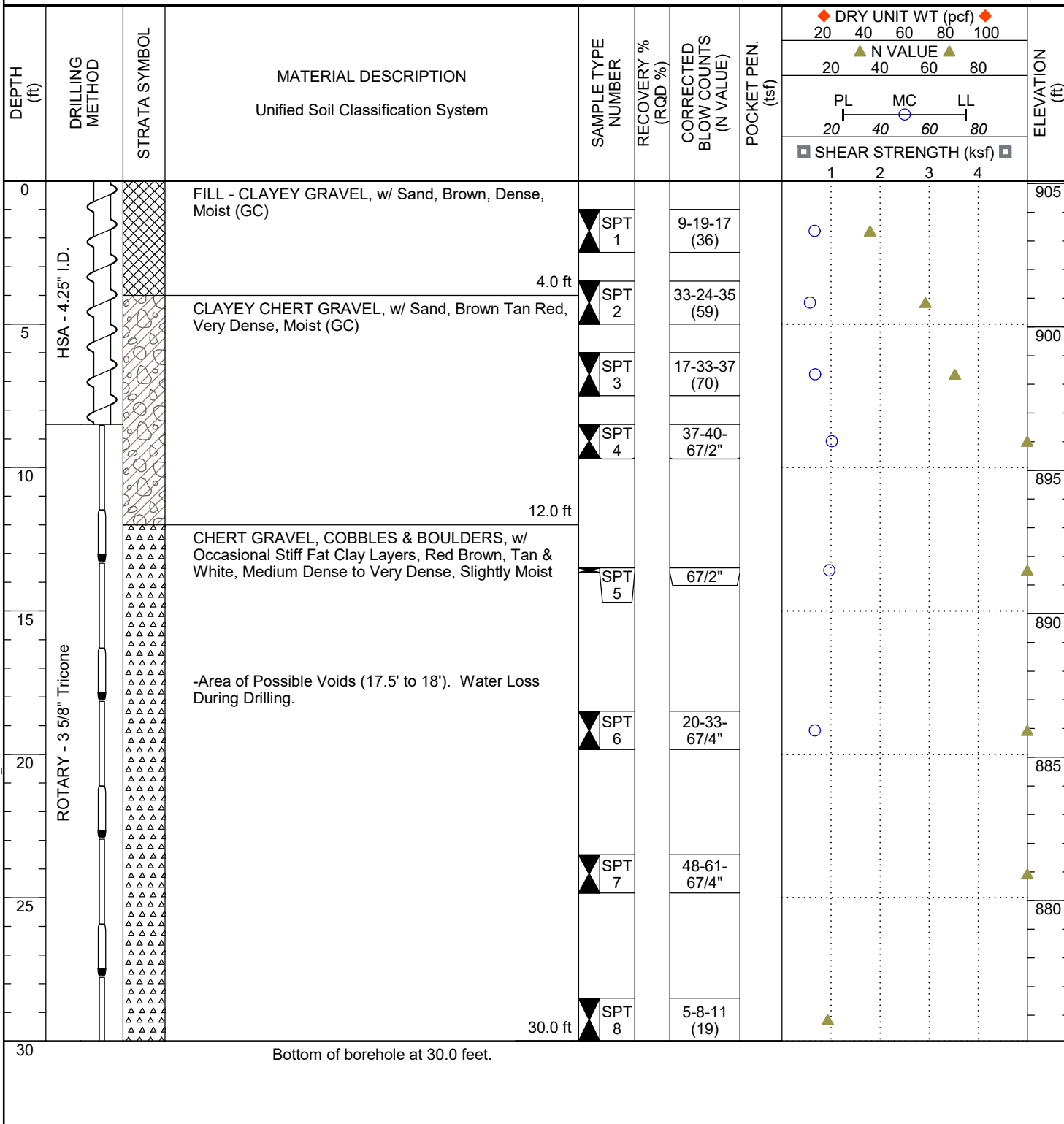
LOGGED BY TB

CHECKED BY BP

AT END OF DRILLING \_\_\_\_\_

NOTES \_\_\_\_\_

BORING LOG - PPI - PPI STD TEMPLATE.GDT - 4/4/19 10:39 - S:\MASTER PROJECT FILE\2019\OK\CHILDERS ARCH-255932-CHEROKEE NATION OSU BLDG-SUBBORING LOGS.GPJ



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# GEOTECHNICAL BORING LOG

**BORING NUMBER**

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**CLIENT** Childers Architect

**PROJECT NAME** Cherokee Nation OSU Building

**PROJECT NO.** 255932

**PROJECT LOCATION** Tahlequah, OK

DATE STARTED 3/28/19

**COMPLETED** 3/29/19

**SURFACE ELEVATION** 903.1 ft

BENCHMARK EL.

DRILLER MRDRILL RIG CME 1050

## GROUND WATER LEVELS

**HAMMER TYPE** Auto

**AT TIME OF DRILLING** None

LOGGED BY TB

**CHECKED BY** BP

### AT END OF DRILLING

## NOTES

DEPTH (ft)	DRILLING METHOD	STRATA SYMBOL	MATERIAL DESCRIPTION  Unified Soil Classification System	SAMPLE TYPE NUMBER	RECOVERY % (RQD %)	CORRECTED BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	◆ DRY UNIT WT (pcf) ◆				ELEVATION (ft)
								20 40 60 80 100				
								▲ N VALUE ▲				
								20 40 60 80				
								PL MC LL				
20 40 60 80												
■ SHEAR STRENGTH (ksf) ■												
1 2 3 4												
0	HSA - 4.25" I.D.		FILL - CLAYEY GRAVEL, w/ Sand, Brown, Dense, Moist (GC)	SPT 1		8-13-17 (30)		20  40  60  80  100				
			4.0 ft	SPT 2	9-8-13 (21)							
5												
				SPT 3		31-17-15 (32)				895		
10												
			12.0 ft									
			CHERT GRAVEL, COBBLES & BOULDERS, w/ Occasional Stiff Fat Clay Layers, Red Brown, Tan & White, Very Dense, Slightly Moist	SPT 4		67/2"		20  40  60  80  100		890		
15												
			16.0 ft									
			CLAYEY CHERT GRAVEL, w/ Sand, Brown Tan Red, Medium Dense to Very Dense, Moist (GC)	SPT 5		1-7-5 (12)		20  40  60  80  100		885		
20												
				SPT 6		67/1"		20  40  60  80  100		880		
25												
				SPT 7		8-12-17 (29)		20  40  60  80  100		875		
30			30.0 ft									
Bottom of borehole at 30.0 feet.												

Bottom of borehole at 30.0 feet.

30RING LOG-PPI- PPI STD TEMPLATE.GDT - 4/4/19 10:39 - S:\\_MASTER PROJECT FILE\2019\KIC\CHILDERS ARCH-255932-CHEROKEE NATION OSU BLDG-SUBBORING LOGS.GPJ



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## KEY TO SYMBOLS

CLIENT Childers Architect

PROJECT NAME Cherokee Nation OSU Building

PROJECT NO. 255932

PROJECT LOCATION Tahlequah, OK

### LITHOLOGIC SYMBOLS (Unified Soil Classification System)



CH: USCS High Plasticity Clay



CHERT: Chert



FILL: Fill (made ground)



GC: USCS Clayey Gravel



TOPSOIL: Topsoil

### SAMPLER SYMBOLS



Standard Penetration Test

### WELL CONSTRUCTION SYMBOLS

### ABBREVIATIONS

LL - LIQUID LIMIT (%)  
PI - PLASTIC INDEX (%)  
W - MOISTURE CONTENT (%)  
DD - DRY DENSITY (PCF)  
NP - NON PLASTIC  
-200 - PERCENT PASSING NO. 200 SIEVE  
PP - POCKET PENETROMETER (TSF)

TV - TORVANE  
PID - PHOTOIONIZATION DETECTOR  
UC - UNCONFINED COMPRESSION  
ppm - PARTS PER MILLION  
▽ Water Level at Time  
Drilling, or as Shown  
▼ Water Level at End of  
Drilling, or as Shown  
▽ Water Level After 24  
Hours, or as Shown

**APPENDIX II**  
**GENERAL NOTES**

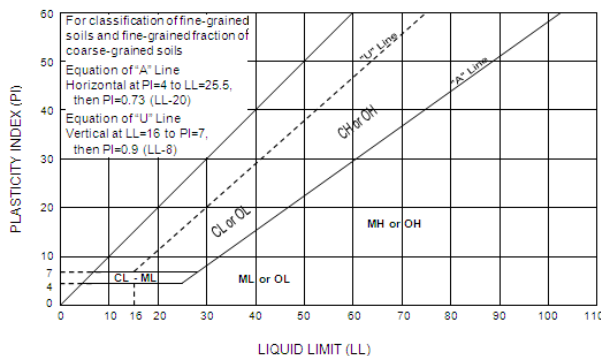


## GENERAL NOTES

### SOIL PROPERTIES & DESCRIPTIONS

#### COHESIVE SOILS

Consistency	Unconfined Compressive Strength (Qu)	Pocket Penetrometer Strength	N-Value
	(psf)	(tsf)	(blows/ft)
Very Soft	<500	<0.25	0-1
Soft	500-1000	0.25-0.50	2-4
Medium Stiff	1001-2000	0.50-1.00	5-8
Stiff	2001-4000	1.00-2.00	9-15
Very Stiff	4001-8000	2.00-4.00	16-30
Hard	>8000	>4.00	31-60
Very Hard			>60



Group Symbol	Group Name
CL	Lean Clay
ML	Silt
OL	Organic Clay or Silt
CH	Fat Clay
MH	Elastic Silt
OH	Organic Clay or Silt
PT	Peat
CL-CH	Lean to Fat Clay

Plasticity		Moisture	
Description	Liquid Limit (LL)	Descriptive Term	Guide
Lean	<45%	Dry	No indication of water
Lean to Fat	45-49%	Moist	Indication of water
Fat	≥50%	Wet	Visible water

Fine Grained Soil Subclassification	Percent (by weight) of Total Sample
Terms: SILT, LEAN CLAY, FAT CLAY, ELASTIC SILT	PRIMARY CONSTITUENT
Sandy, gravelly, abundant cobbles, abundant boulders	>30-50]
with sand, with gravel, with cobbles, with boulders	>15-30] – secondary coarse grained constituents
scattered sand, scattered gravel, scattered cobbles, scattered boulders	5-15]
a trace sand, a trace gravel, a few cobbles, a few boulders	<5]
The relationship of clay and silt constituents is based on plasticity and normally determined by performing index tests. Refined classifications are based on Atterberg Limits tests and the Plasticity Chart.	

#### NON-COHESIVE (GRANULAR) SOILS

RELATIVE DENSITY	N-VALUE
Very Loose	0-4
Loose	5-10
Medium Dense	11-24
Dense	25-50
Very Dense	≥51

MOISTURE CONDITION	
Descriptive Term	Guide
Dry	No indication of water
Moist	Damp but no visible water
Wet	Visible free water, usually soil is below water table.

**GRAIN SIZE IDENTIFICATION		
Name	Size Limits	Familiar Example
Boulder	12 in. or more	Larger than basketball
Cobbles	3 in. to 12 in.	Grapefruit
Coarse Gravel	¾-in. to 3 in.	Orange or lemon
Fine Gravel	No. 4 sieve to ¾-in.	Grape or pea
Coarse Sand	No. 10 sieve to No. 4 sieve	Rock salt
Medium Sand	No. 40 sieve to No. 10 sieve	Sugar, table salt
Fine Sand*	No. 200 sieve to No. 40 sieve	Powdered sugar
Fines	Less than No. 200 sieve	
*Particles finer than fine sand cannot be discerned with the naked eye at a distance of 8 in.		

Coarse Grained Soil Subclassification	Percent (by weight) of Total Sample
Terms: GRAVEL, SAND, COBBLES, BOULDERS	PRIMARY CONSTITUENT
Sandy, gravelly, abundant cobbles, abundant boulders	>30-50]
with gravel, with sand, with cobbles, with boulders	>15-30] – secondary coarse grained constituents
scattered gravel, scattered sand, scattered cobbles, scattered boulders	5-15]
a trace gravel, a trace sand, a few cobbles, a few boulders	<5]
Silty (MH & ML)*, clayey (CL & CH)*	<15 ]
(with silt, with clay)*	5-15 ] – secondary fine grained constituents
(trace silt, trace clay)*	<5 ]
*Index tests and/or plasticity tests are performed to determine whether the term "silt" or "clay" is used.	

\*Modified after Ref. ASTM D2487-93 & D2488-93

\*\*Modified after Ref. Oregon DOT 1987 & FHWA 1997

\*\*\*Modified after Ref. AASHTO 1988, DM 7.1 1982, and Oregon DOT 1987

## GENERAL NOTES

### BEDROCK PROPERTIES & DESCRIPTIONS

ROCK QUALITY DESIGNATION (RQD)	
Description of Rock Quality	*RQD (%)
Very Poor	< 25
Poor	25-50
Fair	50-75
Good	75-90
Excellent	90-100
*RQD is defined as the total length of sound core pieces 4 in. or greater in length, expressed as a percentage of the total length cored. RQD provides an indication of the integrity of the rock mass and relative extent of seams and bedding planes.	

SCALE OF RELATIVE ROCK HARDNESS		
Term	Field Identification	Approx. Unconfined Compressive Strength (tsf)
Extremely Soft	Can be indented by thumbnail	2.6-10
Very Soft	Can be peeled by pocket knife	10-50
Soft	Can be peeled with difficulty by pocket knife	50-260
Medium Hard	Can be grooved 2 mm deep by firm pressure of knife	260-520
Moderately Hard	Requires one hammer blow to fracture	520-1040
Hard	Can be scratched with knife or pick only with difficulty	1040-2610
Very Hard	Cannot be scratched by knife or sharp pick	>2610

DEGREE OF WEATHERING	
Slightly Weathered	Rock generally fresh, joints stained and discoloration extends into rock up to 25mm (1 in), open joints may contain clay, core rings under hammer impact.
Weathered	Rock mass is decomposed 50% or less, significant portions of rock show discoloration and weathering effects, cores cannot be broken by hand or scraped by knife.
Highly Weathered	Rock mass is more than 50% decomposed, complete discoloration of rock fabric, core may be extremely broken and gives clunk sound when struck by hammer, may be shaved with a knife.

GRAIN SIZE (TYPICALLY FOR SEDIMENTARY ROCKS)		
Description	Diameter (mm)	Field Identification
Very Coarse Grained	>4.76	Individual grains can easily be distinguished by eye.
Coarse Grained	2.0-4.76	
Medium Grained	0.42-2.0	Individual grains can be distinguished by eye.
Fine Grained	0.074-0.42	Individual grains can be distinguished by eye with difficulty.
Very Fine Grained	<0.074	Individual grains cannot be distinguished by unaided eye.

VOIDS	
Pit	Voids barely seen with naked eye to 6mm (¼-in)
Vug	Voids 6 to 50mm (¼ to 2 in) in diameter
Cavity	50 to 600mm (2 to 24 in) in diameter
Cave	>600mm

BEDDING THICKNESS	
Very Thick Bedded	> 3' thick
Thick Bedded	1' to 3' thick
Medium Bedded	4" to 1' thick
Thin Bedded	1¼" to 4" thick
Very Thin Bedded	½" to 1¼" thick
Thickly Laminated	⅛" to ½" thick
Thinly Laminated	⅛" or less (paper thin)

### DRILLING NOTES

#### Drilling and Sampling Symbols

NQ – Rock Core (2-in. diameter)

HQ – Rock Core (3 in. diameter)

HSA – Hollow Stem Auger

CFA – Continuous Flight (Solid Stem) Auger

SS – Split Spoon Sampler

ST – Shelby Tube

WB – Wash Bore or Mud Rotary

TP – Test-Pit

HA – Hand Auger

#### Soil Sample Types

**Shelby Tube Samples:** Relatively undisturbed soil samples were obtained from the borings using thin wall (Shelby) tube samplers pushed hydraulically into the soil in advance of drilling. This sampling, which is considered to be undisturbed, was performed in accordance with the requirements of ASTM D 1587. This type of sample is considered best for the testing of "in-situ" soil properties such as natural density and strength characteristics. The use of this sampling method is basically restricted to soil containing little to no chert fragments and to softer shale deposits.

**Split Spoon Samples:** The Standard Penetration Test is conducted in conjunction with the split-barrel sampling procedure. The "N" value corresponds to the number of blows required to drive the last 1 foot of an 18-in. long, 2-in. O.D. split-barrel sampler with a 140 lb. hammer falling a distance of 30 in. The Standard Penetration Test is carried out according to ASTM D-1586.

#### Water Level Measurements

Water levels indicated on the boring logs are levels measured in the borings at the times indicated. In permeable materials, the indicated levels may reflect the location of groundwater. In low permeability soils, shallow groundwater may indicate a perched condition. Caution is merited when interpreting short-term water level readings from open bore holes. Accurate water levels are best determined from piezometers.

#### Automatic Hammer

Palmerton and Parrish's CME's are equipped with automatic hammers. The conventional method used to obtain disturbed soil samples used a safety hammer operated by company personnel with a cat head and rope. However, use of an automatic hammer allows a greater mechanical efficiency to be achieved in the field while performing a Standard Penetration resistance test based upon automatic hammer efficiencies calibrated using dynamic testing techniques.

\*Modified after Ref. ASTM D2487-93 & D2488-93

\*\*Modified after Ref. Oregon DOT 1987 & FHWA 1997

\*\*\*Modified after Ref. AASHTO 1988, DM 7.1 1982, and Oregon DOT 1987

**APPENDIX III**  
**GRAIN SIZE ANALYSIS**



4168 W. Kearney St.  
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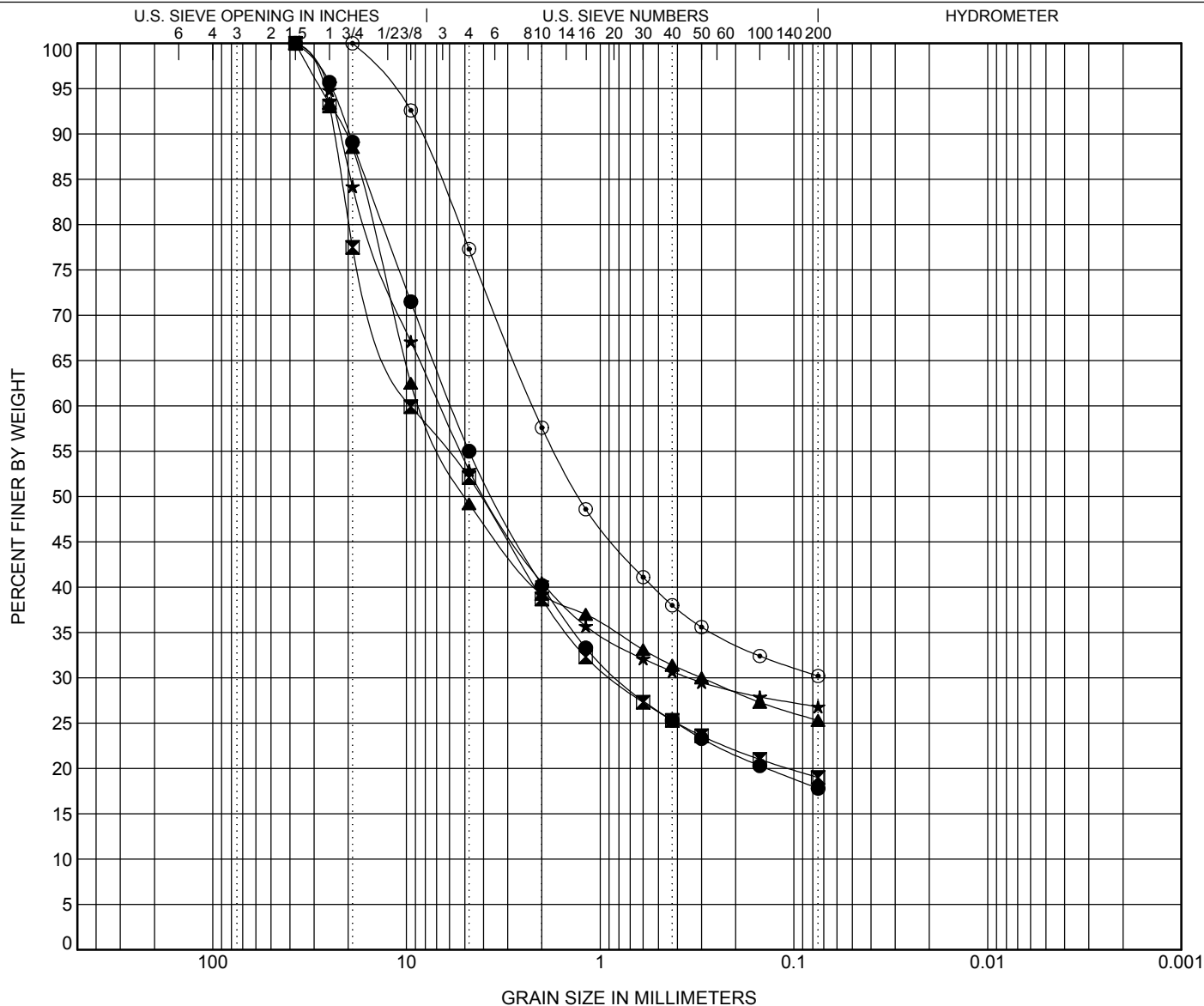
# GRAIN SIZE DISTRIBUTION

CLIENT Childers Architect

PROJECT NAME Cherokee Nation OSU Building

PROJECT NO. 255932

PROJECT LOCATION Tahlequah, OK



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

BOREHOLE	DEPTH	Classification					LL	PL	PI	Cc	Cu
● 1	3.0	CLAYEY GRAVEL with SAND(GC)									
■ 2	3.5	CLAYEY GRAVEL with SAND(GC)									
▲ 3	13.5	CLAYEY GRAVEL with SAND(GC)									
★ 8	3.5	CLAYEY GRAVEL with SAND(GC)									
⊙ 9	18.0	CLAYEY SAND with GRAVEL(SC)									
BOREHOLE	DEPTH	D100	D60	D30	D10	%Gravel	%Sand	%Silt		%Clay	
● 1	3.0	37.5	5.86	0.777		45.0	37.2	17.8			
■ 2	3.5	37.5	9.537	0.868		47.9	33.1	19.0			
▲ 3	13.5	37.5	8.339	0.3		50.8	23.9	25.3			
★ 8	3.5	37.5	6.718	0.347		47.1	26.1	26.8			
⊙ 9	18.0	19	2.222			22.7	47.1	30.2			

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4168 W Kearney St.  
Springfield, MO 65803  
Telephone: 417-864-6000

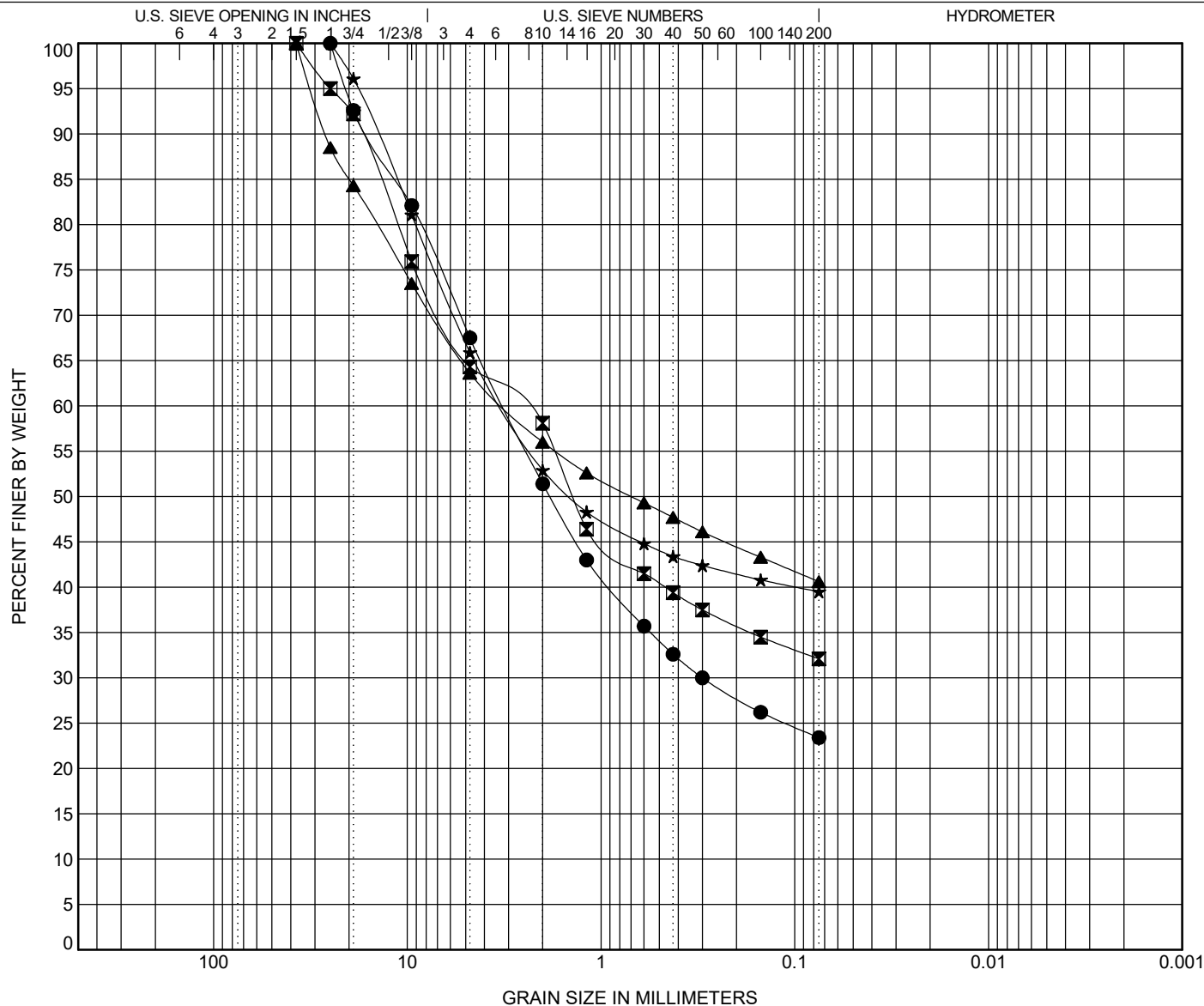
# GRAIN SIZE DISTRIBUTION

CLIENT Childers Architect

PROJECT NAME Cherokee Nation OSU Building

PROJECT NO. 255932

PROJECT LOCATION Tahlequah, OK



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

BOREHOLE	DEPTH	Classification					LL	PL	PI	Cc	Cu
● 11	3.5	CLAYEY SAND with GRAVEL(SC)									
⊠ 12	3.5	CLAYEY GRAVEL with SAND(GC)									
▲ 13	3.5	CLAYEY GRAVEL with SAND(GC)									
★ 13	28.5	CLAYEY GRAVEL with SAND(GC)									
BOREHOLE	DEPTH	D100	D60	D30	D10	%Gravel	%Sand	%Silt		%Clay	
● 11	3.5	25	3.175	0.3		32.5	44.1	23.4			
⊠ 12	3.5	37.5	2.607			35.7	32.2	32.1			
▲ 13	3.5	37.5	3.153			36.4	23.0	40.6			
★ 13	28.5	25	3.208			34.1	26.4	39.5			

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## **APPENDIX IV**

### **IMPORTANT INFORMATION REGARDING YOUR GEOTECHNICAL REPORT**

# Important Information about This Geotechnical-Engineering Report

Subsurface problems are a principal cause of construction delays, cost overruns, claims, and disputes.

While you cannot eliminate all such risks, you can manage them. The following information is provided to help.

**The Geoprofessional Business Association (GBA) has prepared this advisory to help you – assumedly a client representative – interpret and apply this geotechnical-engineering report as effectively as possible. In that way, clients can benefit from a lowered exposure to the subsurface problems that, for decades, have been a principal cause of construction delays, cost overruns, claims, and disputes. If you have questions or want more information about any of the issues discussed below, contact your GBA-member geotechnical engineer. Active involvement in the Geoprofessional Business Association exposes geotechnical engineers to a wide array of risk-confrontation techniques that can be of genuine benefit for everyone involved with a construction project.**

## **Geotechnical-Engineering Services Are Performed for Specific Purposes, Persons, and Projects**

Geotechnical engineers structure their services to meet the specific needs of their clients. A geotechnical-engineering study conducted for a given civil engineer will not likely meet the needs of a civil-works constructor or even a different civil engineer. Because each geotechnical-engineering study is unique, each geotechnical-engineering report is unique, prepared *solely* for the client. *Those who rely on a geotechnical-engineering report prepared for a different client can be seriously misled.* No one except authorized client representatives should rely on this geotechnical-engineering report without first conferring with the geotechnical engineer who prepared it. *And no one – not even you – should apply this report for any purpose or project except the one originally contemplated.*

## **Read this Report in Full**

Costly problems have occurred because those relying on a geotechnical-engineering report did not read it *in its entirety*. Do not rely on an executive summary. Do not read selected elements only. *Read this report in full.*

## **You Need to Inform Your Geotechnical Engineer about Change**

Your geotechnical engineer considered unique, project-specific factors when designing the study behind this report and developing the confirmation-dependent recommendations the report conveys. A few typical factors include:

- the client's goals, objectives, budget, schedule, and risk-management preferences;
- the general nature of the structure involved, its size, configuration, and performance criteria;
- the structure's location and orientation on the site; and
- other planned or existing site improvements, such as retaining walls, access roads, parking lots, and underground utilities.

Typical changes that could erode the reliability of this report include those that affect:

- the site's size or shape;
- the function of the proposed structure, as when it's changed from a parking garage to an office building, or from a light-industrial plant to a refrigerated warehouse;
- the elevation, configuration, location, orientation, or weight of the proposed structure;
- the composition of the design team; or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project changes – even minor ones – and request an assessment of their impact. *The geotechnical engineer who prepared this report cannot accept responsibility or liability for problems that arise because the geotechnical engineer was not informed about developments the engineer otherwise would have considered.*

## **This Report May Not Be Reliable**

*Do not rely on this report* if your geotechnical engineer prepared it:

- for a different client;
- for a different project;
- for a different site (that may or may not include all or a portion of the original site); or
- before important events occurred at the site or adjacent to it; e.g., man-made events like construction or environmental remediation, or natural events like floods, droughts, earthquakes, or groundwater fluctuations.

Note, too, that it could be unwise to rely on a geotechnical-engineering report whose reliability may have been affected by the passage of time, because of factors like changed subsurface conditions; new or modified codes, standards, or regulations; or new techniques or tools. *If your geotechnical engineer has not indicated an "apply-by" date on the report, ask what it should be, and, in general, if you are the least bit uncertain about the continued reliability of this report, contact your geotechnical engineer before applying it.* A minor amount of additional testing or analysis – if any is required at all – could prevent major problems.

## **Most of the "Findings" Related in This Report Are Professional Opinions**

Before construction begins, geotechnical engineers explore a site's subsurface through various sampling and testing procedures. *Geotechnical engineers can observe actual subsurface conditions only at those specific locations where sampling and testing were performed.* The data derived from that sampling and testing were reviewed by your geotechnical engineer, who then applied professional judgment to form opinions about subsurface conditions throughout the site. Actual sitewide-subsurface conditions may differ – maybe significantly – from those indicated in this report. Confront that risk by retaining your geotechnical engineer to serve on the design team from project start to project finish, so the individual can provide informed guidance quickly, whenever needed.



## This Report's Recommendations Are Confirmation-Dependent

The recommendations included in this report – including any options or alternatives – are confirmation-dependent. In other words, *they are not final*, because the geotechnical engineer who developed them relied heavily on judgment and opinion to do so. Your geotechnical engineer can finalize the recommendations *only after observing actual subsurface conditions* revealed during construction. If through observation your geotechnical engineer confirms that the conditions assumed to exist actually do exist, the recommendations can be relied upon, assuming no other changes have occurred. *The geotechnical engineer who prepared this report cannot assume responsibility or liability for confirmation-dependent recommendations if you fail to retain that engineer to perform construction observation.*

## This Report Could Be Misinterpreted

Other design professionals' misinterpretation of geotechnical-engineering reports has resulted in costly problems. Confront that risk by having your geotechnical engineer serve as a full-time member of the design team, to:

- confer with other design-team members,
- help develop specifications,
- review pertinent elements of other design professionals' plans and specifications, and
- be on hand quickly whenever geotechnical-engineering guidance is needed.

You should also confront the risk of constructors misinterpreting this report. Do so by retaining your geotechnical engineer to participate in prebid and preconstruction conferences and to perform construction observation.

## Give Constructors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can shift unanticipated-subsurface-conditions liability to constructors by limiting the information they provide for bid preparation. To help prevent the costly, contentious problems this practice has caused, include the complete geotechnical-engineering report, along with any attachments or appendices, with your contract documents, *but be certain to note conspicuously that you've included the material for informational purposes only*. To avoid misunderstanding, you may also want to note that "informational purposes" means constructors have no right to rely on the interpretations, opinions, conclusions, or recommendations in the report, but they may rely on the factual data relative to the specific times, locations, and depths/elevations referenced. Be certain that constructors know they may learn about specific project requirements, including options selected from the report, *only* from the design drawings and specifications. Remind constructors that they may

perform their own studies if they want to, and *be sure to allow enough time* to permit them to do so. Only then might you be in a position to give constructors the information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions. Conducting prebid and preconstruction conferences can also be valuable in this respect.

## Read Responsibility Provisions Closely

Some client representatives, design professionals, and constructors do not realize that geotechnical engineering is far less exact than other engineering disciplines. That lack of understanding has nurtured unrealistic expectations that have resulted in disappointments, delays, cost overruns, claims, and disputes. To confront that risk, geotechnical engineers commonly include explanatory provisions in their reports. Sometimes labeled "limitations," many of these provisions indicate where geotechnical engineers' responsibilities begin and end, to help others recognize their own responsibilities and risks. *Read these provisions closely*. Ask questions. Your geotechnical engineer should respond fully and frankly.

## Geoenvironmental Concerns Are Not Covered

The personnel, equipment, and techniques used to perform an environmental study – e.g., a "phase-one" or "phase-two" environmental site assessment – differ significantly from those used to perform a geotechnical-engineering study. For that reason, a geotechnical-engineering report does not usually relate any environmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated subsurface environmental problems have led to project failures*. If you have not yet obtained your own environmental information, ask your geotechnical consultant for risk-management guidance. As a general rule, *do not rely on an environmental report prepared for a different client, site, or project, or that is more than six months old*.

## Obtain Professional Assistance to Deal with Moisture Infiltration and Mold

While your geotechnical engineer may have addressed groundwater, water infiltration, or similar issues in this report, none of the engineer's services were designed, conducted, or intended to prevent uncontrolled migration of moisture – including water vapor – from the soil through building slabs and walls and into the building interior, where it can cause mold growth and material-performance deficiencies. Accordingly, *proper implementation of the geotechnical engineer's recommendations will not of itself be sufficient to prevent moisture infiltration*. Confront the risk of moisture infiltration by including building-envelope or mold specialists on the design team. *Geotechnical engineers are not building-envelope or mold specialists*.



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**TAHLEQUAH PUBLIC WORKS AUTHORITY**  
**WATER & SEWER CONSTRUCTION**  
**POLICY GUIDELINES**  
Approved May 16, 2008

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## **SECTION 1: INTENT AND OVERVIEW**

1.1 These policy guidelines are set forth to assist the implementation of the Tahlequah Public Works Authority's purpose to provide, furnish and supply to the citizens of the City of Tahlequah and the territory in proximity thereto, and to protect the health, safety, and general welfare of the general public within the Authority's jurisdiction to serve and maintain water and sanitary sewer facilities.

1.2 LET IT BE KNOWN, that the Tahlequah Public Works Authority, to implement these policies, shall continue to revise and replace existing policies and to establish new standards and policies so that the needs and demands of new growth and expansion to the City of Tahlequah will not burden the existing facilities but provide the necessary increased level of service and funding expected to continue service and maintenance of water and sanitary sewer facilities as part of the Authority's current plans for the future growth of the City of Tahlequah.

1.3 All of the TPWA water and sewer facilities will benefit all new development that depends on these services and it is therefore appropriate to treat each development independently within each basin or distribution grid for the purposes of calculating, collecting, and spending the funds collected for the construction of these facilities.

1.4 A three tier method for new development shall be used to finance, defray, or reimburse all or a portion of the costs incurred by the TPWA to construct the improvements for water and sewer facilities.

## **SECTION 2:      DEFINITIONS**

The following abbreviations and words shall have the designated meanings:

**Board**--- The Tahlequah Public Works Authority Board of Trustees, the Governing Board of the Authority.

**City**---City of Tahlequah, Oklahoma, a municipal corporation acting through the city's duly authorized officers or agents.

**Development**---Any construction or expansion of a building, structure, or use, any change in use of a building or structure, or any change in the use of land, which creates additional demand for water and sewer facilities.

**Inspector**---The authorized representative of the TPWA who is assigned to a specific project site or any part thereof.

**ODEQ**---Oklahoma Department of Environmental Quality, the State regulatory authority under which the State Construction Standards are promulgated.

**Sanitary Sewer**---A pipe that conveys sewage or wastewater, and into which storm, surface and ground waters or unpolluted industrial wastes are not admitted intentionally.

**TPWA**---Tahlequah Public Works Authority, a State of Oklahoma Public Trust acting through the Authority's duly authorized officers or agents.

**Water Line**---A water conveyance pipe that supplies pressurized drinkable water to connections for public use.

### **SECTION 3: PERMITS, PLANS & REVIEW FEES**

3.1 All municipal water and sewer systems, facilities, and connections shall be constructed in compliance with the Oklahoma Administrative Code, Title 252, Chapter 625 titled “**Public Water Supply Construction Standards**” and Chapter 656 titled “**Water Pollution Control Facility Construction Standards**” established by the ODEQ or ordinances, regulations, rules and requirements set forth by the City or TPWA standards, whichever is more stringent.

3.2 No municipal water and sewer systems, collectors or distribution lines shall be constructed until plans and specifications meeting the above criteria are reviewed, approved, and signed by a licensed professional engineer in responsible charge of the project.

3.3 All water and sewer line plans for the connection to the municipal system shall have TPWA Board approval prior to actual construction except plans on small extensions less than 500 feet that can be approved by the General Manager prior to actual construction. Approval shall be withheld if the water or sewer systems to which the proposed lines are connecting to have reached or, with the addition of the proposed lines, would reach treatment or hydraulic capacities (*See Section Five (5) Capacity Guidelines*). Further, approval shall also be withheld if the proposed lines do not meet or exceed the standards of the ODEQ and the TPWA, or may be withheld for any other valid reason.

3.4 All plans approved by the TPWA Board and General Manager shall have an application for a “Permit to Construct” sent, with a minimum of five (5) sets of plans and an Engineers Design Report and application fee, to the ODEQ for review and approval for the Permit.

3.5 The General Manager or his designated representative shall inspect each approved project and shall prohibit commencement of any construction or connection: (1) prior to the scheduled date of a pre-work conference, (2) during construction that is not in accordance with the approved plans, and (3) any deviation that does not meet with these policies and regulations.

3.6 All ODEQ Permit Fees and TPWA Plan Review Fees shall be paid to the TPWA office when submitting the ODEQ Permit Application for “Permit to Construct”, Engineer approved plans, specifications, and Engineering Reports. The ODEQ Permit Fee will be forwarded on to the ODEQ Water Quality Division for review. The amount is determined by the ODEQ Fee schedule for

construction projects and can be obtained through the project engineer. The TPWA Plan Review Fee shall be set by the TPWA General Manager and is presently set at \$100.00 for each water project, \$100.00 for each sewer project and \$175.00 for each combined water & sewer projects.



## **SECTION 4: CONSTRUCTION GUIDELINES & SPECIFICATIONS**

### **TECHNICAL SPECIFICATIONS**

#### **I. WATER LINES**

##### **1.1 GENERAL:**

The intent of this specification is to delineate materials and methods of construction for potable water lines and subsidiary systems as shown on the plans, complete in place and ready for operation by the OWNER. The work consists of all clearing, trench excavation, backfill and cleanup; furnishing and installing all pipe, casings, valves, fittings, concrete thrust blocks, and appurtenant items; testing and disinfection of system; and replacing fences, driveways, road surfaces, and all other improvements disturbed during the construction. All pipe shall be of the type and size shown on the drawings and all materials and work shall conform to the provisions of these specifications unless specifically exempted in other portions of the CONTRACT DOCUMENTS.

##### **1.2 MATERIALS:**

**1.2.1 Ductile Iron Pipe:** All pipe shall conform to ANSI Specification A21.51; AWWA Specification C151, and cement lining in accordance with ANSI Specification A21.4 and AWWA Specification C104. Pipe shall be pressure rated at 350psi with surge allowance of 100psi, with pipe thickness to conform with depth of cover and laying conditions.

**1.2.2 PVC Pressure Pipe:** Materials used to produce the pipe, couplings, and fittings shall be manufactured in accordance with ASTM D-2241, ASTM D-3139, Commercial Standard CS 256, and approved by the National Sanitation Foundation (NSF). The pipe shall be made from clean, virgin, **class 12454-B** PVC compound conforming to ASTM Resin Specifications D-1784 Type 1, Grade 1. Standard joint length shall be twenty (20) feet. The pipe shall have a minimum Standard Dimension ratio (SDR) of 21 for class 200psi. The pipe shall be marked continuously along the length with: Manufacturer's name, nominal size, class pressure rating, PVC 1120, NSF, and identification code. Pipe certification sheets shall be submitted by the manufacturer to show compliance with these specifications as requested by the Engineer.

**1.2.3 Fittings:** Fittings for all pipe 4" or larger shall be standard mechanical joint ductile iron unless otherwise indicated on the plans or noted by details. Ductile Iron Fittings shall conform to ANSI Specifications A21.10 and A21.11 and AWWA Specification C110.

Fittings shall be manufactured in accordance with ANSI Specification A21.4 and AWWA Specification C104, and shall be furnished with a complete set of joint materials for each socket opening.

1.2.4 Joints: Mechanical joints shall conform to and be tested in accordance with ANSI Specification A21.11 and AWWA Specification C111.

Restrained joints, when necessitated by the conditions of construction as determined by the Engineer, shall be used with or without thrust blocking for pipe joints adjacent to fittings, bends and terminal points as well as fitting joints or where utilized in ANSI Specification A21.10 and with A21.11. Joint restraints at Fire Hydrants shall conform to ASTM A307. Specified restraints shall be MIDCO's PERMA-GRIP Mechanical restrained Fittings for Class 200, SDR-21 PVC pipe or Model 1300 Uniflange Pipe restraints by Standard International and MEGALUG joint restraint by EBAA Iron Sales.

Flanged joints shall be used if indicated and shall conform to ANSI Specification A21.15 and AWWA Specification C115 for 125 pounds flange with appropriate bolts per standard ASA specifications for each flange size.

1.2.5 PVC Pipe Couplings: Couplings including bell ends, shall be Ring-Tite, Bell-Ring, or Push Joint connected, with fittings furnished by the pipe manufacturer and certified to be suitable for use with the pipe furnished. They shall have a minimum pressure rating of 200psi, and be constructed with deep sockets.

1.2.6 Gate Valves: Specified gate valves shall be manufactured by AVK. All Gate Valves shall conform to, and be tested in accordance with, the AWWA Standard for Resilient Seated Gate Valves, for water and sewage systems, ANSI/AWWA Specification C509. Valves shall be bubble tight from either direction at a rated design working pressure of 200psi. Valves shall have a single disc gate with synthetic rubber seat bonded or mechanically attached to the disc; a non-rising stem with 2" AWWA operating nut; opening counter clockwise with "O" ring stem seals. Valve interiors shall have a corrosion resistant coating acceptable for potable water and end connection to fit the pipe or connection to which it is attached. Valves installed with stems placed at depths greater than 36-inches shall have extensions attached to the operating nut as part of the valve component.

Each valve shall have the maker's name or initials, pressure rating and year of manufacture cast on the body and shall be furnished complete with set of joint materials for each socket.

1.2.7 Tapping Sleeves & Valves: Tapping sleeves and valves shall be furnished and installed in sizes indicated on connections to existing lines. Tapping sleeves manufactured by SMITH BLAIR or FORD are acceptable. The valves shall be Flange by Mechanical Joint Resilient Seat conforming with applicable provisions of AWWA C509.

1.2.8 Valve Boxes: Valve boxes shall be of the cast iron extension type with screw or slide adjustment and flared base. The minimum thickness of the metal shall be 3/16 inch. The word WATER shall be cast in the cover. The boxes shall be of such length as will be adapted to the depth

of cover over the pipe at the valve location, with bottom section, extension pieces, and top section as needed. **All installed valve boxes shall have a minimum 24"x 24" x 6" thick concrete pad set in place around the valve box for location and protection of the box.**

1.2.9 Valve & Line Markers: Identification markers shall be of metal fabrication with baked enamel finish noting the OWNER, and type of facility identified. Marker must be at least 80 square inches in area and shall have attachments to be firmly secured to a galvanized rod or post five (5) feet in length for erection at the location needed.

1.2.10 Steel Pipe Casing: All steel pipe casing shall be new or used smooth walled, welding steel pipe. The pipe shall be straight, round, and sound with no dents or splits and shall have a standard wall thickness as noted:

18" Pipe.....	0.375" Minimum Thickness
12" Pipe.....	0.330" Minimum Thickness
10" Pipe.....	0.307" Minimum Thickness
8" Pipe.....	0.277" Minimum Thickness

Pipe shall be delivered in lengths that will best fit the crossings as noted in the plans with a minimum number of joints to be welded. Pipe shall be subject to adequate inspection before, during, and after unloading of pipe at the job site and owner reserves the right to reject any and all pipe not in satisfactory conformance with this specification.

Spacers used between casing and pipe shall be as shown on the plans or as manufactured by RACI Spacers, Inc., Tulsa; M-2 THINsulator by T. D. Williamson, Inc., Tulsa; or APS Casing Spacers by Advance Prod. & Systems, Inc., Lafayette, La.

1.2.11 Fire & Flushing Hydrants: Fire Hydrants shall be AVK and shall conform to, and be tested in accordance with the AWWA Standard for Dry-Barrel Fire Hydrants, AWWA C502. Fire Hydrants shall have a 5¼-inch compression main valve; 6-inch inlet connection; mechanical joint hub; bury length as specified on the plans; two 2½-inch hose nozzles with TAHLEQUAH (e.g. Mueller 301 threads are Tahlequah threads) THREADS; one 4½-inch pumper nozzle with National Standard threads(CHECK WITH FIRE DEPARTMENT); and Safety Red finish paint above ground line. Flushing Hydrant shall have a 2¼-inch main valve opening with one 2½-inch hose nozzle with TAHLEQUAH THREADS and Safety Red finish paint above ground line. All other specifications shall meet the model requirements and sizes including a 10 year guarantee.

1.2.12 Air Release Valve: Air Release Valves shall be installed at the locations shown on the plans, or as directed by the Engineer. Valve shall be a heavy-duty air release type for 150psi working pressure, tested to 300psi, size shown on plans. Body, cover and baffle shall be cast iron. All internal parts to be stainless steel and/or bronze, and the inside valve coated with rust inhibitor as manufactured by Val-Matic, or an approved equal. Tapping saddle shall be CLOW, twin seal brass saddle and corporation stop with IP threads on outlet piping connection. Valve and piping connection shall be offset from the main line and properly supported to avoid stresses on piping connections. The valve discharge will have open end piping extended with a screened downward

facing elbow. Valve to be place in a 24" meter box and lid with keyed locking mechanism and lettering as approved by the Engineer. Use tapping sleeve Spec.

**1.2.13 Tracer Wire:** 12 gauge TRACER WIRE for the location of PVC water lines shall be required in all trenched areas of construction. The wire shall be attached to the water line and shall be brought to the surface and attached at all valve and meter boxes and any other appurtenance where the wire can be accessed.

**1.2.14 Cast-in-Place Concrete:** Concrete used for capping channel crossings, road crossings, and thrust blocking shall use as and included by reference herein ACI 301 Concrete Standard Specifications for Concrete for Building in its entirety. All concrete shall be mixed and proportioned as a six sack per yard mix to give good workability with a maximum slump of 4-inches. Concrete shall show a compressive strength of 3500psi at 28 days when tested. All crossing pours shall be vibrated to reduce voids, honeycombing, or defects. Concrete shall not be placed when the outside air temperature is 40° F or under and falling, except with the approval of the Engineer. All concrete will be placed against undisturbed earth or compacted bedding with all exposed concrete leveled and broomed to achieve a smooth brushed finish and all blocking placed so that pipe and fittings will be accessible for repair or Polyethylene wrapped. Concrete thrust blocking for all pipe fittings shall be in accordance with the table on the following page:

**1.2.15 Submittals:** The CONTRACTOR shall submit to the Engineer, three (3) copies of material submittals for all material he proposes to use. Construction shall not begin until the submittals have been approved by the Engineer.

Submittals for pipe shall consist of notarized certifications from the manufacturer that the pipe was manufactured and tested in accordance with the applicable specifications. The certifications shall indicate the pipe diameter, the pressure rating, resin classification, and the batch number from which the pipe was manufactured.

Submittals for material other than pipe shall consist of manufacturer's product literature or shop drawings, indicating dimensions and material specifications. Submittals shall include reference to compliance with ANSI, AWWA, ASTM, NSF, and other applicable standards.

### **1.3 INSTALLATION:**

**1.3.1 Protection of service & lateral lines:** The location of utility service lines and sewer system lateral lines serving individual properties or other utilities may or may not be shown on the plans. The CONTRACTOR shall assume that such service lines exist whether or not they are shown on the plans, and it shall be the responsibility of the Contractor to make any necessary changes in the line and/or grade of such services, or to secure the necessary changes therein to be made by the particular utility company involved or other owner thereof. Contractor shall pay the cost of all such revisions whether performed by the Contractor, the utility company, or other owner. In the event of interruption of a utility service as a result of accidental breakage, the Contractor shall promptly notify the owner of the utility, and shall repair or have repaired, in the same manner as necessary changes above provided for, and the Contractor shall do all things necessary to see the restoration of services as promptly as may be reasonably done.

**1.3.2 General Installation Details:** All material for the project shall be transported, delivered, and stored in a manner to prevent damage to the materials. All damaged, broken or otherwise defective materials will be rejected. Store lubricants, gaskets, jointing materials, and other packaged materials in a dry, protected area in which the manufacturer's name and all other applicable data is plainly marked and visible.

Pipe shall be delivered to the job site by means which will adequately support it, and not subject it to undue stresses. The load shall be so supported that bottom rows of pipe are not damaged by crushing. Pipe shall be stored and protected and shall not be strung along the line of trenching more than two days prior to placing. The trench wall shall be straight with a minimum trench width of eight (8) inches or three (3) times the pipe diameter, whichever is greater, at the grade line with the upper portion of the trench sloped to prevent cave-in or collapse of the trench. The bottom of the trench shall be finished to provide a uniform bearing for the pipe. Changes in grade in the trench bottom shall be made as shown on the drawings so the pipe will rest on the trench bottom. Where smaller radius of curvature than that recommended by the pipe manufacturer is required to fit the trench bottom, suitable elbows shall be used. Concrete thrust blocking shall be installed at all points of lateral thrust such as tees, elbows, etc., unless restraining connections are used as approved by the Water Department Superintendent. The pipe is to be laid in a trench having a six (6) inch bed of select material prepared before the pipe is lowered into the trench. Backfilling shall be carefully placed to avoid dropping rocks or large clods on the pipe. All backfill within eight (8) inches of the edges of the pipe shall contain no stones. Underground crossover piping shall provide a minimum clearance of twenty-four (24) inches between bottom of existing pipe and top of new pipe unless conditions restrict such clearance.

Sand, pea gravel, or crushed stone shall be used as bedding around the pipe, **(6) inches below, and twelve (12) inches over the pipe as standard trench bedding.** All pipe installed shall have a minimum cover over the top of the pipe of thirty-six (36) inches except where otherwise specified or approved by the Engineer. Where ledge or solid rock is encountered at this depth the pipe may be raised to a minimum depth of thirty (30) inches cover over the top of pipe.

The Contractor shall replace all street and paved surfaces as soon as possible after the pipe has been backfilled. Concrete, asphalt and gravel streets, parking lots, and driveways shall be cut in straight lines a minimum of twelve (12) inches on undisturbed soil from the excavated area and replaced with concrete or material in kind to a minimum thickness of eight (8) inches for streets and six (6) inches for driveways and parking lots. Any pavement or other surfaces of streets, roads, driveways, or walks which are removed or damaged whether or not within the trench or excavated limits shall be replaced or repaired to its original or better condition. Backfill above the specified pipe embedment will require compaction to 95% standard density under these surfaces. All other compaction will be of a character that will be reasonable free from settlement. Wherever trenches have not been properly filled or where settlement has occurred at any time prior to final acceptance of the entire work covered by this contract, to the extent that the top of the backfill is below the original ground surface, such trenches shall be refilled and backfill surface compacted and smoothed to conform to the elevation of the adjacent ground surface.

Trench backfill shall proceed immediately behind the pipe laying to avoid leaving open ditches over night. Any excavation which remains open over night shall be properly barricaded and lighted to avoid any injury to persons or property. When work is stopped at night or for any other reason, water tight plugs shall be used to prevent excavated material, water, and small animals from entering the pipe.

Where the Contractor encounters water or the trench soil becomes mucky or in such condition that the bedding cannot be graded properly or support the pipe, then the Contractor shall excavate below the sub-grade sufficiently to allow for a gravel sub-grade bedding to be placed. Pumps shall be installed and operated to allow the water level to be drawn down below the bottom of the pipe. The Contractor shall install trench bracing where protection of his employees and the work is necessary and required by safety codes.

1.3.3 Testing & Disinfection of Lines: After each convenient section of pipe line is completed, that section shall be pressure tested and disinfected. The pipe shall be tested by applying a hydraulic pressure of not less than 150 psi, nor more than the pressure rating of the pipe, for a minimum period of (24) hours. The allowable leakage shall not exceed ten (10) gallons per inch of diameter per mile of pipe. Leakage in excess of this amount shall be isolated and repaired and all visible leakage shall be repaired regardless of the amount. The Contractor shall pay for all water loss and usage during the period of construction and testing and until final acceptance of the system. The Contractor shall disinfect the completed water system in accordance with the latest requirements of the Oklahoma State Department of Environmental Quality, including taking appropriate samples and furnishing the OWNER laboratory test reports.

1.3.4 Clearing & Restoring R-O-W: The Contractor will clear stretches of rights-of-way in advance of staking the line for excavation. Contractor shall notify the OWNER at least one week in advance of any particular section to be staked and shall remove trees, brush, stumps, logs, dirt piles, debris, or other objects along the designated area to be staked. Depressions left from the clearing operations shall be filled and the materials from all clearing operations disposed of to the complete satisfaction of the property owner. Clean up of areas shall proceed as the construction progress. Drainage ditches and culverts shall be cleaned out immediately after the backfill has been placed over the trench to assure proper drainage. Where lines are laid across lawns or other special areas, the Contractor shall backfill the trench as soon as possible and clean up in a workmanlike manner. All excess excavation, rock, waste concrete, wire, piping, or other refuse or debris resulting from the work shall be cleaned up and disposed of. The Contractor is responsible to provide an area to dispose of his waste material. Shrubbery shall be taken up ahead of construction, stored, and reset in such a manner as to not damage the plant. Shrubbery damaged by the construction shall be replaced by the Contractor to the satisfaction of the property owner at no cost to the OWNER.

The Contractor must restore all fences, driveways, road surfaces and other public or private property disturbed during construction, to a condition as good as it was when he entered upon the work including the purchase and installation of new materials to replace all that which is injured or disturbed during the course of the work. The entire site shall be finished to a smooth surface with adequate drainage and left in a clean condition such that all yard areas may be mowed with a lawn

mower and all other areas mowed with a pasture mower. Removing and replacing any road surfaces, driveways, and other improvements will not be measured as a separate pay item but shall be considered a subsidiary part of clearing and restoring rights-of-way.

After trenches have had time to settle, areas requiring top soil shall have a 4 inch layer of topsoil spread over all disturbed areas and sod grass shall be laid over the trench areas or seeded using Bermuda seed broadcast at a rate of 3.0 lbs. per 1000 square feet during the season of May thru August. All other seasons will require seeding with rye grass or fescue applied at a rate of 50 lbs. per acre. Topsoil salvaged prior to the water line construction may be used. Following the application of the seed, 10-20-10 fertilizer shall be spread at a rate of 250 lbs. per acre. Contractor shall water and re-water the seeded area as many times as necessary to develop a thick stand of grass. Any rural area or pasture that is restored without substantial damage to the pasture and has recovered a grass cover will not have to be seeded.

**1.3.5 GUARANTEE** : The developer and/or contractor shall guarantee all materials and appurtenances furnished and work performed for a period of one (1) year from the date of substantial completion. The Developer/Contractor warrants and guarantees for a period of one (1) year from the date of substantial completion of the system that the completed system is free from all defects due to faulty materials or workmanship and the Developer/Contractor shall promptly make such corrections as may be necessary by reason of such defects, including the repairs of any damage to other parts of the system resulting from such defects or workmanship. The TPWA will give notice of observed defects with reasonable promptness. In the event the Developer/Contractor should fail to make such corrections, the TPWA may do so and charge the Developer/Contractor the costs thereby incurred.



## **SECTION 5: CAPACITY GUIDELINES**

5.1 The TPWA has established a water and sewer capacity fee system that implements equitable methods of imposing a proportionate share of the construction costs associated with the overall level of service required to provide, not only the presently needed improvements, but the improvements needed for additional and future areas to be served by the same systems.

5.2 The intent of the capacity guidelines will ensure that new development bears a proportionate share of the improvement costs from the beginning of a planned area of development, to the completion and final stages of future development. That all improvement costs incurred by the TPWA will be distributed by a four tier method to new development through A) the owner/developer, B) future developer/owners, C) the developer/builder, and C) the home/business buyer of the new development properties.

### **( A ) DEVELOPMENT FEES**

5.A.1 The initial planning of any development or extension of water and sewer lines will require the owner or developer to submit site plans for the location and planning of the utilities within the planned area of development. TPWA will utilize this information to develop a specific layout for the surrounding service area to be served. Sewer systems shall include the basin service area and water systems shall include the water distribution grid system.

5.A.2 All costs for water and sewer facilities within a specific development that are intended to serve the specific development will be the responsibility of the owner/developer of the development.

5.A.3 If the development includes a water or sewer line or lines that would be designed for **additional capacity** to serve the surrounding area, then the excess capacity cost for the additional sizing of the system shall be determined and the owner/developer will be required to execute a contract with the TPWA for a fee reimbursement as approved by the TPWA Board.

5.A.4 **INITIAL FEE REIMBURSEMENT:** (1) The maximum amount of any initial excess capacity cost to be considered by the TPWA will be 10% of the estimated **TOTAL** cost of the water and/or sewer line extensions that are constructed having **additional capacity design** to serve the

surrounding areas other than the development as determined by the development's Planning Engineer and approved by the TPWA. Stated again, this is the maximum or any percentage up to the maximum.

(2) On small water and/or sewer line projects that will serve additional surrounding areas or pass through properties that will be served by the same lines, the Initial Fee Reimbursement will be the full cost of the additional capacity. This reimbursement will be set at a maximum of \$50,000 and shall be documented by the development's Planning Engineer and approved by the TPWA after all construction is completed and all actual costs determined.

**5.A.5 CREDITED FEE REIMBURSEMENT:** Owner/Developers may be eligible for site specific credits or reimbursements for providing such improvements that are constructed for additional and future areas to be served by the same facilities. Credits for specific sites (individual lots/properties or future area developments) will be distributed as each site is completed and occupied.

5.A.6 Credits will be given on excess capacity development costs as site specific credits or developer reimbursement credits up to 30% of the **TOTAL** cost of the water and/or sewer line extensions that are constructed having **additional capacity design** to serve the surrounding areas other than the development as determined by the development's Planning Engineer and approved by the TPWA. Stated again, this is the maximum or any percentage up to the maximum. These credits will be dispersed on an annual basis at such time as determined by the TPWA General Manager when proof of each individual site completed is documented and a request by the developer is submitted for the total number of credits to be received for that year.

Credits will be given to the Owner/Developer until all of the excess capacity development costs have been reimbursed or for a period of 15 years, whichever occurs first.

5.A.7 Excess capacity costs should not exceed 40% of the total project cost. If the excess capacity costs exceed the 40% maximum reimbursement then the Board may adjust the maximum on a case by case basis for full excess capacity reimbursement.

5.A.8 Owner/Developers become eligible for these reimbursements after each development, or phase thereof, has all the facilities constructed. If the owner/developer does not meet the one year maintenance guarantee, as described in Section 4 of these guidelines, the reimbursement shall be used by TPWA to perform the required maintenance on the facilities as needed.

## **(B) FUTURE DEVELOPMENT IMPACT FEES**

5.B.1 At such time that the initial water and sewer services have been constructed and all construction costs tabulated, these costs will serve as a base line for additional reimbursement to developers or TPWA for future developments using the new water and sewer services.

5.B.2 All future developments to be served by the TPWA systems will be required to offset the initial costs to provide these services through a calculated Impact Fee that will be established by the size and scope of the future development within the designed water or sewer system. This Impact Fee is for future developers/owners to share in the base line costs of the initial water and sewer improvements that their development will be impacting and using.

5.B.3 The Impact Fee will be calculated on future development design factors that will include flow demand and capacity and what impact their development will have on the additional capacity of the initial system. The Impact Fee will be assessed and shall be paid to the TPWA prior to the first connection to the initial system.

## **(C) SERVICE TAPS & FIRE PROTECTION FEES**

5.C.1 Water and Sewer Tapping Fees shall be imposed on each connection to the TPWA system and each request for service shall be submitted to the TPWA office at least 48 hours prior to the work order being issued to the TPWA construction crews. An inspection report from the City of Tahlequah Building Inspector's Office for the structure service lines must be submitted with each request or the request will be denied and placed on Temporary Status for a period of 30 days and then dropped from the records for service.

The TPWA may allow a maximum of 25 percent of the service tapping fees for new developments to be used to offset capacity fees that are reimbursed to the developers as noted in Section 5.A.5.

5.C.2 The following fees are the current rates for service to the TPWA water and sewer facilities:

### **WATER CONNECTIONS :**

Water Meter connection and tapping services:

¾" meter & tap-----	\$ 600.00
1" meter & tap-----	\$ 850.00
1½" meter & tap-----	\$1,500.00
2" meter & tap-----	\$2,700.00

These charges are for the cost recovery and capacity fee consisting of time and material for administrative and field personnel recording and setting the meters. Field material costs include the meter box, connection plumbing, meter, and tapping the main line for service. In cases where two meters are set in the same box, the additional meter will be one-half ( $\frac{1}{2}$ ) the listed connection fee. Tap sizing will be regulated by the demand needed and pressure from the existing main to be tapped. Installation of live water taps for private contractors and rural water districts furnishing all material are \$300.00 regardless of size

#### **SEWER CONNECTIONS:**

Wastewater connection and tapping services:

4" tapping service -----	\$ 300.00
6" tapping service -----	\$ 400.00
8" or larger -----	Requires Manhole (\$900)

All sewer line connections and taps include tapping saddle and 5 feet of pipe to service line.

#### **FIRE SYSTEM CONNECTIONS:**

Fire System Connections:

2" -----	\$500.00 and \$100/year annual service
4" -----	\$625.00 and \$150/year annual service
6" -----	\$750.00 and \$200/year annual service
8" -----	\$1,000.00 and \$300/year annual service

### **(D) SEWER & WATER DISTRICT ZONE FEES**

5.D.1 To the extent that new development is served by the constructed improvements, the TPWA will seek reimbursement for the incurred public facility costs by District Zone Fees. This cost recovery approach assures that each new development is paying for its share of the useful life or remaining capacity and maintenance of the facilities until these costs are recovered or a maximum of 10 years, which ever comes first.

5.D.2 The costs associated with water or sewer district fees will be assessed by the determination of common types of development. Residential fees will be imposed per housing unit. For nonresidential development, fees will be determined by unique demand indicators, such as different types of commercial users, apartments, schools or motels.

5.D.3 The costs associated with water or sewer district fees for existing areas of development such as annexed areas and developed areas of the city with no sanitary sewer facilities shall be split between the TPWA Capital Improvements Budget for projects of this nature and the property owners of the district area to be served. The TPWA will fund the expense of labor and equipment and the property owners will pay the cost of the planning, design and materials on the area to be served by the district. The total property owner costs will be divided by the number of services capable of being served and distributed to each connection as noted in 5.D.2 as a monthly district surcharge for a period not to exceed ten (10) years. All existing property owners which connect to the district within one year of final construction will not be charged the sewer connection and tapping fee. The costs associated with the existing residence service taps are included in the district construction expense.

## **SECTION 00 3100**

### **AVAILABLE PROJECT INFORMATION**

#### **PART 1 - GENERAL**

##### **1.1 SUMMARY**

- A. This Section references other information relevant to the construction of this Project that is available project information.
- B. At the request of the Owner, the information identified below represents services that have been provided by others, not as an Architect's Consultant, regarding conditions that affect this Project that are beyond the responsibilities of the Architect and Architect's Consultants. Reference to such information herein is solely for the convenience of the Owner. Architect makes no representation, express or implied, as to the accuracy or validity of the information.
- C. Bidders are expected to examine the site and the information available from the Owner to determine for themselves the conditions to be encountered.
- D. If conditions other than those indicated in the information available from the Owner are encountered before or during construction, notify the Owner before work continues.

##### **1.2 PROPERTY SURVEY**

- A. The Owner's Surveyor has performed a property survey and the some of the survey information is included on the Drawings for the convenience of the Contractor.

##### **1.3 GEOTECHNICAL REPORT**

- A. The Owner's Geotechnical Consultant has made subsurface borings at the Project site, has performed an investigation of the geotechnical conditions, and has prepared a report of the investigation that contains specific requirements of the Contractor.
- B. Copies will be provided by the Owner.
- C. The information was obtained for use in preparing the foundation design, but is indicative only of the soil conditions where the borings are taken.

##### **1.4 MEDICAL EQUIPMENT DOCUMENTS**

- A. The Owner's Medical Equipment Planning Consultant has developed medical equipment documents for the Owner's facility and has prepared construction documents.
- B. Copies will be provided by the Owner

##### **1.5 RADIATION PROTECTION REPORT**

- A. The Owner's Radiation Protection Consultant has determined the radiation protection that is required, and has prepared a report that contains specific requirements of the Contractor.
- B. Copies will be provided by the Owner.

**PART 2 - PRODUCTS (NOT USED)**

**PART 3 - EXECUTION (NOT USED)**

**END OF SECTION**



**SECTION 00 7200**  
**GENERAL CONDITIONS**

**PART 1 - GENERAL**

**1.1 GENERAL**

- A. The General Conditions of this Contract are the American Institute of Architects Document A201, "General Conditions of the Contract for Construction", 2007 Edition as amended by the Owner, hereinafter referred to as the "General Conditions."
- B. The General Conditions shall apply to each and every Section of the Work as though written in full therein and are made a part of the Contract Documents by reference.
- C. A copy of the Document is included in this Project Manual, and shall apply to each and every Section of the Work as though written in full therein.

**PART 2 - (NOT USED)**

**PART 3 - (NOT USED)**

**END OF SECTION**





# AIA® Document A201™ – 2017

## General Conditions of the Contract for Construction

### for the following PROJECT:

*(Name and location or address)*

17-13 OSU College of Med. at Hastings Remodel  
Tahlequah, OK

### THE OWNER:

*(Name, legal status and address)*

Cherokee Nation Business  
777 West Cherokee St.  
Catoosa, OK 74015

### THE ARCHITECT:

*(Name, legal status and address)*

James R. Childers, Inc.  
45 South 4<sup>th</sup> Street  
Fort Smith, AR 72901

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### ADDITIONS AND DELETIONS:

The author of this document has added information needed for its completion. The author may also have revised the text of the original AIA standard form. An *Additions and Deletions Report* that notes added information as well as revisions to the standard form text is available from the author and should be reviewed. A vertical line in the left margin of this document indicates where the author has added necessary information and where the author has added to or deleted from the original AIA text.

This document has important legal consequences. Consultation with an attorney is encouraged with respect to its completion or modification.

For guidance in modifying this document to include supplementary conditions, see AIA Document A503™, Guide for Supplementary Conditions.

14      TERMINATION OR SUSPENSION OF THE CONTRACT

15      CLAIMS AND DISPUTES



Init.

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## ARTICLE 1 GENERAL PROVISIONS

### § 1.1 Basic Definitions

#### § 1.1.1 The Contract Documents

The Contract Documents are enumerated in the Agreement between the Owner and Contractor (hereinafter the Agreement) and consist of the Agreement, Conditions of the Contract (General, Supplementary and other Conditions), Drawings, Specifications, Addenda issued prior to execution of the Contract, other documents listed in the Agreement, and Modifications issued after execution of the Contract. A Modification is (1) a written amendment to the Contract signed by both parties, (2) a Change Order, (3) a Construction Change Directive, or (4) a written order for a minor change in the Work issued by the Architect. Unless specifically enumerated in the Agreement, the Contract Documents do not include the advertisement or invitation to bid, Instructions to Bidders, sample forms, other information furnished by the Owner in anticipation of receiving bids or proposals, the Contractor's bid or proposal, or portions of Addenda relating to bidding or proposal requirements.

#### § 1.1.2 The Contract

The Contract Documents form the Contract for Construction. The Contract represents the entire and integrated agreement between the parties hereto and supersedes prior negotiations, representations, or agreements, either written or oral. The Contract may be amended or modified only by a Modification. The Contract Documents shall not be construed to create a contractual relationship of any kind (1) between the Contractor and the Architect or the Architect's consultants, (2) between the Owner and a Subcontractor or a Sub-subcontractor, (3) between the Owner and the Architect or the Architect's consultants, or (4) between any persons or entities other than the Owner and the Contractor. The Architect shall, however, be entitled to performance and enforcement of obligations under the Contract intended to facilitate performance of the Architect's duties.

#### § 1.1.3 The Work

The term "Work" means the construction and services required by the Contract Documents, whether completed or partially completed, and includes all other labor, materials, equipment, and services provided or to be provided by the Contractor to fulfill the Contractor's obligations. The Work may constitute the whole or a part of the Project.

#### § 1.1.4 The Project

The Project is the total construction of which the Work performed under the Contract Documents may be the whole or a part and which may include construction by the Owner and by Separate Contractors.

#### § 1.1.5 The Drawings

The Drawings are the graphic and pictorial portions of the Contract Documents showing the design, location and dimensions of the Work, generally including plans, elevations, sections, details, schedules, and diagrams.

#### § 1.1.6 The Specifications

The Specifications are that portion of the Contract Documents consisting of the written requirements for materials, equipment, systems, standards and workmanship for the Work, and performance of related services.

#### § 1.1.7 Instruments of Service

Instruments of Service are representations, in any medium of expression now known or later developed, of the tangible and intangible creative work performed by the Architect and the Architect's consultants under their respective professional services agreements. Instruments of Service may include, without limitation, studies, surveys, models, sketches, drawings, specifications, and other similar materials.

#### § 1.1.8 Initial Decision Maker

The Initial Decision Maker is the person identified in the Agreement to render initial decisions on Claims in accordance with Section 15.2. The Initial Decision Maker shall not show partiality to the Owner or Contractor and shall not be liable for results of interpretations or decisions rendered in good faith.

### § 1.2 Correlation and Intent of the Contract Documents

§ 1.2.1 The intent of the Contract Documents is to include all items necessary for the proper execution and completion of the Work by the Contractor. The Contract Documents are complementary, and what is required by one shall be as binding as if required by all; performance by the Contractor shall be required only to the extent consistent with the Contract Documents and reasonably inferable from them as being necessary to produce the indicated results.



**§ 1.2.1.1** The invalidity of any provision of the Contract Documents shall not invalidate the Contract or its remaining provisions. If it is determined that any provision of the Contract Documents violates any law, or is otherwise invalid or unenforceable, then that provision shall be revised to the extent necessary to make that provision legal and enforceable. In such case the Contract Documents shall be construed, to the fullest extent permitted by law, to give effect to the parties' intentions and purposes in executing the Contract.

**§ 1.2.2** Organization of the Specifications into divisions, sections and articles, and arrangement of Drawings shall not control the Contractor in dividing the Work among Subcontractors or in establishing the extent of Work to be performed by any trade.

**§ 1.2.3** Unless otherwise stated in the Contract Documents, words that have well-known technical or construction industry meanings are used in the Contract Documents in accordance with such recognized meanings.

### **§ 1.3 Capitalization**

Terms capitalized in these General Conditions include those that are (1) specifically defined, (2) the titles of numbered articles, or (3) the titles of other documents published by the American Institute of Architects.

### **§ 1.4 Interpretation**

In the interest of brevity the Contract Documents frequently omit modifying words such as "all" and "any" and articles such as "the" and "an," but the fact that a modifier or an article is absent from one statement and appears in another is not intended to affect the interpretation of either statement.

### **§ 1.5 Ownership and Use of Drawings, Specifications, and Other Instruments of Service**

**§ 1.5.1** The Architect and the Architect's consultants shall be deemed the authors and owners of their respective Instruments of Service, including the Drawings and Specifications, and retain all common law, statutory, and other reserved rights in their Instruments of Service, including copyrights. The Contractor, Subcontractors, Sub-subcontractors, and suppliers shall not own or claim a copyright in the Instruments of Service. Submittal or distribution to meet official regulatory requirements or for other purposes in connection with the Project is not to be construed as publication in derogation of the Architect's or Architect's consultants' reserved rights.

**§ 1.5.2** The Contractor, Subcontractors, Sub-subcontractors, and suppliers are authorized to use and reproduce the Instruments of Service provided to them, subject to any protocols established pursuant to Sections 1.7 and 1.8, solely and exclusively for execution of the Work. All copies made under this authorization shall bear the copyright notice, if any, shown on the Instruments of Service. The Contractor, Subcontractors, Sub-subcontractors, and suppliers may not use the Instruments of Service on other projects or for additions to the Project outside the scope of the Work without the specific written consent of the Owner, Architect, and the Architect's consultants.

### **§ 1.6 Notice**

**§ 1.6.1** Except as otherwise provided in Section 1.6.2, where the Contract Documents require one party to notify or give notice to the other party, such notice shall be provided in writing to the designated representative of the party to whom the notice is addressed and shall be deemed to have been duly served if delivered in person, by mail, by courier, or by electronic transmission if a method for electronic transmission is set forth in the Agreement.

**§ 1.6.2** Notice of Claims as provided in Section 15.1.3 shall be provided in writing and shall be deemed to have been duly served only if delivered to the designated representative of the party to whom the notice is addressed by certified or registered mail, or by courier providing proof of delivery.

### **§ 1.7 Digital Data Use and Transmission**

The parties shall agree upon protocols governing the transmission and use of Instruments of Service or any other information or documentation in digital form. The parties will use AIA Document E203™–2013, Building Information Modeling and Digital Data Exhibit, to establish the protocols for the development, use, transmission, and exchange of digital data.

### **§ 1.8 Building Information Models Use and Reliance**

Any use of, or reliance on, all or a portion of a building information model without agreement to protocols governing the use of, and reliance on, the information contained in the model and without having those protocols set forth in AIA Document E203™–2013, Building Information Modeling and Digital Data Exhibit, and the requisite AIA Document

G202™–2013, Project Building Information Modeling Protocol Form, shall be at the using or relying party's sole risk and without liability to the other party and its contractors or consultants, the authors of, or contributors to, the building information model, and each of their agents and employees.

## **ARTICLE 2 OWNER**

### **§ 2.1 General**

**§ 2.1.1** The Owner is the person or entity identified as such in the Agreement and is referred to throughout the Contract Documents as if singular in number. The Owner shall designate in writing a representative who shall have express authority to bind the Owner with respect to all matters requiring the Owner's approval or authorization. Except as otherwise provided in Section 4.2.1, the Architect does not have such authority. The term "Owner" means the Owner or the Owner's authorized representative.

**§ 2.1.2** The Owner shall furnish to the Contractor, within fifteen days after receipt of a written request, information necessary and relevant for the Contractor to evaluate, give notice of, or enforce mechanic's lien rights. Such information shall include a correct statement of the record legal title to the property on which the Project is located, usually referred to as the site, and the Owner's interest therein.

### **§ 2.2 Evidence of the Owner's Financial Arrangements**

**§ 2.2.1** Prior to commencement of the Work and upon written request by the Contractor, the Owner shall furnish to the Contractor reasonable evidence that the Owner has made financial arrangements to fulfill the Owner's obligations under the Contract. The Contractor shall have no obligation to commence the Work until the Owner provides such evidence. If commencement of the Work is delayed under this Section 2.2.1, the Contract Time shall be extended appropriately.

**§ 2.2.2** Following commencement of the Work and upon written request by the Contractor, the Owner shall furnish to the Contractor reasonable evidence that the Owner has made financial arrangements to fulfill the Owner's obligations under the Contract only if (1) the Owner fails to make payments to the Contractor as the Contract Documents require; (2) the Contractor identifies in writing a reasonable concern regarding the Owner's ability to make payment when due; or (3) a change in the Work materially changes the Contract Sum. If the Owner fails to provide such evidence, as required, within fourteen days of the Contractor's request, the Contractor may immediately stop the Work and, in that event, shall notify the Owner that the Work has stopped. However, if the request is made because a change in the Work materially changes the Contract Sum under (3) above, the Contractor may immediately stop only that portion of the Work affected by the change until reasonable evidence is provided. If the Work is stopped under this Section 2.2.2, the Contract Time shall be extended appropriately and the Contract Sum shall be increased by the amount of the Contractor's reasonable costs of shutdown, delay and start-up, plus interest as provided in the Contract Documents.

**§ 2.2.3** After the Owner furnishes evidence of financial arrangements under this Section 2.2, the Owner shall not materially vary such financial arrangements without prior notice to the Contractor.

**§ 2.2.4** Where the Owner has designated information furnished under this Section 2.2 as "confidential," the Contractor shall keep the information confidential and shall not disclose it to any other person. However, the Contractor may disclose "confidential" information, after seven (7) days' notice to the Owner, where disclosure is required by law, including a subpoena or other form of compulsory legal process issued by a court or governmental entity, or by court or arbitrator(s) order. The Contractor may also disclose "confidential" information to its employees, consultants, sureties, Subcontractors and their employees, Sub-subcontractors, and others who need to know the content of such information solely and exclusively for the Project and who agree to maintain the confidentiality of such information.

### **§ 2.3 Information and Services Required of the Owner**

**§ 2.3.1** Except for permits and fees that are the responsibility of the Contractor under the Contract Documents, including those required under Section 3.7.1, the Owner shall secure and pay for necessary approvals, easements, assessments and charges required for construction, use or occupancy of permanent structures or for permanent changes in existing facilities.

**§ 2.3.2** The Owner shall retain an architect lawfully licensed to practice architecture, or an entity lawfully practicing architecture, in the jurisdiction where the Project is located. That person or entity is identified as the Architect in the Agreement and is referred to throughout the Contract Documents as if singular in number.

**§ 2.3.3** If the employment of the Architect terminates, the Owner shall employ a successor to whom the Contractor has no reasonable objection and whose status under the Contract Documents shall be that of the Architect.

**§ 2.3.4** The Owner shall furnish surveys describing physical characteristics, legal limitations and utility locations for the site of the Project, and a legal description of the site. The Contractor shall be entitled to rely on the accuracy of information furnished by the Owner but shall exercise proper precautions relating to the safe performance of the Work.

**§ 2.3.5** The Owner shall furnish information or services required of the Owner by the Contract Documents with reasonable promptness. The Owner shall also furnish any other information or services under the Owner's control and relevant to the Contractor's performance of the Work with reasonable promptness after receiving the Contractor's written request for such information or services.

**§ 2.3.6** Unless otherwise provided in the Contract Documents, the Owner shall furnish to the Contractor one copy of the Contract Documents for purposes of making reproductions pursuant to Section 1.5.2.

#### **§ 2.4 Owner's Right to Stop the Work**

If the Contractor fails to correct Work that is not in accordance with the requirements of the Contract Documents as required by Section 12.2 or repeatedly fails to carry out Work in accordance with the Contract Documents, the Owner may issue a written order to the Contractor to stop the Work, or any portion thereof, until the cause for such order has been eliminated; however, the right of the Owner to stop the Work shall not give rise to a duty on the part of the Owner to exercise this right for the benefit of the Contractor or any other person or entity, except to the extent required by Section 6.1.3.

#### **§ 2.5 Owner's Right to Carry Out the Work**

If the Contractor defaults or neglects to carry out the Work in accordance with the Contract Documents and fails within a ten-day period after receipt of notice from the Owner to commence and continue correction of such default or neglect with diligence and promptness, the Owner may, without prejudice to other remedies the Owner may have, correct such default or neglect. Such action by the Owner and amounts charged to the Contractor are both subject to prior approval of the Architect and the Architect may, pursuant to Section 9.5.1, withhold or nullify a Certificate for Payment in whole or in part, to the extent reasonably necessary to reimburse the Owner for the reasonable cost of correcting such deficiencies, including Owner's expenses and compensation for the Architect's additional services made necessary by such default, neglect, or failure. If current and future payments are not sufficient to cover such amounts, the Contractor shall pay the difference to the Owner. If the Contractor disagrees with the actions of the Owner or the Architect, or the amounts claimed as costs to the Owner, the Contractor may file a Claim pursuant to Article 15.

### **ARTICLE 3 CONTRACTOR**

#### **§ 3.1 General**

**§ 3.1.1** The Contractor is the person or entity identified as such in the Agreement and is referred to throughout the Contract Documents as if singular in number. The Contractor shall be lawfully licensed, if required in the jurisdiction where the Project is located. The Contractor shall designate in writing a representative who shall have express authority to bind the Contractor with respect to all matters under this Contract. The term "Contractor" means the Contractor or the Contractor's authorized representative.

**§ 3.1.2** The Contractor shall perform the Work in accordance with the Contract Documents.

**§ 3.1.3** The Contractor shall not be relieved of its obligations to perform the Work in accordance with the Contract Documents either by activities or duties of the Architect in the Architect's administration of the Contract, or by tests, inspections or approvals required or performed by persons or entities other than the Contractor.

#### **§ 3.2 Review of Contract Documents and Field Conditions by Contractor**

**§ 3.2.1** Execution of the Contract by the Contractor is a representation that the Contractor has visited the site, become generally familiar with local conditions under which the Work is to be performed, and correlated personal observations with requirements of the Contract Documents.



**§ 3.2.2** Because the Contract Documents are complementary, the Contractor shall, before starting each portion of the Work, carefully study and compare the various Contract Documents relative to that portion of the Work, as well as the information furnished by the Owner pursuant to Section 2.3.4, shall take field measurements of any existing conditions related to that portion of the Work, and shall observe any conditions at the site affecting it. These obligations are for the purpose of facilitating coordination and construction by the Contractor and are not for the purpose of discovering errors, omissions, or inconsistencies in the Contract Documents; however, the Contractor shall promptly report to the Architect any errors, inconsistencies or omissions discovered by or made known to the Contractor as a request for information in such form as the Architect may require. It is recognized that the Contractor's review is made in the Contractor's capacity as a contractor and not as a licensed design professional, unless otherwise specifically provided in the Contract Documents.

**§ 3.2.3** The Contractor is not required to ascertain that the Contract Documents are in accordance with applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of public authorities, but the Contractor shall promptly report to the Architect any nonconformity discovered by or made known to the Contractor as a request for information in such form as the Architect may require.

**§ 3.2.4** If the Contractor believes that additional cost or time is involved because of clarifications or instructions the Architect issues in response to the Contractor's notices or requests for information pursuant to Sections 3.2.2 or 3.2.3, the Contractor shall submit Claims as provided in Article 15. If the Contractor fails to perform the obligations of Sections 3.2.2 or 3.2.3, the Contractor shall pay such costs and damages to the Owner, subject to Section 15.1.7, as would have been avoided if the Contractor had performed such obligations. If the Contractor performs those obligations, the Contractor shall not be liable to the Owner or Architect for damages resulting from errors, inconsistencies or omissions in the Contract Documents, for differences between field measurements or conditions and the Contract Documents, or for nonconformities of the Contract Documents to applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities.

### **§ 3.3 Supervision and Construction Procedures**

**§ 3.3.1** The Contractor shall supervise and direct the Work, using the Contractor's best skill and attention. The Contractor shall be solely responsible for, and have control over, construction means, methods, techniques, sequences, and procedures, and for coordinating all portions of the Work under the Contract. If the Contract Documents give specific instructions concerning construction means, methods, techniques, sequences, or procedures, the Contractor shall evaluate the jobsite safety thereof and shall be solely responsible for the jobsite safety of such means, methods, techniques, sequences, or procedures. If the Contractor determines that such means, methods, techniques, sequences or procedures may not be safe, the Contractor shall give timely notice to the Owner and Architect, and shall propose alternative means, methods, techniques, sequences, or procedures. The Architect shall evaluate the proposed alternative solely for conformance with the design intent for the completed construction. Unless the Architect objects to the Contractor's proposed alternative, the Contractor shall perform the Work using its alternative means, methods, techniques, sequences, or procedures.

**§ 3.3.2** The Contractor shall be responsible to the Owner for acts and omissions of the Contractor's employees, Subcontractors and their agents and employees, and other persons or entities performing portions of the Work for, or on behalf of, the Contractor or any of its Subcontractors.

**§ 3.3.3** The Contractor shall be responsible for inspection of portions of Work already performed to determine that such portions are in proper condition to receive subsequent Work.

### **§ 3.4 Labor and Materials**

**§ 3.4.1** Unless otherwise provided in the Contract Documents, the Contractor shall provide and pay for labor, materials, equipment, tools, construction equipment and machinery, water, heat, utilities, transportation, and other facilities and services necessary for proper execution and completion of the Work, whether temporary or permanent and whether or not incorporated or to be incorporated in the Work.

**§ 3.4.2** Except in the case of minor changes in the Work approved by the Architect in accordance with Section 3.12.8 or ordered by the Architect in accordance with Section 7.4, the Contractor may make substitutions only with the consent of the Owner, after evaluation by the Architect and in accordance with a Change Order or Construction Change Directive.

**§ 3.4.3** The Contractor shall enforce strict discipline and good order among the Contractor's employees and other persons carrying out the Work. The Contractor shall not permit employment of unfit persons or persons not properly skilled in tasks assigned to them.

### **§ 3.5 Warranty**

**§ 3.5.1** The Contractor warrants to the Owner and Architect that materials and equipment furnished under the Contract will be of good quality and new unless the Contract Documents require or permit otherwise. The Contractor further warrants that the Work will conform to the requirements of the Contract Documents and will be free from defects, except for those inherent in the quality of the Work the Contract Documents require or permit. Work, materials, or equipment not conforming to these requirements may be considered defective. The Contractor's warranty excludes remedy for damage or defect caused by abuse, alterations to the Work not executed by the Contractor, improper or insufficient maintenance, improper operation, or normal wear and tear and normal usage. If required by the Architect, the Contractor shall furnish satisfactory evidence as to the kind and quality of materials and equipment.

**§ 3.5.2** All material, equipment, or other special warranties required by the Contract Documents shall be issued in the name of the Owner, or shall be transferable to the Owner, and shall commence in accordance with Section 9.8.4.

### **§ 3.6 Taxes**

The Contractor shall pay sales, consumer, use and similar taxes for the Work provided by the Contractor that are legally enacted when bids are received or negotiations concluded, whether or not yet effective or merely scheduled to go into effect.

### **§ 3.7 Permits, Fees, Notices and Compliance with Laws**

**§ 3.7.1** Unless otherwise provided in the Contract Documents, the Contractor shall secure and pay for the building permit as well as for other permits, fees, licenses, and inspections by government agencies necessary for proper execution and completion of the Work that are customarily secured after execution of the Contract and legally required at the time bids are received or negotiations concluded.

**§ 3.7.2** The Contractor shall comply with and give notices required by applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities applicable to performance of the Work.

**§ 3.7.3** If the Contractor performs Work knowing it to be contrary to applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of public authorities, the Contractor shall assume appropriate responsibility for such Work and shall bear the costs attributable to correction.

### **§ 3.7.4 Concealed or Unknown Conditions**

If the Contractor encounters conditions at the site that are (1) subsurface or otherwise concealed physical conditions that differ materially from those indicated in the Contract Documents or (2) unknown physical conditions of an unusual nature that differ materially from those ordinarily found to exist and generally recognized as inherent in construction activities of the character provided for in the Contract Documents, the Contractor shall promptly provide notice to the Owner and the Architect before conditions are disturbed and in no event later than 14 days after first observance of the conditions. The Architect will promptly investigate such conditions and, if the Architect determines that they differ materially and cause an increase or decrease in the Contractor's cost of, or time required for, performance of any part of the Work, will recommend that an equitable adjustment be made in the Contract Sum or Contract Time, or both. If the Architect determines that the conditions at the site are not materially different from those indicated in the Contract Documents and that no change in the terms of the Contract is justified, the Architect shall promptly notify the Owner and Contractor, stating the reasons. If either party disputes the Architect's determination or recommendation, that party may submit a Claim as provided in Article 15.

**§ 3.7.5** If, in the course of the Work, the Contractor encounters human remains or recognizes the existence of burial markers, archaeological sites or wetlands not indicated in the Contract Documents, the Contractor shall immediately suspend any operations that would affect them and shall notify the Owner and Architect. Upon receipt of such notice, the Owner shall promptly take any action necessary to obtain governmental authorization required to resume the operations. The Contractor shall continue to suspend such operations until otherwise instructed by the Owner but shall continue with all other operations that do not affect those remains or features. Requests for adjustments in the Contract Sum and Contract Time arising from the existence of such remains or features may be made as provided in Article 15.

### § 3.8 Allowances

§ 3.8.1 The Contractor shall include in the Contract Sum all allowances stated in the Contract Documents. Items covered by allowances shall be supplied for such amounts and by such persons or entities as the Owner may direct, but the Contractor shall not be required to employ persons or entities to whom the Contractor has reasonable objection.

§ 3.8.2 Unless otherwise provided in the Contract Documents,

- .1 allowances shall cover the cost to the Contractor of materials and equipment delivered at the site and all required taxes, less applicable trade discounts;
- .2 Contractor's costs for unloading and handling at the site, labor, installation costs, overhead, profit, and other expenses contemplated for stated allowance amounts shall be included in the Contract Sum but not in the allowances; and
- .3 whenever costs are more than or less than allowances, the Contract Sum shall be adjusted accordingly by Change Order. The amount of the Change Order shall reflect (1) the difference between actual costs and the allowances under Section 3.8.2.1 and (2) changes in Contractor's costs under Section 3.8.2.2.

§ 3.8.3 Materials and equipment under an allowance shall be selected by the Owner with reasonable promptness.

### § 3.9 Superintendent

§ 3.9.1 The Contractor shall employ a competent superintendent and necessary assistants who shall be in attendance at the Project site during performance of the Work. The superintendent shall represent the Contractor, and communications given to the superintendent shall be as binding as if given to the Contractor.

§ 3.9.2 The Contractor, as soon as practicable after award of the Contract, shall notify the Owner and Architect of the name and qualifications of a proposed superintendent. Within 14 days of receipt of the information, the Architect may notify the Contractor, stating whether the Owner or the Architect (1) has reasonable objection to the proposed superintendent or (2) requires additional time for review. Failure of the Architect to provide notice within the 14-day period shall constitute notice of no reasonable objection.

§ 3.9.3 The Contractor shall not employ a proposed superintendent to whom the Owner or Architect has made reasonable and timely objection. The Contractor shall not change the superintendent without the Owner's consent, which shall not unreasonably be withheld or delayed.

### § 3.10 Contractor's Construction and Submittal Schedules

§ 3.10.1 The Contractor, promptly after being awarded the Contract, shall submit for the Owner's and Architect's information a Contractor's construction schedule for the Work. The schedule shall contain detail appropriate for the Project, including (1) the date of commencement of the Work, interim schedule milestone dates, and the date of Substantial Completion; (2) an apportionment of the Work by construction activity; and (3) the time required for completion of each portion of the Work. The schedule shall provide for the orderly progression of the Work to completion and shall not exceed time limits current under the Contract Documents. The schedule shall be revised at appropriate intervals as required by the conditions of the Work and Project.

§ 3.10.2 The Contractor, promptly after being awarded the Contract and thereafter as necessary to maintain a current submittal schedule, shall submit a submittal schedule for the Architect's approval. The Architect's approval shall not be unreasonably delayed or withheld. The submittal schedule shall (1) be coordinated with the Contractor's construction schedule, and (2) allow the Architect reasonable time to review submittals. If the Contractor fails to submit a submittal schedule, or fails to provide submittals in accordance with the approved submittal schedule, the Contractor shall not be entitled to any increase in Contract Sum or extension of Contract Time based on the time required for review of submittals.

§ 3.10.3 The Contractor shall perform the Work in general accordance with the most recent schedules submitted to the Owner and Architect.

### § 3.11 Documents and Samples at the Site

The Contractor shall make available, at the Project site, the Contract Documents, including Change Orders, Construction Change Directives, and other Modifications, in good order and marked currently to indicate field changes and selections made during construction, and the approved Shop Drawings, Product Data, Samples, and similar required submittals. These shall be in electronic form or paper copy, available to the Architect and Owner, and

delivered to the Architect for submittal to the Owner upon completion of the Work as a record of the Work as constructed.

### **§ 3.12 Shop Drawings, Product Data and Samples**

**§ 3.12.1** Shop Drawings are drawings, diagrams, schedules, and other data specially prepared for the Work by the Contractor or a Subcontractor, Sub-subcontractor, manufacturer, supplier, or distributor to illustrate some portion of the Work.

**§ 3.12.2** Product Data are illustrations, standard schedules, performance charts, instructions, brochures, diagrams, and other information furnished by the Contractor to illustrate materials or equipment for some portion of the Work.

**§ 3.12.3** Samples are physical examples that illustrate materials, equipment, or workmanship, and establish standards by which the Work will be judged.

**§ 3.12.4** Shop Drawings, Product Data, Samples, and similar submittals are not Contract Documents. Their purpose is to demonstrate how the Contractor proposes to conform to the information given and the design concept expressed in the Contract Documents for those portions of the Work for which the Contract Documents require submittals. Review by the Architect is subject to the limitations of Section 4.2.7. Informational submittals upon which the Architect is not expected to take responsive action may be so identified in the Contract Documents. Submittals that are not required by the Contract Documents may be returned by the Architect without action.

**§ 3.12.5** The Contractor shall review for compliance with the Contract Documents, approve, and submit to the Architect, Shop Drawings, Product Data, Samples, and similar submittals required by the Contract Documents, in accordance with the submittal schedule approved by the Architect or, in the absence of an approved submittal schedule, with reasonable promptness and in such sequence as to cause no delay in the Work or in the activities of the Owner or of Separate Contractors.

**§ 3.12.6** By submitting Shop Drawings, Product Data, Samples, and similar submittals, the Contractor represents to the Owner and Architect that the Contractor has (1) reviewed and approved them, (2) determined and verified materials, field measurements and field construction criteria related thereto, or will do so, and (3) checked and coordinated the information contained within such submittals with the requirements of the Work and of the Contract Documents.

**§ 3.12.7** The Contractor shall perform no portion of the Work for which the Contract Documents require submittal and review of Shop Drawings, Product Data, Samples, or similar submittals, until the respective submittal has been approved by the Architect.

**§ 3.12.8** The Work shall be in accordance with approved submittals except that the Contractor shall not be relieved of responsibility for deviations from the requirements of the Contract Documents by the Architect's approval of Shop Drawings, Product Data, Samples, or similar submittals, unless the Contractor has specifically notified the Architect of such deviation at the time of submittal and (1) the Architect has given written approval to the specific deviation as a minor change in the Work, or (2) a Change Order or Construction Change Directive has been issued authorizing the deviation. The Contractor shall not be relieved of responsibility for errors or omissions in Shop Drawings, Product Data, Samples, or similar submittals, by the Architect's approval thereof.

**§ 3.12.9** The Contractor shall direct specific attention, in writing or on resubmitted Shop Drawings, Product Data, Samples, or similar submittals, to revisions other than those requested by the Architect on previous submittals. In the absence of such notice, the Architect's approval of a resubmission shall not apply to such revisions.

**§ 3.12.10** The Contractor shall not be required to provide professional services that constitute the practice of architecture or engineering unless such services are specifically required by the Contract Documents for a portion of the Work or unless the Contractor needs to provide such services in order to carry out the Contractor's responsibilities for construction means, methods, techniques, sequences, and procedures. The Contractor shall not be required to provide professional services in violation of applicable law.

**§ 3.12.10.1** If professional design services or certifications by a design professional related to systems, materials, or equipment are specifically required of the Contractor by the Contract Documents, the Owner and the Architect will specify all performance and design criteria that such services must satisfy. The Contractor shall be entitled to rely



upon the adequacy and accuracy of the performance and design criteria provided in the Contract Documents. The Contractor shall cause such services or certifications to be provided by an appropriately licensed design professional, whose signature and seal shall appear on all drawings, calculations, specifications, certifications, Shop Drawings, and other submittals prepared by such professional. Shop Drawings, and other submittals related to the Work, designed or certified by such professional, if prepared by others, shall bear such professional's written approval when submitted to the Architect. The Owner and the Architect shall be entitled to rely upon the adequacy and accuracy of the services, certifications, and approvals performed or provided by such design professionals, provided the Owner and Architect have specified to the Contractor the performance and design criteria that such services must satisfy. Pursuant to this Section 3.12.10, the Architect will review and approve or take other appropriate action on submittals only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents.

**§ 3.12.10.2** If the Contract Documents require the Contractor's design professional to certify that the Work has been performed in accordance with the design criteria, the Contractor shall furnish such certifications to the Architect at the time and in the form specified by the Architect.

### **§ 3.13 Use of Site**

The Contractor shall confine operations at the site to areas permitted by applicable laws, statutes, ordinances, codes, rules and regulations, lawful orders of public authorities, and the Contract Documents and shall not unreasonably encumber the site with materials or equipment.

### **§ 3.14 Cutting and Patching**

**§ 3.14.1** The Contractor shall be responsible for cutting, fitting, or patching required to complete the Work or to make its parts fit together properly. All areas requiring cutting, fitting, or patching shall be restored to the condition existing prior to the cutting, fitting, or patching, unless otherwise required by the Contract Documents.

**§ 3.14.2** The Contractor shall not damage or endanger a portion of the Work or fully or partially completed construction of the Owner or Separate Contractors by cutting, patching, or otherwise altering such construction, or by excavation. The Contractor shall not cut or otherwise alter construction by the Owner or a Separate Contractor except with written consent of the Owner and of the Separate Contractor. Consent shall not be unreasonably withheld. The Contractor shall not unreasonably withhold, from the Owner or a Separate Contractor, its consent to cutting or otherwise altering the Work.

### **§ 3.15 Cleaning Up**

**§ 3.15.1** The Contractor shall keep the premises and surrounding area free from accumulation of waste materials and rubbish caused by operations under the Contract. At completion of the Work, the Contractor shall remove waste materials, rubbish, the Contractor's tools, construction equipment, machinery, and surplus materials from and about the Project.

**§ 3.15.2** If the Contractor fails to clean up as provided in the Contract Documents, the Owner may do so and the Owner shall be entitled to reimbursement from the Contractor.

### **§ 3.16 Access to Work**

The Contractor shall provide the Owner and Architect with access to the Work in preparation and progress wherever located.

### **§ 3.17 Royalties, Patents and Copyrights**

The Contractor shall pay all royalties and license fees. The Contractor shall defend suits or claims for infringement of copyrights and patent rights and shall hold the Owner and Architect harmless from loss on account thereof, but shall not be responsible for defense or loss when a particular design, process, or product of a particular manufacturer or manufacturers is required by the Contract Documents, or where the copyright violations are contained in Drawings, Specifications, or other documents prepared by the Owner or Architect. However, if an infringement of a copyright or patent is discovered by, or made known to, the Contractor, the Contractor shall be responsible for the loss unless the information is promptly furnished to the Architect.

### § 3.18 Indemnification

§ 3.18.1 To the fullest extent permitted by law, the Contractor shall indemnify and hold harmless the Owner, Architect, Architect's consultants, and agents and employees of any of them from and against claims, damages, losses, and expenses, including but not limited to attorneys' fees, arising out of or resulting from performance of the Work, provided that such claim, damage, loss, or expense is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the Work itself), but only to the extent caused by the negligent acts or omissions of the Contractor, a Subcontractor, anyone directly or indirectly employed by them, or anyone for whose acts they may be liable, regardless of whether or not such claim, damage, loss, or expense is caused in part by a party indemnified hereunder. Such obligation shall not be construed to negate, abridge, or reduce other rights or obligations of indemnity that would otherwise exist as to a party or person described in this Section 3.18.

§ 3.18.2 In claims against any person or entity indemnified under this Section 3.18 by an employee of the Contractor, a Subcontractor, anyone directly or indirectly employed by them, or anyone for whose acts they may be liable, the indemnification obligation under Section 3.18.1 shall not be limited by a limitation on amount or type of damages, compensation, or benefits payable by or for the Contractor or a Subcontractor under workers' compensation acts, disability benefit acts, or other employee benefit acts.

## ARTICLE 4 ARCHITECT

### § 4.1 General

§ 4.1.1 The Architect is the person or entity retained by the Owner pursuant to Section 2.3.2 and identified as such in the Agreement.

§ 4.1.2 Duties, responsibilities, and limitations of authority of the Architect as set forth in the Contract Documents shall not be restricted, modified, or extended without written consent of the Owner, Contractor, and Architect. Consent shall not be unreasonably withheld.

### § 4.2 Administration of the Contract

§ 4.2.1 The Architect will provide administration of the Contract as described in the Contract Documents and will be an Owner's representative during construction until the date the Architect issues the final Certificate for Payment. The Architect will have authority to act on behalf of the Owner only to the extent provided in the Contract Documents.

§ 4.2.2 The Architect will visit the site at intervals appropriate to the stage of construction, or as otherwise agreed with the Owner, to become generally familiar with the progress and quality of the portion of the Work completed, and to determine in general if the Work observed is being performed in a manner indicating that the Work, when fully completed, will be in accordance with the Contract Documents. However, the Architect will not be required to make exhaustive or continuous on-site inspections to check the quality or quantity of the Work. The Architect will not have control over, charge of, or responsibility for the construction means, methods, techniques, sequences or procedures, or for the safety precautions and programs in connection with the Work, since these are solely the Contractor's rights and responsibilities under the Contract Documents.

§ 4.2.3 On the basis of the site visits, the Architect will keep the Owner reasonably informed about the progress and quality of the portion of the Work completed, and promptly report to the Owner (1) known deviations from the Contract Documents, (2) known deviations from the most recent construction schedule submitted by the Contractor, and (3) defects and deficiencies observed in the Work. The Architect will not be responsible for the Contractor's failure to perform the Work in accordance with the requirements of the Contract Documents. The Architect will not have control over or charge of, and will not be responsible for acts or omissions of, the Contractor, Subcontractors, or their agents or employees, or any other persons or entities performing portions of the Work.

### § 4.2.4 Communications

The Owner and Contractor shall include the Architect in all communications that relate to or affect the Architect's services or professional responsibilities. The Owner shall promptly notify the Architect of the substance of any direct communications between the Owner and the Contractor otherwise relating to the Project. Communications by and with the Architect's consultants shall be through the Architect. Communications by and with Subcontractors and suppliers shall be through the Contractor. Communications by and with Separate Contractors shall be through the Owner. The Contract Documents may specify other communication protocols.

§ 4.2.5 Based on the Architect's evaluations of the Contractor's Applications for Payment, the Architect will review and certify the amounts due the Contractor and will issue Certificates for Payment in such amounts.

§ 4.2.6 The Architect has authority to reject Work that does not conform to the Contract Documents. Whenever the Architect considers it necessary or advisable, the Architect will have authority to require inspection or testing of the Work in accordance with Sections 13.4.2 and 13.4.3, whether or not the Work is fabricated, installed or completed. However, neither this authority of the Architect nor a decision made in good faith either to exercise or not to exercise such authority shall give rise to a duty or responsibility of the Architect to the Contractor, Subcontractors, suppliers, their agents or employees, or other persons or entities performing portions of the Work.

§ 4.2.7 The Architect will review and approve, or take other appropriate action upon, the Contractor's submittals such as Shop Drawings, Product Data, and Samples, but only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents. The Architect's action will be taken in accordance with the submittal schedule approved by the Architect or, in the absence of an approved submittal schedule, with reasonable promptness while allowing sufficient time in the Architect's professional judgment to permit adequate review. Review of such submittals is not conducted for the purpose of determining the accuracy and completeness of other details such as dimensions and quantities, or for substantiating instructions for installation or performance of equipment or systems, all of which remain the responsibility of the Contractor as required by the Contract Documents. The Architect's review of the Contractor's submittals shall not relieve the Contractor of the obligations under Sections 3.3, 3.5, and 3.12. The Architect's review shall not constitute approval of safety precautions or of any construction means, methods, techniques, sequences, or procedures. The Architect's approval of a specific item shall not indicate approval of an assembly of which the item is a component.

§ 4.2.8 The Architect will prepare Change Orders and Construction Change Directives, and may order minor changes in the Work as provided in Section 7.4. The Architect will investigate and make determinations and recommendations regarding concealed and unknown conditions as provided in Section 3.7.4.

§ 4.2.9 The Architect will conduct inspections to determine the date or dates of Substantial Completion and the date of final completion; issue Certificates of Substantial Completion pursuant to Section 9.8; receive and forward to the Owner, for the Owner's review and records, written warranties and related documents required by the Contract and assembled by the Contractor pursuant to Section 9.10; and issue a final Certificate for Payment pursuant to Section 9.10.

§ 4.2.10 If the Owner and Architect agree, the Architect will provide one or more Project representatives to assist in carrying out the Architect's responsibilities at the site. The Owner shall notify the Contractor of any change in the duties, responsibilities and limitations of authority of the Project representatives.

§ 4.2.11 The Architect will interpret and decide matters concerning performance under, and requirements of, the Contract Documents on written request of either the Owner or Contractor. The Architect's response to such requests will be made in writing within any time limits agreed upon or otherwise with reasonable promptness.

§ 4.2.12 Interpretations and decisions of the Architect will be consistent with the intent of, and reasonably inferable from, the Contract Documents and will be in writing or in the form of drawings. When making such interpretations and decisions, the Architect will endeavor to secure faithful performance by both Owner and Contractor, will not show partiality to either, and will not be liable for results of interpretations or decisions rendered in good faith.

§ 4.2.13 The Architect's decisions on matters relating to aesthetic effect will be final if consistent with the intent expressed in the Contract Documents.

§ 4.2.14 The Architect will review and respond to requests for information about the Contract Documents. The Architect's response to such requests will be made in writing within any time limits agreed upon or otherwise with reasonable promptness. If appropriate, the Architect will prepare and issue supplemental Drawings and Specifications in response to the requests for information.

## ARTICLE 5 SUBCONTRACTORS

### § 5.1 Definitions

§ 5.1.1 A Subcontractor is a person or entity who has a direct contract with the Contractor to perform a portion of the Work at the site. The term "Subcontractor" is referred to throughout the Contract Documents as if singular in number and means a Subcontractor or an authorized representative of the Subcontractor. The term "Subcontractor" does not include a Separate Contractor or the subcontractors of a Separate Contractor.

§ 5.1.2 A Sub-subcontractor is a person or entity who has a direct or indirect contract with a Subcontractor to perform a portion of the Work at the site. The term "Sub-subcontractor" is referred to throughout the Contract Documents as if singular in number and means a Sub-subcontractor or an authorized representative of the Sub-subcontractor.

### § 5.2 Award of Subcontracts and Other Contracts for Portions of the Work

§ 5.2.1 Unless otherwise stated in the Contract Documents, the Contractor, as soon as practicable after award of the Contract, shall notify the Owner and Architect of the persons or entities proposed for each principal portion of the Work, including those who are to furnish materials or equipment fabricated to a special design. Within 14 days of receipt of the information, the Architect may notify the Contractor whether the Owner or the Architect (1) has reasonable objection to any such proposed person or entity or (2) requires additional time for review. Failure of the Architect to provide notice within the 14-day period shall constitute notice of no reasonable objection.

§ 5.2.2 The Contractor shall not contract with a proposed person or entity to whom the Owner or Architect has made reasonable and timely objection. The Contractor shall not be required to contract with anyone to whom the Contractor has made reasonable objection.

§ 5.2.3 If the Owner or Architect has reasonable objection to a person or entity proposed by the Contractor, the Contractor shall propose another to whom the Owner or Architect has no reasonable objection. If the proposed but rejected Subcontractor was reasonably capable of performing the Work, the Contract Sum and Contract Time shall be increased or decreased by the difference, if any, occasioned by such change, and an appropriate Change Order shall be issued before commencement of the substitute Subcontractor's Work. However, no increase in the Contract Sum or Contract Time shall be allowed for such change unless the Contractor has acted promptly and responsively in submitting names as required.

§ 5.2.4 The Contractor shall not substitute a Subcontractor, person, or entity for one previously selected if the Owner or Architect makes reasonable objection to such substitution.

### § 5.3 Subcontractual Relations

By appropriate written agreement, the Contractor shall require each Subcontractor, to the extent of the Work to be performed by the Subcontractor, to be bound to the Contractor by terms of the Contract Documents, and to assume toward the Contractor all the obligations and responsibilities, including the responsibility for safety of the Subcontractor's Work that the Contractor, by these Contract Documents, assumes toward the Owner and Architect. Each subcontract agreement shall preserve and protect the rights of the Owner and Architect under the Contract Documents with respect to the Work to be performed by the Subcontractor so that subcontracting thereof will not prejudice such rights, and shall allow to the Subcontractor, unless specifically provided otherwise in the subcontract agreement, the benefit of all rights, remedies, and redress against the Contractor that the Contractor, by the Contract Documents, has against the Owner. Where appropriate, the Contractor shall require each Subcontractor to enter into similar agreements with Sub-subcontractors. The Contractor shall make available to each proposed Subcontractor, prior to the execution of the subcontract agreement, copies of the Contract Documents to which the Subcontractor will be bound, and, upon written request of the Subcontractor, identify to the Subcontractor terms and conditions of the proposed subcontract agreement that may be at variance with the Contract Documents. Subcontractors will similarly make copies of applicable portions of such documents available to their respective proposed Sub-subcontractors.

### § 5.4 Contingent Assignment of Subcontracts

§ 5.4.1 Each subcontract agreement for a portion of the Work is assigned by the Contractor to the Owner, provided that

- .1 assignment is effective only after termination of the Contract by the Owner for cause pursuant to Section 14.2 and only for those subcontract agreements that the Owner accepts by notifying the Subcontractor and Contractor; and
- .2 assignment is subject to the prior rights of the surety, if any, obligated under bond relating to the Contract.



When the Owner accepts the assignment of a subcontract agreement, the Owner assumes the Contractor's rights and obligations under the subcontract.

**§ 5.4.2** Upon such assignment, if the Work has been suspended for more than 30 days, the Subcontractor's compensation shall be equitably adjusted for increases in cost resulting from the suspension.

**§ 5.4.3** Upon assignment to the Owner under this Section 5.4, the Owner may further assign the subcontract to a successor contractor or other entity. If the Owner assigns the subcontract to a successor contractor or other entity, the Owner shall nevertheless remain legally responsible for all of the successor contractor's obligations under the subcontract.

## **ARTICLE 6 CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS**

### **§ 6.1 Owner's Right to Perform Construction and to Award Separate Contracts**

**§ 6.1.1** The term "Separate Contractor(s)" shall mean other contractors retained by the Owner under separate agreements. The Owner reserves the right to perform construction or operations related to the Project with the Owner's own forces, and with Separate Contractors retained under Conditions of the Contract substantially similar to those of this Contract, including those provisions of the Conditions of the Contract related to insurance and waiver of subrogation.

**§ 6.1.2** When separate contracts are awarded for different portions of the Project or other construction or operations on the site, the term "Contractor" in the Contract Documents in each case shall mean the Contractor who executes each separate Owner-Contractor Agreement.

**§ 6.1.3** The Owner shall provide for coordination of the activities of the Owner's own forces and of each Separate Contractor with the Work of the Contractor, who shall cooperate with them. The Contractor shall participate with any Separate Contractors and the Owner in reviewing their construction schedules. The Contractor shall make any revisions to its construction schedule deemed necessary after a joint review and mutual agreement. The construction schedules shall then constitute the schedules to be used by the Contractor, Separate Contractors, and the Owner until subsequently revised.

**§ 6.1.4** Unless otherwise provided in the Contract Documents, when the Owner performs construction or operations related to the Project with the Owner's own forces or with Separate Contractors, the Owner or its Separate Contractors shall have the same obligations and rights that the Contractor has under the Conditions of the Contract, including, without excluding others, those stated in Article 3, this Article 6, and Articles 10, 11, and 12.

### **§ 6.2 Mutual Responsibility**

**§ 6.2.1** The Contractor shall afford the Owner and Separate Contractors reasonable opportunity for introduction and storage of their materials and equipment and performance of their activities, and shall connect and coordinate the Contractor's construction and operations with theirs as required by the Contract Documents.

**§ 6.2.2** If part of the Contractor's Work depends for proper execution or results upon construction or operations by the Owner or a Separate Contractor, the Contractor shall, prior to proceeding with that portion of the Work, promptly notify the Architect of apparent discrepancies or defects in the construction or operations by the Owner or Separate Contractor that would render it unsuitable for proper execution and results of the Contractor's Work. Failure of the Contractor to notify the Architect of apparent discrepancies or defects prior to proceeding with the Work shall constitute an acknowledgment that the Owner's or Separate Contractor's completed or partially completed construction is fit and proper to receive the Contractor's Work. The Contractor shall not be responsible for discrepancies or defects in the construction or operations by the Owner or Separate Contractor that are not apparent.

**§ 6.2.3** The Contractor shall reimburse the Owner for costs the Owner incurs that are payable to a Separate Contractor because of the Contractor's delays, improperly timed activities or defective construction. The Owner shall be responsible to the Contractor for costs the Contractor incurs because of a Separate Contractor's delays, improperly timed activities, damage to the Work or defective construction.

**§ 6.2.4** The Contractor shall promptly remedy damage that the Contractor wrongfully causes to completed or partially completed construction or to property of the Owner or Separate Contractor as provided in Section 10.2.5.

**§ 6.2.5** The Owner and each Separate Contractor shall have the same responsibilities for cutting and patching as are described for the Contractor in Section 3.14.

### **§ 6.3 Owner's Right to Clean Up**

If a dispute arises among the Contractor, Separate Contractors, and the Owner as to the responsibility under their respective contracts for maintaining the premises and surrounding area free from waste materials and rubbish, the Owner may clean up and the Architect will allocate the cost among those responsible.

## **ARTICLE 7 CHANGES IN THE WORK**

### **§ 7.1 General**

**§ 7.1.1** Changes in the Work may be accomplished after execution of the Contract, and without invalidating the Contract, by Change Order, Construction Change Directive or order for a minor change in the Work, subject to the limitations stated in this Article 7 and elsewhere in the Contract Documents.

**§ 7.1.2** A Change Order shall be based upon agreement among the Owner, Contractor, and Architect. A Construction Change Directive requires agreement by the Owner and Architect and may or may not be agreed to by the Contractor. An order for a minor change in the Work may be issued by the Architect alone.

**§ 7.1.3** Changes in the Work shall be performed under applicable provisions of the Contract Documents. The Contractor shall proceed promptly with changes in the Work, unless otherwise provided in the Change Order, Construction Change Directive, or order for a minor change in the Work.

### **§ 7.2 Change Orders**

**§ 7.2.1** A Change Order is a written instrument prepared by the Architect and signed by the Owner, Contractor, and Architect stating their agreement upon all of the following:

- .1 The change in the Work;
- .2 The amount of the adjustment, if any, in the Contract Sum; and
- .3 The extent of the adjustment, if any, in the Contract Time.

### **§ 7.3 Construction Change Directives**

**§ 7.3.1** A Construction Change Directive is a written order prepared by the Architect and signed by the Owner and Architect, directing a change in the Work prior to agreement on adjustment, if any, in the Contract Sum or Contract Time, or both. The Owner may by Construction Change Directive, without invalidating the Contract, order changes in the Work within the general scope of the Contract consisting of additions, deletions, or other revisions, the Contract Sum and Contract Time being adjusted accordingly.

**§ 7.3.2** A Construction Change Directive shall be used in the absence of total agreement on the terms of a Change Order.

**§ 7.3.3** If the Construction Change Directive provides for an adjustment to the Contract Sum, the adjustment shall be based on one of the following methods:

- .1 Mutual acceptance of a lump sum properly itemized and supported by sufficient substantiating data to permit evaluation;
- .2 Unit prices stated in the Contract Documents or subsequently agreed upon;
- .3 Cost to be determined in a manner agreed upon by the parties and a mutually acceptable fixed or percentage fee; or
- .4 As provided in Section 7.3.4.

**§ 7.3.4** If the Contractor does not respond promptly or disagrees with the method for adjustment in the Contract Sum, the Architect shall determine the adjustment on the basis of reasonable expenditures and savings of those performing the Work attributable to the change, including, in case of an increase in the Contract Sum, an amount for overhead and profit as set forth in the Agreement, or if no such amount is set forth in the Agreement, a reasonable amount. In such case, and also under Section 7.3.3.3, the Contractor shall keep and present, in such form as the Architect may prescribe, an itemized accounting together with appropriate supporting data. Unless otherwise provided in the Contract Documents, costs for the purposes of this Section 7.3.4 shall be limited to the following:

- .1 Costs of labor, including applicable payroll taxes, fringe benefits required by agreement or custom, workers' compensation insurance, and other employee costs approved by the Architect;
- .2 Costs of materials, supplies, and equipment, including cost of transportation, whether incorporated or consumed;
- .3 Rental costs of machinery and equipment, exclusive of hand tools, whether rented from the Contractor or others;
- .4 Costs of premiums for all bonds and insurance, permit fees, and sales, use, or similar taxes, directly related to the change; and
- .5 Costs of supervision and field office personnel directly attributable to the change.

§ 7.3.5 If the Contractor disagrees with the adjustment in the Contract Time, the Contractor may make a Claim in accordance with applicable provisions of Article 15.

§ 7.3.6 Upon receipt of a Construction Change Directive, the Contractor shall promptly proceed with the change in the Work involved and advise the Architect of the Contractor's agreement or disagreement with the method, if any, provided in the Construction Change Directive for determining the proposed adjustment in the Contract Sum or Contract Time.

§ 7.3.7 A Construction Change Directive signed by the Contractor indicates the Contractor's agreement therewith, including adjustment in Contract Sum and Contract Time or the method for determining them. Such agreement shall be effective immediately and shall be recorded as a Change Order.

§ 7.3.8 The amount of credit to be allowed by the Contractor to the Owner for a deletion or change that results in a net decrease in the Contract Sum shall be actual net cost as confirmed by the Architect. When both additions and credits covering related Work or substitutions are involved in a change, the allowance for overhead and profit shall be figured on the basis of net increase, if any, with respect to that change.

§ 7.3.9 Pending final determination of the total cost of a Construction Change Directive to the Owner, the Contractor may request payment for Work completed under the Construction Change Directive in Applications for Payment. The Architect will make an interim determination for purposes of monthly certification for payment for those costs and certify for payment the amount that the Architect determines, in the Architect's professional judgment, to be reasonably justified. The Architect's interim determination of cost shall adjust the Contract Sum on the same basis as a Change Order, subject to the right of either party to disagree and assert a Claim in accordance with Article 15.

§ 7.3.10 When the Owner and Contractor agree with a determination made by the Architect concerning the adjustments in the Contract Sum and Contract Time, or otherwise reach agreement upon the adjustments, such agreement shall be effective immediately and the Architect will prepare a Change Order. Change Orders may be issued for all or any part of a Construction Change Directive.

#### § 7.4 Minor Changes in the Work

The Architect may order minor changes in the Work that are consistent with the intent of the Contract Documents and do not involve an adjustment in the Contract Sum or an extension of the Contract Time. The Architect's order for minor changes shall be in writing. If the Contractor believes that the proposed minor change in the Work will affect the Contract Sum or Contract Time, the Contractor shall notify the Architect and shall not proceed to implement the change in the Work. If the Contractor performs the Work set forth in the Architect's order for a minor change without prior notice to the Architect that such change will affect the Contract Sum or Contract Time, the Contractor waives any adjustment to the Contract Sum or extension of the Contract Time.

### ARTICLE 8 TIME

#### § 8.1 Definitions

§ 8.1.1 Unless otherwise provided, Contract Time is the period of time, including authorized adjustments, allotted in the Contract Documents for Substantial Completion of the Work.

§ 8.1.2 The date of commencement of the Work is the date established in the Agreement.

§ 8.1.3 The date of Substantial Completion is the date certified by the Architect in accordance with Section 9.8.

§ 8.1.4 The term "day" as used in the Contract Documents shall mean calendar day unless otherwise specifically defined.

## § 8.2 Progress and Completion

§ 8.2.1 Time limits stated in the Contract Documents are of the essence of the Contract. By executing the Agreement, the Contractor confirms that the Contract Time is a reasonable period for performing the Work.

§ 8.2.2 The Contractor shall not knowingly, except by agreement or instruction of the Owner in writing, commence the Work prior to the effective date of insurance required to be furnished by the Contractor and Owner.

§ 8.2.3 The Contractor shall proceed expeditiously with adequate forces and shall achieve Substantial Completion within the Contract Time.

## § 8.3 Delays and Extensions of Time

§ 8.3.1 If the Contractor is delayed at any time in the commencement or progress of the Work by (1) an act or neglect of the Owner or Architect, of an employee of either, or of a Separate Contractor; (2) by changes ordered in the Work; (3) by labor disputes, fire, unusual delay in deliveries, unavoidable casualties, adverse weather conditions documented in accordance with Section 15.1.6.2, or other causes beyond the Contractor's control; (4) by delay authorized by the Owner pending mediation and binding dispute resolution; or (5) by other causes that the Contractor asserts, and the Architect determines, justify delay, then the Contract Time shall be extended for such reasonable time as the Architect may determine.

§ 8.3.2 Claims relating to time shall be made in accordance with applicable provisions of Article 15.

§ 8.3.3 This Section 8.3 does not preclude recovery of damages for delay by either party under other provisions of the Contract Documents.

## ARTICLE 9 PAYMENTS AND COMPLETION

### § 9.1 Contract Sum

§ 9.1.1 The Contract Sum is stated in the Agreement and, including authorized adjustments, is the total amount payable by the Owner to the Contractor for performance of the Work under the Contract Documents.

§ 9.1.2 If unit prices are stated in the Contract Documents or subsequently agreed upon, and if quantities originally contemplated are materially changed so that application of such unit prices to the actual quantities causes substantial inequity to the Owner or Contractor, the applicable unit prices shall be equitably adjusted.

### § 9.2 Schedule of Values

Where the Contract is based on a stipulated sum or Guaranteed Maximum Price, the Contractor shall submit a schedule of values to the Architect before the first Application for Payment, allocating the entire Contract Sum to the various portions of the Work. The schedule of values shall be prepared in the form, and supported by the data to substantiate its accuracy, required by the Architect. This schedule, unless objected to by the Architect, shall be used as a basis for reviewing the Contractor's Applications for Payment. Any changes to the schedule of values shall be submitted to the Architect and supported by such data to substantiate its accuracy as the Architect may require, and unless objected to by the Architect, shall be used as a basis for reviewing the Contractor's subsequent Applications for Payment.

### § 9.3 Applications for Payment

§ 9.3.1 At least ten days before the date established for each progress payment, the Contractor shall submit to the Architect an itemized Application for Payment prepared in accordance with the schedule of values, if required under Section 9.2, for completed portions of the Work. The application shall be notarized, if required, and supported by all data substantiating the Contractor's right to payment that the Owner or Architect require, such as copies of requisitions, and releases and waivers of liens from Subcontractors and suppliers, and shall reflect retainage if provided for in the Contract Documents.

§ 9.3.1.1 As provided in Section 7.3.9, such applications may include requests for payment on account of changes in the Work that have been properly authorized by Construction Change Directives, or by interim determinations of the Architect, but not yet included in Change Orders.



**§ 9.3.1.2** Applications for Payment shall not include requests for payment for portions of the Work for which the Contractor does not intend to pay a Subcontractor or supplier, unless such Work has been performed by others whom the Contractor intends to pay.

**§ 9.3.2** Unless otherwise provided in the Contract Documents, payments shall be made on account of materials and equipment delivered and suitably stored at the site for subsequent incorporation in the Work. If approved in advance by the Owner, payment may similarly be made for materials and equipment suitably stored off the site at a location agreed upon in writing. Payment for materials and equipment stored on or off the site shall be conditioned upon compliance by the Contractor with procedures satisfactory to the Owner to establish the Owner's title to such materials and equipment or otherwise protect the Owner's interest, and shall include the costs of applicable insurance, storage, and transportation to the site, for such materials and equipment stored off the site.

**§ 9.3.3** The Contractor warrants that title to all Work covered by an Application for Payment will pass to the Owner no later than the time of payment. The Contractor further warrants that upon submittal of an Application for Payment all Work for which Certificates for Payment have been previously issued and payments received from the Owner shall, to the best of the Contractor's knowledge, information, and belief, be free and clear of liens, claims, security interests, or encumbrances, in favor of the Contractor, Subcontractors, suppliers, or other persons or entities that provided labor, materials, and equipment relating to the Work.

#### **§ 9.4 Certificates for Payment**

**§ 9.4.1** The Architect will, within seven days after receipt of the Contractor's Application for Payment, either (1) issue to the Owner a Certificate for Payment in the full amount of the Application for Payment, with a copy to the Contractor; or (2) issue to the Owner a Certificate for Payment for such amount as the Architect determines is properly due, and notify the Contractor and Owner of the Architect's reasons for withholding certification in part as provided in Section 9.5.1; or (3) withhold certification of the entire Application for Payment, and notify the Contractor and Owner of the Architect's reason for withholding certification in whole as provided in Section 9.5.1.

**§ 9.4.2** The issuance of a Certificate for Payment will constitute a representation by the Architect to the Owner, based on the Architect's evaluation of the Work and the data in the Application for Payment, that, to the best of the Architect's knowledge, information, and belief, the Work has progressed to the point indicated, the quality of the Work is in accordance with the Contract Documents, and that the Contractor is entitled to payment in the amount certified. The foregoing representations are subject to an evaluation of the Work for conformance with the Contract Documents upon Substantial Completion, to results of subsequent tests and inspections, to correction of minor deviations from the Contract Documents prior to completion, and to specific qualifications expressed by the Architect. However, the issuance of a Certificate for Payment will not be a representation that the Architect has (1) made exhaustive or continuous on-site inspections to check the quality or quantity of the Work; (2) reviewed construction means, methods, techniques, sequences, or procedures; (3) reviewed copies of requisitions received from Subcontractors and suppliers and other data requested by the Owner to substantiate the Contractor's right to payment; or (4) made examination to ascertain how or for what purpose the Contractor has used money previously paid on account of the Contract Sum.

#### **§ 9.5 Decisions to Withhold Certification**

**§ 9.5.1** The Architect may withhold a Certificate for Payment in whole or in part, to the extent reasonably necessary to protect the Owner, if in the Architect's opinion the representations to the Owner required by Section 9.4.2 cannot be made. If the Architect is unable to certify payment in the amount of the Application, the Architect will notify the Contractor and Owner as provided in Section 9.4.1. If the Contractor and Architect cannot agree on a revised amount, the Architect will promptly issue a Certificate for Payment for the amount for which the Architect is able to make such representations to the Owner. The Architect may also withhold a Certificate for Payment or, because of subsequently discovered evidence, may nullify the whole or a part of a Certificate for Payment previously issued, to such extent as may be necessary in the Architect's opinion to protect the Owner from loss for which the Contractor is responsible, including loss resulting from acts and omissions described in Section 3.3.2, because of

- .1 defective Work not remedied;
- .2 third party claims filed or reasonable evidence indicating probable filing of such claims, unless security acceptable to the Owner is provided by the Contractor;
- .3 failure of the Contractor to make payments properly to Subcontractors or suppliers for labor, materials or equipment;

- .4 reasonable evidence that the Work cannot be completed for the unpaid balance of the Contract Sum;
- .5 damage to the Owner or a Separate Contractor;
- .6 reasonable evidence that the Work will not be completed within the Contract Time, and that the unpaid balance would not be adequate to cover actual or liquidated damages for the anticipated delay; or
- .7 repeated failure to carry out the Work in accordance with the Contract Documents.

**§ 9.5.2** When either party disputes the Architect's decision regarding a Certificate for Payment under Section 9.5.1, in whole or in part, that party may submit a Claim in accordance with Article 15.

**§ 9.5.3** When the reasons for withholding certification are removed, certification will be made for amounts previously withheld.

**§ 9.5.4** If the Architect withholds certification for payment under Section 9.5.1.3, the Owner may, at its sole option, issue joint checks to the Contractor and to any Subcontractor or supplier to whom the Contractor failed to make payment for Work properly performed or material or equipment suitably delivered. If the Owner makes payments by joint check, the Owner shall notify the Architect and the Contractor shall reflect such payment on its next Application for Payment.

## **§ 9.6 Progress Payments**

**§ 9.6.1** After the Architect has issued a Certificate for Payment, the Owner shall make payment in the manner and within the time provided in the Contract Documents, and shall so notify the Architect.

**§ 9.6.2** The Contractor shall pay each Subcontractor, no later than seven days after receipt of payment from the Owner, the amount to which the Subcontractor is entitled, reflecting percentages actually retained from payments to the Contractor on account of the Subcontractor's portion of the Work. The Contractor shall, by appropriate agreement with each Subcontractor, require each Subcontractor to make payments to Sub-subcontractors in a similar manner.

**§ 9.6.3** The Architect will, on request, furnish to a Subcontractor, if practicable, information regarding percentages of completion or amounts applied for by the Contractor and action taken thereon by the Architect and Owner on account of portions of the Work done by such Subcontractor.

**§ 9.6.4** The Owner has the right to request written evidence from the Contractor that the Contractor has properly paid Subcontractors and suppliers amounts paid by the Owner to the Contractor for subcontracted Work. If the Contractor fails to furnish such evidence within seven days, the Owner shall have the right to contact Subcontractors and suppliers to ascertain whether they have been properly paid. Neither the Owner nor Architect shall have an obligation to pay, or to see to the payment of money to, a Subcontractor or supplier, except as may otherwise be required by law.

**§ 9.6.5** The Contractor's payments to suppliers shall be treated in a manner similar to that provided in Sections 9.6.2, 9.6.3 and 9.6.4.

**§ 9.6.6** A Certificate for Payment, a progress payment, or partial or entire use or occupancy of the Project by the Owner shall not constitute acceptance of Work not in accordance with the Contract Documents.

**§ 9.6.7** Unless the Contractor provides the Owner with a payment bond in the full penal sum of the Contract Sum, payments received by the Contractor for Work properly performed by Subcontractors or provided by suppliers shall be held by the Contractor for those Subcontractors or suppliers who performed Work or furnished materials, or both, under contract with the Contractor for which payment was made by the Owner. Nothing contained herein shall require money to be placed in a separate account and not commingled with money of the Contractor, create any fiduciary liability or tort liability on the part of the Contractor for breach of trust, or entitle any person or entity to an award of punitive damages against the Contractor for breach of the requirements of this provision.

**§ 9.6.8** Provided the Owner has fulfilled its payment obligations under the Contract Documents, the Contractor shall defend and indemnify the Owner from all loss, liability, damage or expense, including reasonable attorney's fees and litigation expenses, arising out of any lien claim or other claim for payment by any Subcontractor or supplier of any tier. Upon receipt of notice of a lien claim or other claim for payment, the Owner shall notify the Contractor. If approved by the applicable court, when required, the Contractor may substitute a surety bond for the property against which the lien or other claim for payment has been asserted.

### § 9.7 Failure of Payment

If the Architect does not issue a Certificate for Payment, through no fault of the Contractor, within seven days after receipt of the Contractor's Application for Payment, or if the Owner does not pay the Contractor within seven days after the date established in the Contract Documents, the amount certified by the Architect or awarded by binding dispute resolution, then the Contractor may, upon seven additional days' notice to the Owner and Architect, stop the Work until payment of the amount owing has been received. The Contract Time shall be extended appropriately and the Contract Sum shall be increased by the amount of the Contractor's reasonable costs of shutdown, delay and start-up, plus interest as provided for in the Contract Documents.

### § 9.8 Substantial Completion

**§ 9.8.1** Substantial Completion is the stage in the progress of the Work when the Work or designated portion thereof is sufficiently complete in accordance with the Contract Documents so that the Owner can occupy or utilize the Work for its intended use.

**§ 9.8.2** When the Contractor considers that the Work, or a portion thereof which the Owner agrees to accept separately, is substantially complete, the Contractor shall prepare and submit to the Architect a comprehensive list of items to be completed or corrected prior to final payment. Failure to include an item on such list does not alter the responsibility of the Contractor to complete all Work in accordance with the Contract Documents.

**§ 9.8.3** Upon receipt of the Contractor's list, the Architect will make an inspection to determine whether the Work or designated portion thereof is substantially complete. If the Architect's inspection discloses any item, whether or not included on the Contractor's list, which is not sufficiently complete in accordance with the Contract Documents so that the Owner can occupy or utilize the Work or designated portion thereof for its intended use, the Contractor shall, before issuance of the Certificate of Substantial Completion, complete or correct such item upon notification by the Architect. In such case, the Contractor shall then submit a request for another inspection by the Architect to determine Substantial Completion.

**§ 9.8.4** When the Work or designated portion thereof is substantially complete, the Architect will prepare a Certificate of Substantial Completion that shall establish the date of Substantial Completion; establish responsibilities of the Owner and Contractor for security, maintenance, heat, utilities, damage to the Work and insurance; and fix the time within which the Contractor shall finish all items on the list accompanying the Certificate. Warranties required by the Contract Documents shall commence on the date of Substantial Completion of the Work or designated portion thereof unless otherwise provided in the Certificate of Substantial Completion.

**§ 9.8.5** The Certificate of Substantial Completion shall be submitted to the Owner and Contractor for their written acceptance of responsibilities assigned to them in the Certificate. Upon such acceptance, and consent of surety if any, the Owner shall make payment of retainage applying to the Work or designated portion thereof. Such payment shall be adjusted for Work that is incomplete or not in accordance with the requirements of the Contract Documents.

### § 9.9 Partial Occupancy or Use

**§ 9.9.1** The Owner may occupy or use any completed or partially completed portion of the Work at any stage when such portion is designated by separate agreement with the Contractor, provided such occupancy or use is consented to by the insurer and authorized by public authorities having jurisdiction over the Project. Such partial occupancy or use may commence whether or not the portion is substantially complete, provided the Owner and Contractor have accepted in writing the responsibilities assigned to each of them for payments, retainage, if any, security, maintenance, heat, utilities, damage to the Work and insurance, and have agreed in writing concerning the period for correction of the Work and commencement of warranties required by the Contract Documents. When the Contractor considers a portion substantially complete, the Contractor shall prepare and submit a list to the Architect as provided under Section 9.8.2. Consent of the Contractor to partial occupancy or use shall not be unreasonably withheld. The stage of the progress of the Work shall be determined by written agreement between the Owner and Contractor or, if no agreement is reached, by decision of the Architect.

**§ 9.9.2** Immediately prior to such partial occupancy or use, the Owner, Contractor, and Architect shall jointly inspect the area to be occupied or portion of the Work to be used in order to determine and record the condition of the Work.

**§ 9.9.3** Unless otherwise agreed upon, partial occupancy or use of a portion or portions of the Work shall not constitute acceptance of Work not complying with the requirements of the Contract Documents.

### **§ 9.10 Final Completion and Final Payment**

**§ 9.10.1** Upon receipt of the Contractor's notice that the Work is ready for final inspection and acceptance and upon receipt of a final Application for Payment, the Architect will promptly make such inspection. When the Architect finds the Work acceptable under the Contract Documents and the Contract fully performed, the Architect will promptly issue a final Certificate for Payment stating that to the best of the Architect's knowledge, information and belief, and on the basis of the Architect's on-site visits and inspections, the Work has been completed in accordance with the Contract Documents and that the entire balance found to be due the Contractor and noted in the final Certificate is due and payable. The Architect's final Certificate for Payment will constitute a further representation that conditions listed in Section 9.10.2 as precedent to the Contractor's being entitled to final payment have been fulfilled.

**§ 9.10.2** Neither final payment nor any remaining retained percentage shall become due until the Contractor submits to the Architect (1) an affidavit that payrolls, bills for materials and equipment, and other indebtedness connected with the Work for which the Owner or the Owner's property might be responsible or encumbered (less amounts withheld by Owner) have been paid or otherwise satisfied, (2) a certificate evidencing that insurance required by the Contract Documents to remain in force after final payment is currently in effect, (3) a written statement that the Contractor knows of no reason that the insurance will not be renewable to cover the period required by the Contract Documents, (4) consent of surety, if any, to final payment, (5) documentation of any special warranties, such as manufacturers' warranties or specific Subcontractor warranties, and (6) if required by the Owner, other data establishing payment or satisfaction of obligations, such as receipts and releases and waivers of liens, claims, security interests, or encumbrances arising out of the Contract, to the extent and in such form as may be designated by the Owner. If a Subcontractor refuses to furnish a release or waiver required by the Owner, the Contractor may furnish a bond satisfactory to the Owner to indemnify the Owner against such lien, claim, security interest, or encumbrance. If a lien, claim, security interest, or encumbrance remains unsatisfied after payments are made, the Contractor shall refund to the Owner all money that the Owner may be compelled to pay in discharging the lien, claim, security interest, or encumbrance, including all costs and reasonable attorneys' fees.

**§ 9.10.3** If, after Substantial Completion of the Work, final completion thereof is materially delayed through no fault of the Contractor or by issuance of Change Orders affecting final completion, and the Architect so confirms, the Owner shall, upon application by the Contractor and certification by the Architect, and without terminating the Contract, make payment of the balance due for that portion of the Work fully completed, corrected, and accepted. If the remaining balance for Work not fully completed or corrected is less than retainage stipulated in the Contract Documents, and if bonds have been furnished, the written consent of the surety to payment of the balance due for that portion of the Work fully completed and accepted shall be submitted by the Contractor to the Architect prior to certification of such payment. Such payment shall be made under terms and conditions governing final payment, except that it shall not constitute a waiver of Claims.

**§ 9.10.4** The making of final payment shall constitute a waiver of Claims by the Owner except those arising from

- .1 liens, Claims, security interests, or encumbrances arising out of the Contract and unsettled;
- .2 failure of the Work to comply with the requirements of the Contract Documents;
- .3 terms of special warranties required by the Contract Documents; or
- .4 audits performed by the Owner, if permitted by the Contract Documents, after final payment.

**§ 9.10.5** Acceptance of final payment by the Contractor, a Subcontractor, or a supplier, shall constitute a waiver of claims by that payee except those previously made in writing and identified by that payee as unsettled at the time of final Application for Payment.

## **ARTICLE 10 PROTECTION OF PERSONS AND PROPERTY**

### **§ 10.1 Safety Precautions and Programs**

The Contractor shall be responsible for initiating, maintaining, and supervising all safety precautions and programs in connection with the performance of the Contract.

### **§ 10.2 Safety of Persons and Property**

**§ 10.2.1** The Contractor shall take reasonable precautions for safety of, and shall provide reasonable protection to prevent damage, injury, or loss to



- .1 employees on the Work and other persons who may be affected thereby;
- .2 the Work and materials and equipment to be incorporated therein, whether in storage on or off the site, under care, custody, or control of the Contractor, a Subcontractor, or a Sub-subcontractor; and
- .3 other property at the site or adjacent thereto, such as trees, shrubs, lawns, walks, pavements, roadways, structures, and utilities not designated for removal, relocation, or replacement in the course of construction.

**§ 10.2.2** The Contractor shall comply with, and give notices required by applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities, bearing on safety of persons or property or their protection from damage, injury, or loss.

**§ 10.2.3** The Contractor shall implement, erect, and maintain, as required by existing conditions and performance of the Contract, reasonable safeguards for safety and protection, including posting danger signs and other warnings against hazards; promulgating safety regulations; and notifying the owners and users of adjacent sites and utilities of the safeguards.

**§ 10.2.4** When use or storage of explosives or other hazardous materials or equipment, or unusual methods are necessary for execution of the Work, the Contractor shall exercise utmost care and carry on such activities under supervision of properly qualified personnel.

**§ 10.2.5** The Contractor shall promptly remedy damage and loss (other than damage or loss insured under property insurance required by the Contract Documents) to property referred to in Sections 10.2.1.2 and 10.2.1.3 caused in whole or in part by the Contractor, a Subcontractor, a Sub-subcontractor, or anyone directly or indirectly employed by any of them, or by anyone for whose acts they may be liable and for which the Contractor is responsible under Sections 10.2.1.2 and 10.2.1.3. The Contractor may make a Claim for the cost to remedy the damage or loss to the extent such damage or loss is attributable to acts or omissions of the Owner or Architect or anyone directly or indirectly employed by either of them, or by anyone for whose acts either of them may be liable, and not attributable to the fault or negligence of the Contractor. The foregoing obligations of the Contractor are in addition to the Contractor's obligations under Section 3.18.

**§ 10.2.6** The Contractor shall designate a responsible member of the Contractor's organization at the site whose duty shall be the prevention of accidents. This person shall be the Contractor's superintendent unless otherwise designated by the Contractor in writing to the Owner and Architect.

**§ 10.2.7** The Contractor shall not permit any part of the construction or site to be loaded so as to cause damage or create an unsafe condition.

**§ 10.2.8 Injury or Damage to Person or Property**

If either party suffers injury or damage to person or property because of an act or omission of the other party, or of others for whose acts such party is legally responsible, notice of the injury or damage, whether or not insured, shall be given to the other party within a reasonable time not exceeding 21 days after discovery. The notice shall provide sufficient detail to enable the other party to investigate the matter.

**§ 10.3 Hazardous Materials and Substances**

**§ 10.3.1** The Contractor is responsible for compliance with any requirements included in the Contract Documents regarding hazardous materials or substances. If the Contractor encounters a hazardous material or substance not addressed in the Contract Documents and if reasonable precautions will be inadequate to prevent foreseeable bodily injury or death to persons resulting from a material or substance, including but not limited to asbestos or polychlorinated biphenyl (PCB), encountered on the site by the Contractor, the Contractor shall, upon recognizing the condition, immediately stop Work in the affected area and notify the Owner and Architect of the condition.

**§ 10.3.2** Upon receipt of the Contractor's notice, the Owner shall obtain the services of a licensed laboratory to verify the presence or absence of the material or substance reported by the Contractor and, in the event such material or substance is found to be present, to cause it to be rendered harmless. Unless otherwise required by the Contract Documents, the Owner shall furnish in writing to the Contractor and Architect the names and qualifications of persons or entities who are to perform tests verifying the presence or absence of the material or substance or who are to perform the task of removal or safe containment of the material or substance. The Contractor and the Architect will

promptly reply to the Owner in writing stating whether or not either has reasonable objection to the persons or entities proposed by the Owner. If either the Contractor or Architect has an objection to a person or entity proposed by the Owner, the Owner shall propose another to whom the Contractor and the Architect have no reasonable objection. When the material or substance has been rendered harmless, Work in the affected area shall resume upon written agreement of the Owner and Contractor. By Change Order, the Contract Time shall be extended appropriately and the Contract Sum shall be increased by the amount of the Contractor's reasonable additional costs of shutdown, delay, and start-up.

**§ 10.3.3** To the fullest extent permitted by law, the Owner shall indemnify and hold harmless the Contractor, Subcontractors, Architect, Architect's consultants, and agents and employees of any of them from and against claims, damages, losses, and expenses, including but not limited to attorneys' fees, arising out of or resulting from performance of the Work in the affected area if in fact the material or substance presents the risk of bodily injury or death as described in Section 10.3.1 and has not been rendered harmless, provided that such claim, damage, loss, or expense is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the Work itself), except to the extent that such damage, loss, or expense is due to the fault or negligence of the party seeking indemnity.

**§ 10.3.4** The Owner shall not be responsible under this Section 10.3 for hazardous materials or substances the Contractor brings to the site unless such materials or substances are required by the Contract Documents. The Owner shall be responsible for hazardous materials or substances required by the Contract Documents, except to the extent of the Contractor's fault or negligence in the use and handling of such materials or substances.

**§ 10.3.5** The Contractor shall reimburse the Owner for the cost and expense the Owner incurs (1) for remediation of hazardous materials or substances the Contractor brings to the site and negligently handles, or (2) where the Contractor fails to perform its obligations under Section 10.3.1, except to the extent that the cost and expense are due to the Owner's fault or negligence.

**§ 10.3.6** If, without negligence on the part of the Contractor, the Contractor is held liable by a government agency for the cost of remediation of a hazardous material or substance solely by reason of performing Work as required by the Contract Documents, the Owner shall reimburse the Contractor for all cost and expense thereby incurred.

#### **§ 10.4 Emergencies**

In an emergency affecting safety of persons or property, the Contractor shall act, at the Contractor's discretion, to prevent threatened damage, injury, or loss. Additional compensation or extension of time claimed by the Contractor on account of an emergency shall be determined as provided in Article 15 and Article 7.

### **ARTICLE 11 INSURANCE AND BONDS**

#### **§ 11.1 Contractor's Insurance and Bonds**

**§ 11.1.1** The Contractor shall purchase and maintain insurance of the types and limits of liability, containing the endorsements, and subject to the terms and conditions, as described in the Agreement or elsewhere in the Contract Documents. The Contractor shall purchase and maintain the required insurance from an insurance company or insurance companies lawfully authorized to issue insurance in the jurisdiction where the Project is located. The Owner, Architect, and Architect's consultants shall be named as additional insureds under the Contractor's commercial general liability policy or as otherwise described in the Contract Documents.

**§ 11.1.2** The Contractor shall provide surety bonds of the types, for such penal sums, and subject to such terms and conditions as required by the Contract Documents. The Contractor shall purchase and maintain the required bonds from a company or companies lawfully authorized to issue surety bonds in the jurisdiction where the Project is located.

**§ 11.1.3** Upon the request of any person or entity appearing to be a potential beneficiary of bonds covering payment of obligations arising under the Contract, the Contractor shall promptly furnish a copy of the bonds or shall authorize a copy to be furnished.

**§ 11.1.4 Notice of Cancellation or Expiration of Contractor's Required Insurance.** Within three (3) business days of the date the Contractor becomes aware of an impending or actual cancellation or expiration of any insurance required by the Contract Documents, the Contractor shall provide notice to the Owner of such impending or actual cancellation or

expiration. Upon receipt of notice from the Contractor, the Owner shall, unless the lapse in coverage arises from an act or omission of the Owner, have the right to stop the Work until the lapse in coverage has been cured by the procurement of replacement coverage by the Contractor. The furnishing of notice by the Contractor shall not relieve the Contractor of any contractual obligation to provide any required coverage.

## **§ 11.2 Owner's Insurance**

**§ 11.2.1** The Owner shall purchase and maintain insurance of the types and limits of liability, containing the endorsements, and subject to the terms and conditions, as described in the Agreement or elsewhere in the Contract Documents. The Owner shall purchase and maintain the required insurance from an insurance company or insurance companies lawfully authorized to issue insurance in the jurisdiction where the Project is located.

**§ 11.2.2 Failure to Purchase Required Property Insurance.** If the Owner fails to purchase and maintain the required property insurance, with all of the coverages and in the amounts described in the Agreement or elsewhere in the Contract Documents, the Owner shall inform the Contractor in writing prior to commencement of the Work. Upon receipt of notice from the Owner, the Contractor may delay commencement of the Work and may obtain insurance that will protect the interests of the Contractor, Subcontractors, and Sub-Subcontractors in the Work. When the failure to provide coverage has been cured or resolved, the Contract Sum and Contract Time shall be equitably adjusted. In the event the Owner fails to procure coverage, the Owner waives all rights against the Contractor, Subcontractors, and Sub-subcontractors to the extent the loss to the Owner would have been covered by the insurance to have been procured by the Owner. The cost of the insurance shall be charged to the Owner by a Change Order. If the Owner does not provide written notice, and the Contractor is damaged by the failure or neglect of the Owner to purchase or maintain the required insurance, the Owner shall reimburse the Contractor for all reasonable costs and damages attributable thereto.

**§ 11.2.3 Notice of Cancellation or Expiration of Owner's Required Property Insurance.** Within three (3) business days of the date the Owner becomes aware of an impending or actual cancellation or expiration of any property insurance required by the Contract Documents, the Owner shall provide notice to the Contractor of such impending or actual cancellation or expiration. Unless the lapse in coverage arises from an act or omission of the Contractor: (1) the Contractor, upon receipt of notice from the Owner, shall have the right to stop the Work until the lapse in coverage has been cured by the procurement of replacement coverage by either the Owner or the Contractor; (2) the Contract Time and Contract Sum shall be equitably adjusted; and (3) the Owner waives all rights against the Contractor, Subcontractors, and Sub-subcontractors to the extent any loss to the Owner would have been covered by the insurance had it not expired or been cancelled. If the Contractor purchases replacement coverage, the cost of the insurance shall be charged to the Owner by an appropriate Change Order. The furnishing of notice by the Owner shall not relieve the Owner of any contractual obligation to provide required insurance.

## **§ 11.3 Waivers of Subrogation**

**§ 11.3.1** The Owner and Contractor waive all rights against (1) each other and any of their subcontractors, sub-subcontractors, agents, and employees, each of the other; (2) the Architect and Architect's consultants; and (3) Separate Contractors, if any, and any of their subcontractors, sub-subcontractors, agents, and employees, for damages caused by fire, or other causes of loss, to the extent those losses are covered by property insurance required by the Agreement or other property insurance applicable to the Project, except such rights as they have to proceeds of such insurance. The Owner or Contractor, as appropriate, shall require similar written waivers in favor of the individuals and entities identified above from the Architect, Architect's consultants, Separate Contractors, subcontractors, and sub-subcontractors. The policies of insurance purchased and maintained by each person or entity agreeing to waive claims pursuant to this section 11.3.1 shall not prohibit this waiver of subrogation. This waiver of subrogation shall be effective as to a person or entity (1) even though that person or entity would otherwise have a duty of indemnification, contractual or otherwise, (2) even though that person or entity did not pay the insurance premium directly or indirectly, or (3) whether or not the person or entity had an insurable interest in the damaged property.

**§ 11.3.2** If during the Project construction period the Owner insures properties, real or personal or both, at or adjacent to the site by property insurance under policies separate from those insuring the Project, or if after final payment property insurance is to be provided on the completed Project through a policy or policies other than those insuring the Project during the construction period, to the extent permissible by such policies, the Owner waives all rights in accordance with the terms of Section 11.3.1 for damages caused by fire or other causes of loss covered by this separate property insurance.

#### **§ 11.4 Loss of Use, Business Interruption, and Delay in Completion Insurance**

The Owner, at the Owner's option, may purchase and maintain insurance that will protect the Owner against loss of use of the Owner's property, or the inability to conduct normal operations, due to fire or other causes of loss. The Owner waives all rights of action against the Contractor and Architect for loss of use of the Owner's property, due to fire or other hazards however caused.

#### **§11.5 Adjustment and Settlement of Insured Loss**

**§ 11.5.1** A loss insured under the property insurance required by the Agreement shall be adjusted by the Owner as fiduciary and made payable to the Owner as fiduciary for the insureds, as their interests may appear, subject to requirements of any applicable mortgagee clause and of Section 11.5.2. The Owner shall pay the Architect and Contractor their just shares of insurance proceeds received by the Owner, and by appropriate agreements the Architect and Contractor shall make payments to their consultants and Subcontractors in similar manner.

**§ 11.5.2** Prior to settlement of an insured loss, the Owner shall notify the Contractor of the terms of the proposed settlement as well as the proposed allocation of the insurance proceeds. The Contractor shall have 14 days from receipt of notice to object to the proposed settlement or allocation of the proceeds. If the Contractor does not object, the Owner shall settle the loss and the Contractor shall be bound by the settlement and allocation. Upon receipt, the Owner shall deposit the insurance proceeds in a separate account and make the appropriate distributions. Thereafter, if no other agreement is made or the Owner does not terminate the Contract for convenience, the Owner and Contractor shall execute a Change Order for reconstruction of the damaged or destroyed Work in the amount allocated for that purpose. If the Contractor timely objects to either the terms of the proposed settlement or the allocation of the proceeds, the Owner may proceed to settle the insured loss, and any dispute between the Owner and Contractor arising out of the settlement or allocation of the proceeds shall be resolved pursuant to Article 15. Pending resolution of any dispute, the Owner may issue a Construction Change Directive for the reconstruction of the damaged or destroyed Work.

### **ARTICLE 12 UNCOVERING AND CORRECTION OF WORK**

#### **§ 12.1 Uncovering of Work**

**§ 12.1.1** If a portion of the Work is covered contrary to the Architect's request or to requirements specifically expressed in the Contract Documents, it must, if requested in writing by the Architect, be uncovered for the Architect's examination and be replaced at the Contractor's expense without change in the Contract Time.

**§ 12.1.2** If a portion of the Work has been covered that the Architect has not specifically requested to examine prior to its being covered, the Architect may request to see such Work and it shall be uncovered by the Contractor. If such Work is in accordance with the Contract Documents, the Contractor shall be entitled to an equitable adjustment to the Contract Sum and Contract Time as may be appropriate. If such Work is not in accordance with the Contract Documents, the costs of uncovering the Work, and the cost of correction, shall be at the Contractor's expense.

#### **§ 12.2 Correction of Work**

##### **§ 12.2.1 Before Substantial Completion**

The Contractor shall promptly correct Work rejected by the Architect or failing to conform to the requirements of the Contract Documents, discovered before Substantial Completion and whether or not fabricated, installed or completed. Costs of correcting such rejected Work, including additional testing and inspections, the cost of uncovering and replacement, and compensation for the Architect's services and expenses made necessary thereby, shall be at the Contractor's expense.

##### **§ 12.2.2 After Substantial Completion**

**§ 12.2.2.1** In addition to the Contractor's obligations under Section 3.5, if, within one year after the date of Substantial Completion of the Work or designated portion thereof or after the date for commencement of warranties established under Section 9.9.1, or by terms of any applicable special warranty required by the Contract Documents, any of the Work is found to be not in accordance with the requirements of the Contract Documents, the Contractor shall correct it promptly after receipt of notice from the Owner to do so, unless the Owner has previously given the Contractor a written acceptance of such condition. The Owner shall give such notice promptly after discovery of the condition. During the one-year period for correction of Work, if the Owner fails to notify the Contractor and give the Contractor an opportunity to make the correction, the Owner waives the rights to require correction by the Contractor and to make a claim for breach of warranty. If the Contractor fails to correct nonconforming Work within a reasonable time during



that period after receipt of notice from the Owner or Architect, the Owner may correct it in accordance with Section 2.5.

**§ 12.2.2.2** The one-year period for correction of Work shall be extended with respect to portions of Work first performed after Substantial Completion by the period of time between Substantial Completion and the actual completion of that portion of the Work.

**§ 12.2.2.3** The one-year period for correction of Work shall not be extended by corrective Work performed by the Contractor pursuant to this Section 12.2.

**§ 12.2.3** The Contractor shall remove from the site portions of the Work that are not in accordance with the requirements of the Contract Documents and are neither corrected by the Contractor nor accepted by the Owner.

**§ 12.2.4** The Contractor shall bear the cost of correcting destroyed or damaged construction of the Owner or Separate Contractors, whether completed or partially completed, caused by the Contractor's correction or removal of Work that is not in accordance with the requirements of the Contract Documents.

**§ 12.2.5** Nothing contained in this Section 12.2 shall be construed to establish a period of limitation with respect to other obligations the Contractor has under the Contract Documents. Establishment of the one-year period for correction of Work as described in Section 12.2.2 relates only to the specific obligation of the Contractor to correct the Work, and has no relationship to the time within which the obligation to comply with the Contract Documents may be sought to be enforced, nor to the time within which proceedings may be commenced to establish the Contractor's liability with respect to the Contractor's obligations other than specifically to correct the Work.

### **§ 12.3 Acceptance of Nonconforming Work**

If the Owner prefers to accept Work that is not in accordance with the requirements of the Contract Documents, the Owner may do so instead of requiring its removal and correction, in which case the Contract Sum will be reduced as appropriate and equitable. Such adjustment shall be effected whether or not final payment has been made.

## **ARTICLE 13 MISCELLANEOUS PROVISIONS**

### **§ 13.1 Governing Law**

The Contract shall be governed by the law of the place where the Project is located, excluding that jurisdiction's choice of law rules. If the parties have selected arbitration as the method of binding dispute resolution, the Federal Arbitration Act shall govern Section 15.4.

### **§ 13.2 Successors and Assigns**

**§ 13.2.1** The Owner and Contractor respectively bind themselves, their partners, successors, assigns, and legal representatives to covenants, agreements, and obligations contained in the Contract Documents. Except as provided in Section 13.2.2, neither party to the Contract shall assign the Contract as a whole without written consent of the other. If either party attempts to make an assignment without such consent, that party shall nevertheless remain legally responsible for all obligations under the Contract.

**§ 13.2.2** The Owner may, without consent of the Contractor, assign the Contract to a lender providing construction financing for the Project, if the lender assumes the Owner's rights and obligations under the Contract Documents. The Contractor shall execute all consents reasonably required to facilitate the assignment.

### **§ 13.3 Rights and Remedies**

**§ 13.3.1** Duties and obligations imposed by the Contract Documents and rights and remedies available thereunder shall be in addition to and not a limitation of duties, obligations, rights, and remedies otherwise imposed or available by law.

**§ 13.3.2** No action or failure to act by the Owner, Architect, or Contractor shall constitute a waiver of a right or duty afforded them under the Contract, nor shall such action or failure to act constitute approval of or acquiescence in a breach thereunder, except as may be specifically agreed upon in writing.

## § 13.4 Tests and Inspections

§ 13.4.1 Tests, inspections, and approvals of portions of the Work shall be made as required by the Contract Documents and by applicable laws, statutes, ordinances, codes, rules, and regulations or lawful orders of public authorities. Unless otherwise provided, the Contractor shall make arrangements for such tests, inspections, and approvals with an independent testing laboratory or entity acceptable to the Owner, or with the appropriate public authority, and shall bear all related costs of tests, inspections, and approvals. The Contractor shall give the Architect timely notice of when and where tests and inspections are to be made so that the Architect may be present for such procedures. The Owner shall bear costs of tests, inspections, or approvals that do not become requirements until after bids are received or negotiations concluded. The Owner shall directly arrange and pay for tests, inspections, or approvals where building codes or applicable laws or regulations so require.

§ 13.4.2 If the Architect, Owner, or public authorities having jurisdiction determine that portions of the Work require additional testing, inspection, or approval not included under Section 13.4.1, the Architect will, upon written authorization from the Owner, instruct the Contractor to make arrangements for such additional testing, inspection, or approval, by an entity acceptable to the Owner, and the Contractor shall give timely notice to the Architect of when and where tests and inspections are to be made so that the Architect may be present for such procedures. Such costs, except as provided in Section 13.4.3, shall be at the Owner's expense.

§ 13.4.3 If procedures for testing, inspection, or approval under Sections 13.4.1 and 13.4.2 reveal failure of the portions of the Work to comply with requirements established by the Contract Documents, all costs made necessary by such failure, including those of repeated procedures and compensation for the Architect's services and expenses, shall be at the Contractor's expense.

§ 13.4.4 Required certificates of testing, inspection, or approval shall, unless otherwise required by the Contract Documents, be secured by the Contractor and promptly delivered to the Architect.

§ 13.4.5 If the Architect is to observe tests, inspections, or approvals required by the Contract Documents, the Architect will do so promptly and, where practicable, at the normal place of testing.

§ 13.4.6 Tests or inspections conducted pursuant to the Contract Documents shall be made promptly to avoid unreasonable delay in the Work.

## § 13.5 Interest

Payments due and unpaid under the Contract Documents shall bear interest from the date payment is due at the rate the parties agree upon in writing or, in the absence thereof, at the legal rate prevailing from time to time at the place where the Project is located.

## ARTICLE 14 TERMINATION OR SUSPENSION OF THE CONTRACT

### § 14.1 Termination by the Contractor

§ 14.1.1 The Contractor may terminate the Contract if the Work is stopped for a period of 30 consecutive days through no act or fault of the Contractor, a Subcontractor, a Sub-subcontractor, their agents or employees, or any other persons or entities performing portions of the Work, for any of the following reasons:

- .1 Issuance of an order of a court or other public authority having jurisdiction that requires all Work to be stopped;
- .2 An act of government, such as a declaration of national emergency, that requires all Work to be stopped;
- .3 Because the Architect has not issued a Certificate for Payment and has not notified the Contractor of the reason for withholding certification as provided in Section 9.4.1, or because the Owner has not made payment on a Certificate for Payment within the time stated in the Contract Documents; or
- .4 The Owner has failed to furnish to the Contractor reasonable evidence as required by Section 2.2.

§ 14.1.2 The Contractor may terminate the Contract if, through no act or fault of the Contractor, a Subcontractor, a Sub-subcontractor, their agents or employees, or any other persons or entities performing portions of the Work, repeated suspensions, delays, or interruptions of the entire Work by the Owner as described in Section 14.3, constitute in the aggregate more than 100 percent of the total number of days scheduled for completion, or 120 days in any 365-day period, whichever is less.

**§ 14.1.3** If one of the reasons described in Section 14.1.1 or 14.1.2 exists, the Contractor may, upon seven days' notice to the Owner and Architect, terminate the Contract and recover from the Owner payment for Work executed, as well as reasonable overhead and profit on Work not executed, and costs incurred by reason of such termination.

**§ 14.1.4** If the Work is stopped for a period of 60 consecutive days through no act or fault of the Contractor, a Subcontractor, a Sub-subcontractor, or their agents or employees or any other persons or entities performing portions of the Work because the Owner has repeatedly failed to fulfill the Owner's obligations under the Contract Documents with respect to matters important to the progress of the Work, the Contractor may, upon seven additional days' notice to the Owner and the Architect, terminate the Contract and recover from the Owner as provided in Section 14.1.3.

## **§ 14.2 Termination by the Owner for Cause**

**§ 14.2.1** The Owner may terminate the Contract if the Contractor

- .1 repeatedly refuses or fails to supply enough properly skilled workers or proper materials;
- .2 fails to make payment to Subcontractors or suppliers in accordance with the respective agreements between the Contractor and the Subcontractors or suppliers;
- .3 repeatedly disregards applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of a public authority; or
- .4 otherwise is guilty of substantial breach of a provision of the Contract Documents.

**§ 14.2.2** When any of the reasons described in Section 14.2.1 exist, and upon certification by the Architect that sufficient cause exists to justify such action, the Owner may, without prejudice to any other rights or remedies of the Owner and after giving the Contractor and the Contractor's surety, if any, seven days' notice, terminate employment of the Contractor and may, subject to any prior rights of the surety:

- .1 Exclude the Contractor from the site and take possession of all materials, equipment, tools, and construction equipment and machinery thereon owned by the Contractor;
- .2 Accept assignment of subcontracts pursuant to Section 5.4; and
- .3 Finish the Work by whatever reasonable method the Owner may deem expedient. Upon written request of the Contractor, the Owner shall furnish to the Contractor a detailed accounting of the costs incurred by the Owner in finishing the Work.

**§ 14.2.3** When the Owner terminates the Contract for one of the reasons stated in Section 14.2.1, the Contractor shall not be entitled to receive further payment until the Work is finished.

**§ 14.2.4** If the unpaid balance of the Contract Sum exceeds costs of finishing the Work, including compensation for the Architect's services and expenses made necessary thereby, and other damages incurred by the Owner and not expressly waived, such excess shall be paid to the Contractor. If such costs and damages exceed the unpaid balance, the Contractor shall pay the difference to the Owner. The amount to be paid to the Contractor or Owner, as the case may be, shall be certified by the Initial Decision Maker, upon application, and this obligation for payment shall survive termination of the Contract.

## **§ 14.3 Suspension by the Owner for Convenience**

**§ 14.3.1** The Owner may, without cause, order the Contractor in writing to suspend, delay or interrupt the Work, in whole or in part for such period of time as the Owner may determine.

**§ 14.3.2** The Contract Sum and Contract Time shall be adjusted for increases in the cost and time caused by suspension, delay, or interruption under Section 14.3.1. Adjustment of the Contract Sum shall include profit. No adjustment shall be made to the extent

- .1 that performance is, was, or would have been, so suspended, delayed, or interrupted, by another cause for which the Contractor is responsible; or
- .2 that an equitable adjustment is made or denied under another provision of the Contract.

## **§ 14.4 Termination by the Owner for Convenience**

**§ 14.4.1** The Owner may, at any time, terminate the Contract for the Owner's convenience and without cause.

**§ 14.4.2** Upon receipt of notice from the Owner of such termination for the Owner's convenience, the Contractor shall

- .1 cease operations as directed by the Owner in the notice;

- .2 take actions necessary, or that the Owner may direct, for the protection and preservation of the Work; and
- .3 except for Work directed to be performed prior to the effective date of termination stated in the notice, terminate all existing subcontracts and purchase orders and enter into no further subcontracts and purchase orders.

**§ 14.4.3** In case of such termination for the Owner's convenience, the Owner shall pay the Contractor for Work properly executed; costs incurred by reason of the termination, including costs attributable to termination of Subcontracts; and the termination fee, if any, set forth in the Agreement.

## **ARTICLE 15 CLAIMS AND DISPUTES**

### **§ 15.1 Claims**

#### **§ 15.1.1 Definition**

A Claim is a demand or assertion by one of the parties seeking, as a matter of right, payment of money, a change in the Contract Time, or other relief with respect to the terms of the Contract. The term "Claim" also includes other disputes and matters in question between the Owner and Contractor arising out of or relating to the Contract. The responsibility to substantiate Claims shall rest with the party making the Claim. This Section 15.1.1 does not require the Owner to file a Claim in order to impose liquidated damages in accordance with the Contract Documents.

#### **§ 15.1.2 Time Limits on Claims**

The Owner and Contractor shall commence all Claims and causes of action against the other and arising out of or related to the Contract, whether in contract, tort, breach of warranty or otherwise, in accordance with the requirements of the binding dispute resolution method selected in the Agreement and within the period specified by applicable law, but in any case not more than 10 years after the date of Substantial Completion of the Work. The Owner and Contractor waive all Claims and causes of action not commenced in accordance with this Section 15.1.2.

#### **§ 15.1.3 Notice of Claims**

**§ 15.1.3.1** Claims by either the Owner or Contractor, where the condition giving rise to the Claim is first discovered prior to expiration of the period for correction of the Work set forth in Section 12.2.2, shall be initiated by notice to the other party and to the Initial Decision Maker with a copy sent to the Architect, if the Architect is not serving as the Initial Decision Maker. Claims by either party under this Section 15.1.3.1 shall be initiated within 21 days after occurrence of the event giving rise to such Claim or within 21 days after the claimant first recognizes the condition giving rise to the Claim, whichever is later.

**§ 15.1.3.2** Claims by either the Owner or Contractor, where the condition giving rise to the Claim is first discovered after expiration of the period for correction of the Work set forth in Section 12.2.2, shall be initiated by notice to the other party. In such event, no decision by the Initial Decision Maker is required.

#### **§ 15.1.4 Continuing Contract Performance**

**§ 15.1.4.1** Pending final resolution of a Claim, except as otherwise agreed in writing or as provided in Section 9.7 and Article 14, the Contractor shall proceed diligently with performance of the Contract and the Owner shall continue to make payments in accordance with the Contract Documents.

**§ 15.1.4.2** The Contract Sum and Contract Time shall be adjusted in accordance with the Initial Decision Maker's decision, subject to the right of either party to proceed in accordance with this Article 15. The Architect will issue Certificates for Payment in accordance with the decision of the Initial Decision Maker.

#### **§ 15.1.5 Claims for Additional Cost**

If the Contractor wishes to make a Claim for an increase in the Contract Sum, notice as provided in Section 15.1.3 shall be given before proceeding to execute the portion of the Work that is the subject of the Claim. Prior notice is not required for Claims relating to an emergency endangering life or property arising under Section 10.4.

#### **§ 15.1.6 Claims for Additional Time**

**§ 15.1.6.1** If the Contractor wishes to make a Claim for an increase in the Contract Time, notice as provided in Section 15.1.3 shall be given. The Contractor's Claim shall include an estimate of cost and of probable effect of delay on progress of the Work. In the case of a continuing delay, only one Claim is necessary.



**§ 15.1.6.2** If adverse weather conditions are the basis for a Claim for additional time, such Claim shall be documented by data substantiating that weather conditions were abnormal for the period of time, could not have been reasonably anticipated, and had an adverse effect on the scheduled construction.

#### **§ 15.1.7 Waiver of Claims for Consequential Damages**

The Contractor and Owner waive Claims against each other for consequential damages arising out of or relating to this Contract. This mutual waiver includes

- .1 damages incurred by the Owner for rental expenses, for losses of use, income, profit, financing, business and reputation, and for loss of management or employee productivity or of the services of such persons; and
- .2 damages incurred by the Contractor for principal office expenses including the compensation of personnel stationed there, for losses of financing, business and reputation, and for loss of profit, except anticipated profit arising directly from the Work.

This mutual waiver is applicable, without limitation, to all consequential damages due to either party's termination in accordance with Article 14. Nothing contained in this Section 15.1.7 shall be deemed to preclude assessment of liquidated damages, when applicable, in accordance with the requirements of the Contract Documents.

#### **§ 15.2 Initial Decision**

**§ 15.2.1** Claims, excluding those where the condition giving rise to the Claim is first discovered after expiration of the period for correction of the Work set forth in Section 12.2.2 or arising under Sections 10.3, 10.4, and 11.5, shall be referred to the Initial Decision Maker for initial decision. The Architect will serve as the Initial Decision Maker, unless otherwise indicated in the Agreement. Except for those Claims excluded by this Section 15.2.1, an initial decision shall be required as a condition precedent to mediation of any Claim. If an initial decision has not been rendered within 30 days after the Claim has been referred to the Initial Decision Maker, the party asserting the Claim may demand mediation and binding dispute resolution without a decision having been rendered. Unless the Initial Decision Maker and all affected parties agree, the Initial Decision Maker will not decide disputes between the Contractor and persons or entities other than the Owner.

**§ 15.2.2** The Initial Decision Maker will review Claims and within ten days of the receipt of a Claim take one or more of the following actions: (1) request additional supporting data from the claimant or a response with supporting data from the other party, (2) reject the Claim in whole or in part, (3) approve the Claim, (4) suggest a compromise, or (5) advise the parties that the Initial Decision Maker is unable to resolve the Claim if the Initial Decision Maker lacks sufficient information to evaluate the merits of the Claim or if the Initial Decision Maker concludes that, in the Initial Decision Maker's sole discretion, it would be inappropriate for the Initial Decision Maker to resolve the Claim.

**§ 15.2.3** In evaluating Claims, the Initial Decision Maker may, but shall not be obligated to, consult with or seek information from either party or from persons with special knowledge or expertise who may assist the Initial Decision Maker in rendering a decision. The Initial Decision Maker may request the Owner to authorize retention of such persons at the Owner's expense.

**§ 15.2.4** If the Initial Decision Maker requests a party to provide a response to a Claim or to furnish additional supporting data, such party shall respond, within ten days after receipt of the request, and shall either (1) provide a response on the requested supporting data, (2) advise the Initial Decision Maker when the response or supporting data will be furnished, or (3) advise the Initial Decision Maker that no supporting data will be furnished. Upon receipt of the response or supporting data, if any, the Initial Decision Maker will either reject or approve the Claim in whole or in part.

**§ 15.2.5** The Initial Decision Maker will render an initial decision approving or rejecting the Claim, or indicating that the Initial Decision Maker is unable to resolve the Claim. This initial decision shall (1) be in writing; (2) state the reasons therefor; and (3) notify the parties and the Architect, if the Architect is not serving as the Initial Decision Maker, of any change in the Contract Sum or Contract Time or both. The initial decision shall be final and binding on the parties but subject to mediation and, if the parties fail to resolve their dispute through mediation, to binding dispute resolution.

**§ 15.2.6** Either party may file for mediation of an initial decision at any time, subject to the terms of Section 15.2.6.1.

§ 15.2.6.1 Either party may, within 30 days from the date of receipt of an initial decision, demand in writing that the other party file for mediation. If such a demand is made and the party receiving the demand fails to file for mediation within 30 days after receipt thereof, then both parties waive their rights to mediate or pursue binding dispute resolution proceedings with respect to the initial decision.

§ 15.2.7 In the event of a Claim against the Contractor, the Owner may, but is not obligated to, notify the surety, if any, of the nature and amount of the Claim. If the Claim relates to a possibility of a Contractor's default, the Owner may, but is not obligated to, notify the surety and request the surety's assistance in resolving the controversy.

§ 15.2.8 If a Claim relates to or is the subject of a mechanic's lien, the party asserting such Claim may proceed in accordance with applicable law to comply with the lien notice or filing deadlines.

### § 15.3 Mediation

§ 15.3.1 Claims, disputes, or other matters in controversy arising out of or related to the Contract, except those waived as provided for in Sections 9.10.4, 9.10.5, and 15.1.7, shall be subject to mediation as a condition precedent to binding dispute resolution.

§ 15.3.2 The parties shall endeavor to resolve their Claims by mediation which, unless the parties mutually agree otherwise, shall be administered by the American Arbitration Association in accordance with its Construction Industry Mediation Procedures in effect on the date of the Agreement. A request for mediation shall be made in writing, delivered to the other party to the Contract, and filed with the person or entity administering the mediation. The request may be made concurrently with the filing of binding dispute resolution proceedings but, in such event, mediation shall proceed in advance of binding dispute resolution proceedings, which shall be stayed pending mediation for a period of 60 days from the date of filing, unless stayed for a longer period by agreement of the parties or court order. If an arbitration is stayed pursuant to this Section 15.3.2, the parties may nonetheless proceed to the selection of the arbitrator(s) and agree upon a schedule for later proceedings.

§ 15.3.3 Either party may, within 30 days from the date that mediation has been concluded without resolution of the dispute or 60 days after mediation has been demanded without resolution of the dispute, demand in writing that the other party file for binding dispute resolution. If such a demand is made and the party receiving the demand fails to file for binding dispute resolution within 60 days after receipt thereof, then both parties waive their rights to binding dispute resolution proceedings with respect to the initial decision.

§ 15.3.4 The parties shall share the mediator's fee and any filing fees equally. The mediation shall be held in the place where the Project is located, unless another location is mutually agreed upon. Agreements reached in mediation shall be enforceable as settlement agreements in any court having jurisdiction thereof.

### § 15.4 Arbitration

§ 15.4.1 If the parties have selected arbitration as the method for binding dispute resolution in the Agreement, any Claim subject to, but not resolved by, mediation shall be subject to arbitration which, unless the parties mutually agree otherwise, shall be administered by the American Arbitration Association in accordance with its Construction Industry Arbitration Rules in effect on the date of the Agreement. The Arbitration shall be conducted in the place where the Project is located, unless another location is mutually agreed upon. A demand for arbitration shall be made in writing, delivered to the other party to the Contract, and filed with the person or entity administering the arbitration. The party filing a notice of demand for arbitration must assert in the demand all Claims then known to that party on which arbitration is permitted to be demanded.

§ 15.4.1.1 A demand for arbitration shall be made no earlier than concurrently with the filing of a request for mediation, but in no event shall it be made after the date when the institution of legal or equitable proceedings based on the Claim would be barred by the applicable statute of limitations. For statute of limitations purposes, receipt of a written demand for arbitration by the person or entity administering the arbitration shall constitute the institution of legal or equitable proceedings based on the Claim.

§ 15.4.2 The award rendered by the arbitrator or arbitrators shall be final, and judgment may be entered upon it in accordance with applicable law in any court having jurisdiction thereof.

§ 15.4.3 The foregoing agreement to arbitrate and other agreements to arbitrate with an additional person or entity duly consented to by parties to the Agreement, shall be specifically enforceable under applicable law in any court having jurisdiction thereof.

**§ 15.4.4 Consolidation or Joinder**

§ 15.4.4.1 Subject to the rules of the American Arbitration Association or other applicable arbitration rules, either party may consolidate an arbitration conducted under this Agreement with any other arbitration to which it is a party provided that (1) the arbitration agreement governing the other arbitration permits consolidation, (2) the arbitrations to be consolidated substantially involve common questions of law or fact, and (3) the arbitrations employ materially similar procedural rules and methods for selecting arbitrator(s).

§ 15.4.4.2 Subject to the rules of the American Arbitration Association or other applicable arbitration rules, either party may include by joinder persons or entities substantially involved in a common question of law or fact whose presence is required if complete relief is to be accorded in arbitration, provided that the party sought to be joined consents in writing to such joinder. Consent to arbitration involving an additional person or entity shall not constitute consent to arbitration of any claim, dispute or other matter in question not described in the written consent.

§ 15.4.4.3 The Owner and Contractor grant to any person or entity made a party to an arbitration conducted under this Section 15.4, whether by joinder or consolidation, the same rights of joinder and consolidation as those of the Owner and Contractor under this Agreement.

# **Additions and Deletions Report for**

## **AIA® Document A201™ – 2017**

This Additions and Deletions Report, as defined on page 1 of the associated document, reproduces below all text the author has added to the standard form AIA document in order to complete it, as well as any text the author may have added to or deleted from the original AIA text. Added text is shown underlined. Deleted text is indicated with a horizontal line through the original AIA text.

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### **PAGE 1**

17-13 OSU College of Med. at Hastings Remodel  
Tahlequah, OK

...

Cherokee Nation Business  
777 West Cherokee St.  
Catoosa, OK 74015

...

James R. Childers, Inc.  
45 South 4<sup>th</sup> Street  
Fort Smith, AR 72901

# Project Manual

Bid Package 04

Underground Utilities/Steel

Vol. 01



COLLEGE OF

Osteopathic Medicine

AT THE CHEROKEE NATION

Tahlequah, Oklahoma

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May 10, 2019



CHILDERS  
ARCHITECT

HKCS

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## LEGEND

First Column:	Current Date for Section
Second Column:	Checked Indicates Section is Included in Current Issue
Third Column:	Section Number
Fourth Column:	Section Title
Fifth Column:	Section Author

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<b>Addendum No. 01</b>		<b>2019-02-08</b>	
<b>Bid Package No. 02,</b>	<b>Rough Grading</b>	<b>2019-02-08</b>	
<b>Schematic Design Package</b>		<b>2019-02-22</b>	
<b>Bulk Steel Package</b>		<b>2019-03-15</b>	<b>Not for Construction</b>
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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).

## VOLUME 1

### DIVISION 00 - PROCUREMENT AND CONTRACTING REQUIREMENTS

	<input type="checkbox"/>	00 1115	Invitation to Bid
	<input type="checkbox"/>	00 2113	Instructions to Bidders
2019-02-08	<input type="checkbox"/>	00 3100	Available Project Information
	<input type="checkbox"/>	00 4100	Bid Form
	<input type="checkbox"/>	00 5200	Agreement Form
	<input type="checkbox"/>	00 6100	Bonds
2019-02-08	<input type="checkbox"/>	00 7200	General Conditions
	<input type="checkbox"/>	00 7300	Supplementary Conditions

### DIVISION 01 - GENERAL REQUIREMENTS

<input type="checkbox"/>	01 0500	Design Selections
<input type="checkbox"/>	01 0510	Exterior Design Selections

17-13 OSU, College of Osteopathic Medicine at  
Cherokee Nation  
Childers Architect  
2019-05-10

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	<input type="checkbox"/>	01 0520	Interior Design Selections
	<input type="checkbox"/>	01 1000	Summary
	<input type="checkbox"/>	01 2100	Allowances
2019-02-08	<input type="checkbox"/>	01 2200	Unit Prices
2019-02-08	<input type="checkbox"/>	01 2300	Alternates
2019-02-08	<input type="checkbox"/>	01 2500	Substitution Procedures
2019-02-08	<input type="checkbox"/>	01 2600	Contract Modification Procedures
2019-02-08	<input type="checkbox"/>	01 2900	Payment Procedures
2019-02-08	<input type="checkbox"/>	01 3100	Project Management and Coordination
2019-02-08	<input type="checkbox"/>	01 3200	Construction Progress Documentation
	<input type="checkbox"/>	01 3233	Photographic Documentation
	<input type="checkbox"/>	01 3300	Submittal Procedures
	<input type="checkbox"/>	01 4000	Quality Requirements
	<input type="checkbox"/>	01 4200	References
2019-02-08	<input type="checkbox"/>	01 4323	Special Inspection
2019-02-08	<input type="checkbox"/>	01 4339	Visual Mock-Up Requirements
2019-02-08	<input type="checkbox"/>	01 4516	Field Test for Water Leakage
	<input type="checkbox"/>	01 4540	Testing Mock-Up for Building Enclosure Systems
2019-02-08	<input type="checkbox"/>	01 5000	Temporary Facilities and Controls
2019-02-08	<input type="checkbox"/>	01 6000	Product Requirements
2019-02-08	<input type="checkbox"/>	01 7300	Execution
2019-02-08	<input type="checkbox"/>	01 7419	Construction Waste Management and Disposal
	<input type="checkbox"/>	01 7420	LEED Construction Waste Management and Disposal
2019-02-08	<input type="checkbox"/>	01 7700	Closeout Procedures
2019-02-08	<input type="checkbox"/>	01 7823	Operations and Maintenance Data
2019-02-08	<input type="checkbox"/>	01 7839	Project Record Documents
2019-02-08	<input type="checkbox"/>	01 7900	Demonstration and Training
	<input type="checkbox"/>	01 7910	Demonstration and Training
2019-02-08	<input type="checkbox"/>	01 8111	Sustainable Construction Requirements
	<input type="checkbox"/>	01 8112	LEED Construction Requirements
	<input type="checkbox"/>	01 8113	LEED Construction Requirements for New Construction and Major Renovations
	<input type="checkbox"/>	01 8123	LEED Construction Requirements for Commercial Interiors
	<input type="checkbox"/>	01 8133	LEED Construction Requirements for Core and Shell Development
	<input type="checkbox"/>	01 8143	LEED Construction Requirements for Schools
2019-02-08	<input type="checkbox"/>	01 9113	General Commissioning Requirements

## **DIVISION 02 - EXISTING CONDITIONS**

2019-01-18	<input type="checkbox"/>	02 1113	Selective Site Demolition
		02 1116	Building Demolition
	<input type="checkbox"/>	02 4119	Selective Demolition

## **DIVISION 03 - CONCRETE**

	<input type="checkbox"/>	03 0150	Concrete Patching
2019-03-20	<input type="checkbox"/>	03 1000	Concrete Forming and Accessories
	<input type="checkbox"/>	03 1100	Concrete Forming



	<input type="checkbox"/>	03 1500	Concrete Accessories
2019-03-20	<input type="checkbox"/>	03 2000	Concrete Reinforcing
2019-03-20	<input type="checkbox"/>	03 3000	Cast-In-Place Concrete
2019-04-19	<input type="checkbox"/>	03 3500	Concrete Finishing
2019-04-19	<input type="checkbox"/>	03 3543	Polished Concrete
	<input type="checkbox"/>	03 3600	Special Concrete Finishes
	<input type="checkbox"/>	03 3800	Post-Tensioned Concrete
	<input type="checkbox"/>	03 4100	Plant-Precast Structural Concrete
	<input type="checkbox"/>	03 4500	Architectural Precast Concrete
	<input type="checkbox"/>	03 4713	Tilt-Up Concrete
	<input type="checkbox"/>	03 4900	Glass-Fiber Reinforced Precast Concrete (GFRC)
	<input type="checkbox"/>	03 5216	Lightweight Insulating Concrete
	<input type="checkbox"/>	03 5300	Concrete Toppings
	<input type="checkbox"/>	03 5416	Hydraulic Cement Underlayment

#### **DIVISION 04 - MASONRY**

	<input type="checkbox"/>	04 2100	Masonry Veneer
2019-03-20	<input type="checkbox"/>	04 2200	Concrete Unit Masonry
	<input type="checkbox"/>	04 2300	Glass Unit Masonry
2019-04-19	<input type="checkbox"/>	04 4200	Exterior Stone Cladding
	<input type="checkbox"/>	04 4216	Steel Supported Stone Cladding
	<input type="checkbox"/>	04 7200	Cast Stone Masonry
	<input type="checkbox"/>	04 7500	Adhered Masonry Veneer

#### **DIVISION 05 – METALS**

2019-05-10	<input checked="" type="checkbox"/>	05 1000	Structural Steel
	<input type="checkbox"/>	05 1200	Structural Steel Framing
2019-05-10	<input checked="" type="checkbox"/>	05 1213	Architecturally Exposed Structural Steel (AESS) Framing
	<input type="checkbox"/>	05 1636	Barrier Cables
	<input type="checkbox"/>	05 2100	Steel Joists Framing
2019-05-10	<input checked="" type="checkbox"/>	053000	Metal Decking
	<input type="checkbox"/>	05 3100	Steel Decking
	<input type="checkbox"/>	05 3123	Steel Roof Deck System
	<input type="checkbox"/>	05 3133	Permanent Metal Forming
2019-05-10	<input checked="" type="checkbox"/>	05 4000	Cold-Formed Steel Framing
2019-04-19	<input type="checkbox"/>	05 4300	Slotted Channel Framing
2019-05-10	<input checked="" type="checkbox"/>	05 5000	Metal Fabrications
2019-05-10	<input checked="" type="checkbox"/>	05 5100	Metal Stairs
2019-04-19	<input type="checkbox"/>	05 5213	Pipe and Tube Railings
2019-04-19	<input type="checkbox"/>	05 5300	Metal Gratings
	<input type="checkbox"/>	05 5813	Ornamental Metal Column Covers
2019-05-10	<input checked="" type="checkbox"/>	05 6000	Metal Equipment Support System
2019-04-19	<input type="checkbox"/>	05 7000	Ornamental Metal
2019-04-19	<input type="checkbox"/>	05 7300	Ornamental Handrails and Railings

## DIVISION 06 - WOOD, PLASTICS, AND COMPOSITES

2019-04-19	<input type="checkbox"/>	06 1053	Miscellaneous Rough Carpentry
2019-04-19	<input type="checkbox"/>	06 1643	Exterior Gypsum Sheathing
2019-04-19	<input type="checkbox"/>	06 4023	Interior Architectural Woodwork
	<input type="checkbox"/>	06 4223	Slatwall Paneling
	<input type="checkbox"/>	06 6100	Simulated Stone Fabrications
2019-04-19	<input type="checkbox"/>	06 6400	Plastic (FRP) Paneling
	<input type="checkbox"/>	06 6413	Translucent Resin Panel Fabrications
	<input type="checkbox"/>	06 6419	Simulated Stone Paneling
	<input type="checkbox"/>	06 6713	Louvered Light Diffusers
	<input type="checkbox"/>	06 6813	Plastic Gratings

## DIVISION 07 - THERMAL AND MOISTURE PROTECTION

	<input type="checkbox"/>	07 0151	Preparation for Re-Roofing
	<input type="checkbox"/>	07 0152	Patching of Existing Roofing
	<input type="checkbox"/>	07 1114	Asphalt Mastic Dampproofing
	<input type="checkbox"/>	07 1328	Pre-Applied Sheet Waterproofing
	<input type="checkbox"/>	07 1352	Modified Bituminous Sheet Waterproofing
	<input type="checkbox"/>	07 1413	Hot Fluid-Applied Rubberized Asphalt Waterproofing
2019-04-19	<input type="checkbox"/>	07 1416	Cold Fluid Applied Waterproofing
2019-04-19	<input type="checkbox"/>	07 1616	Crystalline Waterproofing
	<input type="checkbox"/>	07 1700	Bentonite Waterproofing
	<input type="checkbox"/>	07 1800	Traffic Coatings
	<input type="checkbox"/>	07 1900	Water Repellents
2019-04-19	<input type="checkbox"/>	07 2100	Thermal Insulation
2019-04-19	<input type="checkbox"/>	07 2119	Spray-Applied Foam Insulation
2019-04-19	<input type="checkbox"/>	07 2400	EIFS
	<input type="checkbox"/>	07 2423	DEFS for Soffits
	<input type="checkbox"/>	07 2500	Mechanically Fastened Air and Water Barriers
2019-03-20	<input type="checkbox"/>	07 2600	Under-Slab Vapor Retarder
	<input type="checkbox"/>	07 2613	Rubberized Asphalt Vapor Retarders
	<input type="checkbox"/>	07 2617	Below Slab Vapor Retarders
	<input type="checkbox"/>	07 2713	Self-Adhering Air and Water Barriers
	<input type="checkbox"/>	07 3113	Asphalt Shingles
	<input type="checkbox"/>	07 3127	Simulated Slate Roofing
	<input type="checkbox"/>	07 3200	Roof Tiles
2019-04-19	<input type="checkbox"/>	07 4114	Metal Roof Panels
2019-04-19	<input type="checkbox"/>	07 4213	Formed Metal Wall Panels
	<input type="checkbox"/>	07 4216	Modular Metal Wall Panels
	<input type="checkbox"/>	07 4229	Terra Cotta Wall Panels
	<input type="checkbox"/>	07 4243	Composite Metal Wall Panels
	<input type="checkbox"/>	07 4263	Insulated-Core Metal Wall Panels
	<input type="checkbox"/>	07 5013	Single-Ply Membrane Roofing
2019-04-19	<input type="checkbox"/>	07 5216	Modified Bituminous Membrane Roofing
	<input type="checkbox"/>	07 5556	Fluid-Applied Protected Membrane Roofing
	<input type="checkbox"/>	07 5563	Vegetated Protected Membrane Roofing
2019-04-19	<input type="checkbox"/>	07 6200	Flashing and Sheet Metal

2019-04-19	<input type="checkbox"/>	07 7200	Roof Accessories
	<input type="checkbox"/>	07 7600	Roof Pavers and Pedestal Assemblies
	<input type="checkbox"/>	07 8116	Cementitious Fireproofing
	<input type="checkbox"/>	07 8123	Intumescent Mastic Fireproofing
2019-04-19	<input type="checkbox"/>	07 8413	Penetration Firestopping
2019-04-19	<input type="checkbox"/>	07 8446	Fire-Resistive Joint Firestopping
	<input type="checkbox"/>	07 9100	Preformed Joint Seals
2019-04-19	<input type="checkbox"/>	07 9200	Joint Sealants
	<input type="checkbox"/>	07 9500	Expansion Control

## **DIVISION 08 - OPENINGS**

	<input type="checkbox"/>	08 0610	Door Schedule
2019-04-19	<input type="checkbox"/>	08 1113	Hollow Metal Doors and Frames
	<input type="checkbox"/>	08 1114	Interior Hollow Metal Frames
	<input type="checkbox"/>	08 1170	Steel Fire Door and Frame Assembly
2019-04-19	<input type="checkbox"/>	08 1216	Interior Aluminum Frames
2019-04-19	<input type="checkbox"/>	08 1416	Prefinished Flush Wood Doors
	<input type="checkbox"/>	08 1433	Stile and Rail Wood Doors
2019-04-19	<input type="checkbox"/>	08 3113	Access Doors and Frames
2019-04-19	<input type="checkbox"/>	08 3213	Sliding Aluminum-Framed Glass Doors
	<input type="checkbox"/>	08 3313	Coiling Counter Doors
	<input type="checkbox"/>	08 3323	Overhead Coiling Doors
	<input type="checkbox"/>	08 3326	Overhead Coiling Grilles
	<input type="checkbox"/>	08 3338	Interior Side Coiling Grilles
2019-04-19	<input type="checkbox"/>	08 3400	Special – Function Doors
	<input type="checkbox"/>	08 3470	Acoustical Metal Door, Window, and Frame Assemblies
	<input type="checkbox"/>	08 3513	Folding Doors
	<input type="checkbox"/>	08 3515	Accordion Folding Fire Doors
	<input type="checkbox"/>	08 3613	Sectional Overhead Doors
2019-04-19	<input type="checkbox"/>	08 4110	Interior Storefront
	<input type="checkbox"/>	08 4127	Exterior All-Glass Entrances and Storefronts
	<input type="checkbox"/>	08 4128	Interior All-Glass Entrances and Storefronts
	<input type="checkbox"/>	08 4213	Exterior Aluminum Entrance Doors
2019-04-19	<input type="checkbox"/>	08 4216	Interior Aluminum Entrance Doors
2019-04-19	<input type="checkbox"/>	08 4229	Automatic Entrances
	<input type="checkbox"/>	08 4233	Revolving Entrance Doors
2019-04-19	<input type="checkbox"/>	08 4243	Medical Specialty Sliding Entrances
2019-04-19	<input type="checkbox"/>	08 4400	Glazed Aluminum Framing Systems
	<input type="checkbox"/>	08 4426	Structural Glass Curtainwall
	<input type="checkbox"/>	08 4500	Translucent Insulating Panel Assemblies
	<input type="checkbox"/>	08 5113	Aluminum Windows
2019-04-19	<input type="checkbox"/>	08 5619	Sliding Pass Windows
	<input type="checkbox"/>	08 5656	Bullet-Resistive Windows
	<input type="checkbox"/>	08 6200	Unit Skylights
	<input type="checkbox"/>	08 6300	Metal-Framed Skylights
2019-04-19	<input type="checkbox"/>	08 7100	Door Hardware
	<input type="checkbox"/>	08 7121	Interior Automatic Door Operators for Staff Use
2019-04-19	<input type="checkbox"/>	08 7122	Automatic Door Operators for the Disabled
2019-04-19	<input type="checkbox"/>	08 8000	Glazing

2019-04-19	<input type="checkbox"/>	08 8300	Unframed Mirrored Glazing
	<input type="checkbox"/>	08 8816	Between Glass Blinds Units
	<input type="checkbox"/>	08 8840	Switchable Privacy Glass Units
	<input type="checkbox"/>	08 9100	Wall Louvers

## DIVISION 09 - FINISHES

	<input type="checkbox"/>	09 0565	Floor Preparation for Renovation Work
	<input type="checkbox"/>	09 0600	Room Finish Schedule
	<input type="checkbox"/>	09 2300	Gypsum Plastering
	<input type="checkbox"/>	09 2400	Portland Cement Plastering
	<input type="checkbox"/>	09 2600	Veneer Plastering
	<input type="checkbox"/>	09 2613	Gypsum Veneer Plastering
	<input type="checkbox"/>	09 2713	GFRG Fabrications
2019-04-19	<input type="checkbox"/>	09 2900	Gypsum Board Assemblies
2019-04-19	<input type="checkbox"/>	09 3000	Tiling
2019-04-19	<input type="checkbox"/>	09 5113	Acoustical Panel Ceilings
	<input type="checkbox"/>	09 5133	Acoustical Metal Pan Ceilings
	<input type="checkbox"/>	09 5135	Snap-in Metal Pan Ceilings
2019-04-19	<input type="checkbox"/>	09 5423	Linear Metal Ceilings
	<input type="checkbox"/>	09 5436	Suspended Decorative Grids
2019-04-19	<input type="checkbox"/>	09 6115	Concrete Floor Sealer
	<input type="checkbox"/>	09 6116	Liquid Floor Hardener
	<input type="checkbox"/>	09 6119	Moisture Floor Treatment
	<input type="checkbox"/>	09 6340	Stone Flooring
	<input type="checkbox"/>	09 6400	Wood Flooring
2019-04-19	<input type="checkbox"/>	09 6500	Resilient Flooring
2019-04-19	<input type="checkbox"/>	09 6513	Resilient Base and Accessories
	<input type="checkbox"/>	09 6520	Interlocking Rubber Tile Flooring
2019-04-19	<input type="checkbox"/>	09 6603	Precast Terrazzo Flooring for Stairs
	<input type="checkbox"/>	09 6613	Thick-Set Terrazzo Flooring
2019-04-19	<input type="checkbox"/>	09 6623	Thin-Set Terrazzo Flooring
	<input type="checkbox"/>	09 6723	Resinous Flooring
2019-04-19	<input type="checkbox"/>	09 6800	Carpeting
	<input type="checkbox"/>	09 6900	Access Flooring
2019-04-19	<input type="checkbox"/>	09 7200	Wall Covering
	<input type="checkbox"/>	09 7213	Tackboard Wall Coverings
	<input type="checkbox"/>	09 7500	Interior Stone Facing
	<input type="checkbox"/>	09 7723	Fabric Wrapped Panels
2019-04-19	<input type="checkbox"/>	09 8433	Acoustical Wall Panels
2019-04-19	<input type="checkbox"/>	09 9100	Painting
	<input type="checkbox"/>	09 9413	Textured Interior Coatings
	<input type="checkbox"/>	09 9600	High-Performance Coatings
	<input type="checkbox"/>	09 9613	Multicolored Interior Coatings
2019-04-19	<input type="checkbox"/>	09 9653	Elastomeric Coatings
2019-04-19	<input type="checkbox"/>	09 9663	Textured Acrylic Coating

## DIVISION 10 - SPECIALTIES

2019-04-19	<input type="checkbox"/>	10 1100	Visual Display Boards
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	<input type="checkbox"/>	10 1146	Visual Display Fabrics
2019-04-19	<input type="checkbox"/>	10 1400	Interior Signage
	<input type="checkbox"/>	10 1443	Photoluminescent Exit Path Marking System
	<input type="checkbox"/>	10 1700	Telephone Specialties
2019-04-19	<input type="checkbox"/>	10 2113	Toilet Compartments
2019-04-19	<input type="checkbox"/>	10 2115	Cubicle Specialties
	<input type="checkbox"/>	10 2213	Wire Mesh Partitions
	<input type="checkbox"/>	10 2223	Accordion Folding Partitions
2019-04-19	<input type="checkbox"/>	10 2238	Operable Panel Partition
	<input type="checkbox"/>	10 2239	Vertically Folding Panel Partitions
2019-04-19	<input type="checkbox"/>	10 2613	Wall and Corner Guards
2019-04-19	<input type="checkbox"/>	10 2813	Toilet Accessories
	<input type="checkbox"/>	10 2819	Shower Doors and Enclosures
2019-04-19	<input type="checkbox"/>	10 4116	Emergency Key Cabinets
2019-04-19	<input type="checkbox"/>	10 4400	Fire Protection Specialties
	<input type="checkbox"/>	10 4450	Automated External Defibrillators (AED)
2019-04-19	<input type="checkbox"/>	10 5113	Metal Lockers
2019-04-19	<input type="checkbox"/>	10 5116	Wood Lockers
	<input type="checkbox"/>	10 5503	USPS-Delivery Postal Specialties
	<input type="checkbox"/>	10 5506	Private-Delivery Postal Specialties
2019-04-19	<input type="checkbox"/>	10 5713	Wall Mounted Coat Rack and Shelf
	<input type="checkbox"/>	10 7113	Exterior Sun Control Devices
2019-04-19	<input type="checkbox"/>	10 7500	Flagpoles

## **DIVISION 11 - EQUIPMENT**

	<input type="checkbox"/>	11 1300	Loading Dock Equipment
2019-04-19	<input type="checkbox"/>	11 2400	Building Maintenance Equipment
2019-04-19	<input type="checkbox"/>	11 5213	Projection Screens
2019-04-19	<input type="checkbox"/>	11 7000	Medical Equipment
	<input type="checkbox"/>	11 7313	Wall-Mounted Fold-Up Writing Surface
	<input type="checkbox"/>	11 7316	Wall-Mounted Chart Rack

## **DIVISION 12 - FURNISHINGS**

	<input type="checkbox"/>	12 2113	Horizontal Louver Blinds
	<input type="checkbox"/>	12 2116	Vertical Louver Blinds
2019-04-19	<input type="checkbox"/>	12 2413	Roller Window Shades
	<input type="checkbox"/>	12 2500	Between Glass Blinds
	<input type="checkbox"/>	12 3553	Laboratory Casework
2019-04-19	<input type="checkbox"/>	12 3571	Stainless Steel Casework
	<input type="checkbox"/>	12 3640	Stone Countertops
2019-04-19	<input type="checkbox"/>	12 3661	Simulated Stone Countertops
	<input type="checkbox"/>	12 4816	Entrance Floor Grilles
2019-04-19	<input type="checkbox"/>	12 4843	Entrance Floor Mats
	<input type="checkbox"/>	12 6300	Stadium Seating
2019-04-19	<input type="checkbox"/>	12 9313	Bicycle Racks

## **DIVISION 13 - SPECIAL CONSTRUCTION**

<input type="checkbox"/>	13 2817	Ballpark Netting and Supports
--------------------------	---------	-------------------------------

	<input type="checkbox"/>	13 3448	Pre-Fabricated Rooftop Helipad
	<input type="checkbox"/>	13 4900	Radiation Protection
	<input type="checkbox"/>	13 4923	RF/MRI Modular Shielding Enclosure
2019-05-10	<input checked="" type="checkbox"/>	13 8500	Seismic Protection

## DIVISION 14 - CONVEYING EQUIPMENT

	<input type="checkbox"/>	14 1000	Dumbwaiters
2019-05-10	<input checked="" type="checkbox"/>	14 2100	Electric Traction Elevators
	<input type="checkbox"/>	14 2400	Hydraulic Elevators
	<input type="checkbox"/>	14 3100	Escalators
	<input type="checkbox"/>	14 9100	Chutes
	<input type="checkbox"/>	14 9200	Pneumatic Tube Systems

## DIVISION 31 - EARTHWORK

2019-01-18	<input type="checkbox"/>	31 1000	Site Clearing
	<input type="checkbox"/>	31 2000	Earth Moving
2019-02-08	<input type="checkbox"/>	31 2200	Grading
2019-02-08	<input type="checkbox"/>	31 2300	Excavation and Fill
2019-03-20	<input type="checkbox"/>	31 2311	Earthwork for Building Construction
	<input type="checkbox"/>	31 2400	Earthwork for Structures
2019-01-18	<input type="checkbox"/>	31 2500	Erosion and Sedimentation Controls
	<input type="checkbox"/>	31 3116	Termite Control
	<input type="checkbox"/>	31 6213	Prestressed Concrete Piles
	<input type="checkbox"/>	31 6216	Steel H Piles
	<input type="checkbox"/>	31 6218	Mini-Piles
	<input type="checkbox"/>	31 6329	Drilled Concrete Piers

## DIVISION 32 - EXTERIOR IMPROVEMENTS

2019-02-08	<input type="checkbox"/>	32 1100	Base Courses
2019-04-19	<input type="checkbox"/>	32 1200	Flexible Paving
2019-02-08	<input type="checkbox"/>	32 1300	Rigid Paving
	<input type="checkbox"/>	32 1313	Concrete Paving
2019-02-08	<input type="checkbox"/>	32 1373	Concrete Paving Joint Sealants
		32 1413	Interlocking Precast Concrete Paving
	<input type="checkbox"/>	32 1416	Brick unit Paving
	<input type="checkbox"/>	32 1440	Stone Paving
2019-02-08	<input type="checkbox"/>	321613	Curbs and Gutters
	<input type="checkbox"/>	32 1715	Parking Accessories
	<input type="checkbox"/>	32 3113	Chain Link Fencing
	<input type="checkbox"/>	32 3115	Tubular Steel Fencing
	<input type="checkbox"/>	32 3117	Gate Operators
	<input type="checkbox"/>	32 3121	Cable Guardrail System

## DIVISION 33 - UTILITIES

	<input type="checkbox"/>	33 1000	Water Utilities
2019-05-10	<input checked="" type="checkbox"/>	33 3000	Sanitary Sewerage Utilities
2019-05-10	<input checked="" type="checkbox"/>	33 3200	Wastewater Utility Pumping stations
2019-04-19	<input type="checkbox"/>	33 3400	Sanitary Utility Sewerage Force Mains
2019-05-10	<input checked="" type="checkbox"/>	33 4000	Storm Drainage Utilities
2019-05-10	<input checked="" type="checkbox"/>	33 4600	Sub drainage Pipe
	<input type="checkbox"/>	33 4613	Foundation Drainage System

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# Project Manual

Bid Package 04  
Underground Utilities/Steel  
Vol. 02



COLLEGE OF  
**Osteopathic Medicine**  
AT THE CHEROKEE NATION

Tahlequah, Oklahoma



05/10/2019  
CA5338(PE)

May 10, 2019



Division	Section Title	Pages
<b>PROCUREMENT AND CONTRACTING DOCUMENTS GROUP</b>		
<b>DIVISION 00 - PROCUREMENT AND CONTRACTING REQUIREMENTS</b>		
NOT APPLICABLE		
<b>SPECIFICATIONS GROUP</b>		
<i>Facility Services Subgroup</i>		
<b>DIVISION 21 - FIRE SUPPRESSION</b>		
21 1100	FACILITY FIRE-SUPPRESSION WATER-SERVICE PIPING	14
<b>DIVISION 22 - PLUMBING</b>		
22 0517	SLEEVES AND SLEEVE SEALS FOR PLUMBING PIPING	4
22 0553	IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT	6
22 1116	DOMESTIC WATER PIPING	10
22 1316	SANITARY WASTE AND VENT PIPING	10
22 1124	FACILITY NATURAL GAS	12
22 1319	SANITARY WASTE PIPING SPECIALTIES	8
22 1413	FACILITY STORM DRAINAGE PIPING	10
22 1423	STORM DRAINAGE PIPING SPECIALTIES	4
22 1429	SUMP PUMPS	6
<b>DIVISION 23 - HEATING, VENTILATING, AND AIR CONDITIONING (HVAC)</b>		
23 0517	SLEEVES AND SLEEVE SEALS FOR HVAC PIPING	4
23 2300	REFRIGERANT PIPING	6
<b>DIVISION 26 - ELECTRICAL</b>		
26 0526	GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS	10
26 0533	RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS	12
26 0539	UNDERFLOOR RACEWAYS FOR ELECTRICAL SYSTEMS	8
26 0543	UNDERGROUND DUCTS AND RACEWAYS FOR ELECTRICAL SYSTEMS	14
26 0544	SLEEVES AND SLEEVE SEALS FOR ELECTRICAL RACEWAYS AND CABLING	4
26 0553	IDENTIFICATION FOR ELECTRICAL SYSTEMS	10

**END OF TABLE OF CONTENTS**

## **SECTION 01 2200**

### **UNIT PRICES**

#### **PART 1 - GENERAL**

##### **1.1 SUMMARY**

- A. Section includes administrative and procedural requirements for unit prices.

##### **1.2 DEFINITIONS**

- A. Unit price is an amount incorporated in the Agreement, applicable during the duration of the Work as a price per unit of measurement for materials, equipment, or services, or a portion of the Work, added to or deducted from the Contract Sum by appropriate modification, if the scope of Work or estimated quantities of Work required by the Contract Documents are increased or decreased.

##### **1.3 PROCEDURES**

- A. Unit prices include all necessary material, plus cost for delivery, installation, insurance, applicable taxes, overhead, and profit.
- B. Measurement and Payment: See individual Specification Sections for work that requires establishment of unit prices. Methods of measurement and payment for unit prices are specified in those Sections.
- C. Owner reserves the right to reject Contractor's measurement of work-in-place that involves use of established unit prices and to have this work measured, at Owner's expense, by an independent surveyor acceptable to Contractor.
- D. List of Unit Prices: A schedule of unit prices is included in Part 3. Specification Sections referenced in the schedule contain requirements for materials described under each unit price.

#### **PART 2 - PRODUCTS (Not Used)**

#### **PART 3 - EXECUTION**

##### **3.1 SCHEDULE OF UNIT PRICES**

- A. Item No. 1 - Rock Excavation:
1. Description: Rock excavation in accordance with Division 31 Section "Earthwork".
  2. Unit of Measurement: Cubic yard of rock excavated.

**END OF SECTION**

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UNIT PRICES

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## **SECTION 01 2300**

### **ALTERNATES**

#### **PART 1 - GENERAL**

##### **1.1 SUMMARY**

- A. Section includes administrative and procedural requirements for alternates.

##### **1.2 DEFINITIONS**

- A. Alternate: An amount proposed by bidders and stated on the Bid Form for certain work defined in the bidding requirements that may be added to or deducted from the base bid amount if Owner decides to accept a corresponding change either in the amount of construction to be completed or in the products, materials, equipment, systems, or installation methods described in the Contract Documents.
  - 1. Alternates described in this Section are part of the Work only if enumerated in the Agreement.
  - 2. The cost or credit for each alternate is the net addition to or deduction from the Contract Sum to incorporate alternate into the Work. No other adjustments are made to the Contract Sum.

##### **1.3 PROCEDURES**

- A. Documentation: Show compliance with requirements for accepted alternates and the following, as applicable:
  - 1. Coordination information, including a list of changes or revisions needed to other parts of the Work and to construction performed by Owner and separate contractors that will be necessary to accommodate accepted alternates.
  - 2. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
  - 3. Samples, where applicable or requested.
  - 4. Certificates and qualification data, where applicable or requested.
  - 5. Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
  - 6. Research reports evidencing compliance with building code in effect for Project, from ICC-ES.
  - 7. Detailed comparison of Contractor's construction schedule using accepted alternates with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating date of receipt of purchase order, lack of availability, or delays in delivery.
  - 8. Cost information, including change in the Contract Sum.
- B. Coordination: Revise or adjust affected adjacent work as necessary to completely integrate work of the alternate into Project.

1. Include as part of each alternate, miscellaneous devices, accessory objects, and similar items incidental to or required for a complete installation whether or not indicated as part of alternate.
- C. Notification: Immediately following award of the Contract, notify each party involved, in writing, of the status of each alternate. Indicate if alternates have been accepted, rejected, or deferred for later consideration. Include a complete description of negotiated revisions to alternates.
- D. Execute accepted alternates under the same conditions as other work of the Contract.
- E. Schedule: A schedule of alternates is included at the end of this Section. Specification Sections referenced in schedule contain requirements for materials necessary to achieve the work described under each alternate.
- F. Acceptance of Alternates will be exercised at option of Owner in any order or combination.

## **PART 2 - PRODUCTS (Not Used)**

## **PART 3 - EXECUTION**

### **3.1 SCHEDULE OF ALTERNATES**

- A. ALTERNATE NO. 1:
- B. ALTERNATE NO. 2:

**END OF SECTION**



## **SECTION 01 2500**

### **SUBSTITUTION PROCEDURES**

#### **PART 1 - GENERAL**

##### **1.1 SUMMARY**

- A. Section includes administrative and procedural requirements for substitutions.

##### **1.2 DEFINITIONS**

- A. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Contractor.
  - 1. Substitutions for Cause: Changes proposed by Contractor that are required due to changed Project conditions, such as unavailability of product, regulatory changes, or unavailability of required warranty terms.
  - 2. Substitutions for Convenience: Changes proposed by Contractor or Owner that are not required in order to meet other Project requirements but may offer advantage to Contractor or Owner.

##### **1.3 SUBMITTALS**

- A. Substitution Requests: Submit electronic copies of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
  - 1. Substitution Request Form: Use scanned PDF electronic file of form provided at end of this section or annotated PDF electronic file of electronic form received from Architect matching form provided at end of this section.
  - 2. Documentation: Show compliance with requirements for substitutions and the following, as applicable:
    - a. Statement indicating why specified product or fabrication or installation cannot be provided, if applicable.
    - b. Coordination information, including a list of changes or revisions needed to other parts of the Work and to construction performed by Owner and separate contractors that will be necessary to accommodate proposed substitution.
    - c. Detailed comparison of significant qualities of proposed substitution with those of the Work specified. Include annotated copy of applicable Specification Section. Significant qualities may include attributes such as performance, weight, size, durability, visual effect, sustainable design characteristics, warranties, and specific features and requirements indicated. Indicate deviations, if any, from the Work specified.
    - d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
    - e. Samples, where applicable or requested.
    - f. Certificates and qualification data, where applicable or requested.
    - g. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners.
    - h. Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
    - i. Research reports evidencing compliance with building code in effect for Project, from ICC-ES.

- j. Detailed comparison of Contractor's construction schedule using proposed substitution with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating date of receipt of purchase order, lack of availability, or delays in delivery.
  - k. Cost information, including a proposal of change, if any, in the Contract Sum.
  - l. Contractor's certification that proposed substitution complies with requirements in the Contract Documents except as indicated in substitution request, is compatible with related materials, and is appropriate for applications indicated.
  - m. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.
3. Architect's Action: If necessary, with reasonable promptness, Architect will request additional information or documentation for evaluation. Architect will notify Contractor of acceptance or rejection of proposed substitution with reasonable promptness. Acceptance of proposed substitution does not constitute approval or inclusion in Contract Documents. Pay applications certification, change orders, and certificate of substantial completion will contain such qualification.

#### **1.4 QUALITY ASSURANCE**

- A. Compatibility of Substitutions: Investigate and document compatibility of proposed substitution with related products and materials. Engage a qualified testing agency to perform compatibility tests recommended by manufacturers.

#### **1.5 PROCEDURES**

- A. Coordination: Revise or adjust affected work as necessary to integrate work of the approved substitutions.

### **PART 2 - PRODUCTS**

#### **2.1 SUBSTITUTIONS**

- A. Prior to starting Substitution Process, review proposed recommendations with Architect.
- B. Contractor's submittal and Architect's acceptance of Shop Drawings, Product Data or Samples for construction activities not complying with Contract Documents does not constitute acceptable or valid request for substitution, nor does it constitute approval.
- C. Contractor Representations: By making substitution request, Contractor:
  - 1. Recognizes burden of proof of equality for requested substitution rests with Contractor.
  - 2. Represents and warrants that Contractor has personally investigated requested substitution and determined that it is equal to or superior in all respects to specified Work.
  - 3. Represents and warrants that Contractor will provide same warranties for requested substitution that Contractor would for specified Work.
  - 4. Certifies that cost data presented is complete and includes all related costs under this Contract except for Architect's redesign cost, and waives all claims for additional costs related to requested substitution which may subsequently become apparent.
  - 5. Will coordinate installation of accepted substitution, making such other changes as may be required to make Work complete in all respects.

## SUBSTITUTION PROCEDURES

6. Represents and warrants that accepted substitution will perform same as specified Work would have performed. Should accepted substitution fail to perform as required, Contractor shall replace accepted substitution with specified Work at no additional cost to Owner.
- D. Substitutions for Cause: Submit requests for substitution immediately on discovery of need for change.
1. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:
    - a. Requested substitution is consistent with the Contract Documents and will produce indicated results.
    - b. Requested substitution provides sustainable design characteristics that specified product provided.
    - c. Substitution request is fully documented and properly submitted.
    - d. Requested substitution will not adversely affect Contractor's construction schedule.
    - e. Requested substitution has received necessary approvals of authorities having jurisdiction.
    - f. Requested substitution is compatible with other portions of the Work.
    - g. Requested substitution has been coordinated with other portions of the Work.
    - h. Requested substitution provides specified warranty.
- E. Substitutions for Convenience:
1. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:
    - a. Requested substitution offers Owner a substantial advantage in cost, time, energy conservation, or other considerations, after deducting additional responsibilities Owner must assume. Owner's additional responsibilities may include compensation to Architect for redesign and evaluation services, increased cost of other construction by Owner, and similar considerations.
    - b. Requested substitution does not require extensive revisions to the Contract Documents.
    - c. Requested substitution is consistent with the Contract Documents and will produce indicated results.
    - d. Requested substitution provides sustainable design characteristics that specified product provided.
    - e. Substitution request is fully documented and properly submitted.
    - f. Requested substitution will not adversely affect Contractor's construction schedule.
    - g. Requested substitution has received necessary approvals of authorities having jurisdiction.
    - h. Requested substitution is compatible with other portions of the Work.
    - i. Requested substitution has been coordinated with other portions of the Work.
    - j. Requested substitution provides specified warranty.

**PART 3 - EXECUTION (Not Used)**

**END OF SECTION**

## Substitution Request Form 012500a

To Contract Manager \_\_\_\_\_

Project No. \_\_\_\_\_

Project Name \_\_\_\_\_

Specified Item \_\_\_\_\_

Section	Page	Paragraph	Description
---------	------	-----------	-------------

The undersigned General Contractor requests consideration of the following:

Proposed Substitution \_\_\_\_\_

(Include all product data as indicated in Specification Section 01 2500 and any supplemental information as requested by the Architect.)

The undersigned General Contractor warrants to the Architect and Owner that the following paragraphs, unless modified on attachments, are correct.

1. The Proposed Substitution does not affect dimensions shown on Drawings.
2. The cost reduction/increase indicated in item 5 below includes costs for changes to the building design, including engineering, design, detailing and construction costs caused by the requested Substitution. Any additional costs resulting from this substitution will be reimbursed from the cost savings in item 5 or, in it's absence, funded as a project cost.
3. The Proposed Substitution will have no adverse affect on other trades, the construction schedule, or specified warranty requirements.
4. Maintenance and service parts will be locally available for the Proposed Substitution.

The General Contractor further warrants to the Architect and Owner that the function and quality of the Proposed Substitution are equivalent or superior to the Specified Item. The General Contractor further warrants that specification section 01 2500, paragraph 2.1G intent has been met.

5. Total Cost Savings/Increase to the Owner: \$ \_\_\_\_\_
6. Compensation to the Architect / Consultant for related Additional Service Fee: \$ \_\_\_\_\_

### Manufacturer's Certification of Equal Quality

I \_\_\_\_\_ represent the manufacturer of the Proposed Substitution item and hereby certify and warrant to the Architect and Owner that the function and quality of the Proposed Substitution are equivalent or superior to the Specified Item.

\_\_\_\_\_  
Manufacturer's Representative

\_\_\_\_\_  
Date

\_\_\_\_\_  
Company

### Acceptances

1.

\_\_\_\_\_  
General Contractor Acceptance

\_\_\_\_\_  
Date

\_\_\_\_\_  
Company

2.

\_\_\_\_\_  
Owner Acceptance

\_\_\_\_\_  
Date

\_\_\_\_\_  
Company

3.

\_\_\_\_\_  
Architect Acceptance

\_\_\_\_\_  
Date

\_\_\_\_\_  
Company

**Recommend Acceptance:**

☐ Yes

☐ No

## **SECTION 01 2900**

### **PAYMENT PROCEDURES**

#### **PART 1 - GENERAL**

##### **1.1 SUMMARY**

- A. Section includes administrative and procedural requirements necessary to prepare and process Applications for Payment.

##### **1.2 SCHEDULE OF VALUES**

- A. Coordination: Coordinate preparation of the schedule of values with preparation of Contractor's construction schedule.
  - 1. Coordinate line items in the schedule of values with other required administrative forms and schedules, including the following:
    - a. Application for Payment forms with continuation sheets.
    - b. Submittal schedule.
    - c. Accepted Alternates.
  - 2. Submit the schedule of values to Architect at earliest possible date, but no later than seven days before the date scheduled for submittal of initial Applications for Payment.
  - 3. Subschedules for Phased Work: Where the Work is separated into phases requiring separately phased payments; provide subschedules showing values coordinated with each phase of payment.
  - 4. Subschedules for Separate Elements of Work: Where the Contractor's construction schedule defines separate elements of the Work; provide subschedules showing values coordinated with each element.
  - 5. Subschedules for Separate Design Contracts: Where the Owner has retained design professionals under separate contracts who will each provide certification of payment requests, provide subschedules showing values coordinated with the scope of each design services contract as described in Division 01 Section "Summary."
- B. Format and Content: Use Project Manual table of contents as a guide to establish line items for the schedule of values. Provide at least one line item for each Specification Section.
  - 1. Identification: Include the following Project identification on the schedule of values:
    - a. Project name and location.
    - b. Name of Architect.
    - c. Architect's project number.
    - d. Contractor's name and address.
    - e. Date of submittal.
  - 2. Arrange the schedule of values in tabular form, in format accepted by Architect, with separate columns to indicate the following for each item listed:
    - a. Related Specification Section or Division.

- b. Description of the Work.
  - c. Name of subcontractor.
  - d. Name of manufacturer or fabricator.
  - e. Name of supplier.
  - f. Change Orders.
  - g. Dollar value of the following, as a percentage of the Contract Sum to nearest one-hundredth percent, adjusted to total 100 percent.
    - 1) Labor.
    - 2) Materials.
    - 3) Equipment.
3. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Coordinate with Project Manual table of contents. Provide multiple line items for principal subcontract amounts, where appropriate.
  4. Round amounts to nearest whole dollar; total shall equal the Contract Sum.
  5. Provide a separate line item in the schedule of values for each part of the Work where Applications for Payment may include materials or equipment purchased or fabricated and stored, but not yet installed.
    - a. Differentiate between items stored on-site and items stored off-site. If required, include evidence of insurance or bonded warehousing.
  6. Provide separate line items in the schedule of values for initial cost of materials, for each subsequent stage of completion, and for total installed value of that part of the Work.
  7. Allowances (If Applicable): Provide a separate line item in the schedule of values for each allowance. Show line-item value of unit-cost allowances (if applicable), as a product of the unit cost, multiplied by measured quantity. Use information indicated in the Contract Documents to determine quantities.
  8. Alternates (If Applicable): Provide a separate line item in the schedule of values for each accepted alternate.
  9. Change Orders: Provide a separate line item in the schedule of values for each change order.
  10. Separate Owner-Consultant Contracts: Provide a separate line item in the schedule of values for each separate Owner-Consultant related Work item.
  11. Purchase Contracts: When applicable, provide a separate line item in the schedule of values for each purchase contract. Show line-item value of purchase contract. Indicate owner payments or deposits, if any, and balance to be paid by Contractor.
  12. Each item in the schedule of values and Applications for Payment shall be complete. Include total cost and proportionate share of general overhead and profit for each item.
    - a. Temporary facilities and other major cost items that are not direct cost of actual work-in-place may be shown either as separate line items in the schedule of values or distributed as general overhead expense, at Contractor's option.
  13. Schedule Updating: Update and resubmit the schedule of values before the next Applications for Payment when Change Orders or Construction Change Directives result in a change in the Contract Sum.



### **1.3 ARCHITECTS COST DATA**

- A. In addition to the Schedule of Values, submit itemized cost data reporting on Architect's Form HKS-757 "Project Cost Summary"; copy attached at the end of this Section. Initial submission shall be included with contractors first Application for Payment. Final updated submission shall be included with contractors final Application for Payment.

### **1.4 APPLICATIONS FOR PAYMENT**

- A. Each Application for Payment following the initial Application for Payment shall be consistent with previous applications and payments as certified by Architect and paid for by Owner.
  - 1. Initial Application for Payment, Application for Payment at time of Substantial Completion, and final Application for Payment involve additional requirements.
- B. Payment Application Times: The date for each progress payment is indicated in the Agreement between Owner and Contractor. The period of construction work covered by each Application for Payment is the period indicated in the Agreement.
  - 1. If the Agreement does not state payment dates, establish dates at preconstruction conference.
  - 2. Submit draft, or pencil, copy of Application for Payment seven days prior to due date for review by Architect.
- C. Application for Payment Forms: Unless directed otherwise by Owner, use AIA Document G702 and AIA Document G703 as form for Applications for Payment.
- D. Application Preparation: Complete every entry on form. Notarize and execute by a person authorized to sign legal documents on behalf of Contractor. Architect will return incomplete applications without action.
  - 1. Entries shall match data on the schedule of values and Contractor's construction schedule. Use updated schedules if revisions were made.
  - 2. Include amounts of Change Orders and Construction Change Directives issued before last day of construction period covered by application.
- E. Stored Materials: If accepted by Owner, include in Application for Payment amounts applied for materials or equipment purchased or fabricated and stored, but not yet installed. Differentiate between items stored on-site and items stored off-site.
  - 1. Provide certificate of insurance, evidence of transfer of title to Owner, and consent of surety to payment, for stored materials.
  - 2. Provide supporting documentation that verifies amount requested, such as paid invoices. Match amount requested with amounts indicated on documentation; do not include overhead and profit on stored materials.
  - 3. Provide summary documentation for stored materials indicating the following:
    - a. Value of materials previously stored and remaining stored as of date of previous Applications for Payment.
    - b. Value of previously stored materials put in place after date of previous Application for Payment and on or before date of current Application for Payment.
    - c. Value of materials stored since date of previous Application for Payment and remaining stored as of date of current Application for Payment.

- F. Transmittal: Submit 3 signed and notarized original copies of each Application for Payment to Architect by a method ensuring receipt within 24 hours. One copy shall include waivers of lien and similar attachments if required.
1. Transmit each copy with a transmittal form listing attachments and recording appropriate information about application.
- G. Waivers of Mechanic's Lien: With each Application for Payment, submit waivers of mechanic's liens from General Contractor, subcontractors, sub-subcontractors, and suppliers for construction period covered by the previous application.
1. Submit partial waivers on each item for amount requested in previous application, after deduction for retainage, on each item.
  2. When an application shows completion of an item, submit conditional final or full waivers.
  3. Owner reserves the right to designate which entities involved in the Work must submit waivers.
  4. Waiver Delays: Submit each Application for Payment with Contractor's waiver of mechanic's lien for construction period covered by the application.
    - a. Submit final Application for Payment with or preceded by conditional final waivers from every entity involved with performance of the Work covered by the application who is lawfully entitled to a lien.
  5. Waiver Forms: Submit executed waivers of lien on forms, acceptable to Owner.
- H. Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of first Application for Payment include the following:
1. List of subcontractors.
  2. Schedule of values.
  3. Contractor's construction schedule (preliminary if not final).
  4. Products list (preliminary if not final).
  5. Schedule of unit prices.
  6. Submittal schedule (preliminary if not final).
  7. List of Contractor's staff assignments.
  8. List of Contractor's principal consultants.
  9. Copies of building permits.
  10. Copies of authorizations and licenses from authorities having jurisdiction for performance of the Work.
  11. Initial progress report.
  12. Report of preconstruction conference.
  13. Certificates of insurance and insurance policies.
  14. Performance and payment bonds.
- I. Application for Payment at Substantial Completion: After Architect issues the Certificate of Substantial Completion, submit an Application for Payment showing 100 percent completion for portion of the Work claimed as substantially complete.
1. Include documentation supporting claim that the Work is substantially complete and a statement showing an accounting of changes to the Contract Sum.
  2. When applicable, this application shall reflect Certificate(s) of **Partial** Substantial Completion issued previously for Owner occupancy of designated portions of the Work.

- J. Final Payment Application: Submit final Application for Payment with releases and supporting documentation not previously submitted and accepted, including, but not limited, to the following:
1. Evidence of completion of Project closeout requirements.
  2. Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.
  3. Updated final statement, accounting for final changes to the Contract Sum.
  4. AIA Document G706, "Contractor's Affidavit of Payment of Debts and Claims."
  5. AIA Document G706A, "Contractor's Affidavit of Release of Liens."
  6. AIA Document G707, "Consent of Surety to Final Payment."
  7. Evidence that claims have been settled.
  8. Final meter readings for utilities, a measured record of stored fuel, and similar data as of date of Substantial Completion or when Owner took possession of and assumed responsibility for corresponding elements of the Work.
  9. If applicable, final liquidated damages settlement statement.

**PART 2 - PRODUCTS (Not Used)**

**PART 3 - EXECUTION (Not Used)**

**END OF SECTION**

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**PAYMENT PROCEDURES**

## **SECTION 01 2600**

### **CONTRACT MODIFICATION PROCEDURES**

#### **PART 1 - GENERAL**

##### **1.1 SUMMARY**

- A. Section includes administrative and procedural requirements for handling and processing Contract modifications.

##### **1.2 MINOR CHANGES IN THE WORK**

- A. Architect will issue supplemental instructions authorizing minor changes in the Work, not involving adjustment to the Contract Sum or the Contract Time, on Architect's Form HKS-710 "Architect's Supplemental Instructions"; copy attached at the end of this Section.

##### **1.3 PROPOSAL REQUESTS**

- A. Owner-Initiated Proposed Change: Architect will issue a detailed description of proposed changes in the Work that may require adjustment to the Contract Sum or the Contract Time using Architect's Form HKS-709 "Proposed Change"; copy attached at the end of this Section. If necessary, the description will include supplemental or revised Drawings and Specifications.
  - 1. Proposed Changes issued by Architect are not instructions either to stop work in progress or to execute the proposed change.
  - 2. Within time specified in Proposed Change or with reasonable promptness, when not otherwise specified, after receipt of Proposed Change, submit a quotation estimating cost adjustments to the Contract Sum and the Contract Time necessary to execute the change.
    - a. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
    - b. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
    - c. Include costs of labor and supervision directly attributable to the change.
    - d. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
    - e. Include updated Submittal Schedule showing effect of the change.
- B. Contractor-Initiated Proposed Change: If latent or changed conditions require modifications to the Contract, Contractor may initiate a claim by submitting a request for a change to Architect using Contractor's Standard Form.
  - 1. Include a statement outlining reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and the Contract Time.

2. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
3. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
4. Include costs of labor and supervision directly attributable to the change.
5. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
6. Include updated Submittal Schedule showing effect of the change.
7. Comply with requirements in Division 01 Section "Substitution Procedures" if the proposed change requires substitution of one product or system for product or system specified.

#### **1.4 ADMINISTRATIVE CHANGE ORDERS**

- A. Allowance Adjustment: If applicable, see Division 01 Section "Allowances" for administrative procedures for preparation of Proposed Change for adjusting the Contract Sum to reflect actual costs of allowances.
- B. Unit-Price Adjustment: If applicable, see Division 01 Section "Unit Prices" for administrative procedures for preparation of Proposed Change for adjusting the Contract Sum to reflect measured scope of unit-price work.
- C. Alternates: If applicable, see Division 01 Section "Alternates" for administrative procedures for preparation of Proposed Change for adjusting the Contract Sum to reflect measured scope of alternate work.

#### **1.5 CHANGE ORDER PROCEDURES**

- A. On Owner's approval of a Proposed Change, Architect will issue a Change Order for signatures of Owner and Contractor on Architects Form HKS-701 "Change Order"; copy attached at the end of this Section.

#### **1.6 CONSTRUCTION CHANGE DIRECTIVE**

- A. Construction Change Directive: Architect may issue a Construction Change Directive on Architects Form HKS-714 "Construction Change Directive"; copy attached at the end of this Section. Construction Change Directive instructs Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.
  1. Construction Change Directive contains a complete description of change in the Work. It also designates method to be followed to determine change in the Contract Sum or the Contract Time.
- B. Documentation: Maintain detailed records on a time and material basis of work required by the Construction Change Directive.
  1. After completion of change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.

**PART 2 - PRODUCTS (Not Used)**

**PART 3 - EXECUTION (Not Used)**

**END OF SECTION**



**17-13 OSU, College of Osteopathic Medicine at  
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2019-02-08**

**CONTRACT MODIFICATION PROCEDURES**

**01 2600 - 4**

## **SECTION 01 3100**

### **PROJECT MANAGEMENT AND COORDINATION**

#### **PART 1 - GENERAL**

##### **1.1 SUMMARY**

- A. Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:
  - 1. General coordination procedures.
  - 2. Coordination drawings.
  - 3. Requests for Information (RFIs).
  - 4. Project Web site.
  - 5. Project meetings.

##### **1.2 DEFINITIONS**

- A. Project communications documents shall be defined as the following:
  - 1. Letters.
  - 2. Memoranda.
  - 3. E-Mail Communications/Internet Communications/Project Management Software Communications.
  - 4. RFI (Request for Information - Contractor).
  - 5. RFI-A (Request for Information - Architect).

##### **1.3 FORMAT**

- A. Letters and Memoranda: Submit in formats acceptable to the Architect.
- B. E-Mail Communications/Internet Communications/Project Management Software Communications: Submit in forms and formats acceptable to and as approved by the Architect.
- C. RFI (Request for Information - Contractor): Submit on forms furnished by the Architect, or on other forms as approved by the Architect. Unless otherwise approved use Architect's Form HKS-750, "Request for Information"; copy attached at the end of this Section.
- D. RFI-A (Request for Information - Architect), will be submitted by Architect to Contractor on Architects standard form.

##### **1.4 PROJECT COMMUNICATIONS DOCUMENTS**

- A. Letters and Memoranda documents shall be submitted in a timely manner so as to facilitate project delivery and coordination. Routing of communications shall be as established in the Contract, the Contract Documents and the Pre-Construction Conference. Communications documents shall be transmitted or forwarded in a manner consistent with the schedule and progress of the work.

- B. E-Mail Communications, Internet Communications, and Project Management Software programs must be compatible with the Architect's and Owner's computer systems and equipment. The responsibility for all costs for management of these systems, including, but not limited to, licensing, onsite training or other training necessary for the proper operation of such systems, shall be by the Contractor. The Contractor shall keep written records and hard file copies of all electronic communications. Failure of the Contractor to keep such records shall waive the Contractor's right to rely on such communications and such communications shall be deemed to have not taken place.
- C. RFI (Request for Information - Contractor) shall be defined and limited to a request from the Contractor seeking interpretation or clarification of the requirements of the Contract Documents. Such requests shall comply with the following requirements:
1. RFI requests shall be submitted in a timely manner, well in advance of related work, and allow sufficient time for the resolution of issues relating to the request for interpretation or clarification. Contractor shall schedule the submission of RFI's so as to moderate and manage the flow of RFI requests. RFI's shall be submitted in a manner consistent with the schedule and progress of the work, and shall not be submitted in a sporadic and/or excessive manner.
  2. RFI requests shall be numbered in a sequential manner and contain a detailed description of the areas of work requiring interpretation or clarification. Include drawing and specification references, sketches, technical data, brochures, or other supporting data as deemed necessary by the Architect, for the Architect to provide the interpretations and clarifications requested.
    - a. The Contractor shall include a "Proposed Solution" to the issue requiring interpretation or clarification.
  3. RFI's submitted to the Contractor by Sub-Contractors, vendors, suppliers, or other parties to the work shall be reviewed by the Contractor prior to submission to the Architect. If the Architect deems that such RFI requests have not been adequately reviewed by the Contractor, such requests will be returned to the Contractor for further action. Sub-Contractor's RFI shall contain a "Proposed Solution".
  4. RFI requests shall not contain submittals, substitutions requests, routine communications, correspondence, memos, claims, or any information required by other areas of the Contract Documents. RFI requests containing such information will be returned to the Contractor without action by the Architect.
  5. RFI requests are limited to a request for interpretation or clarification of the requirements of the Contract Documents. Interpretations provided by the Architect shall not change the requirements of the Contract or the Contract Documents. If the Contractor determines that the Architect's response to an RFI gives cause for a change in the Contract or the Contract Documents, the Contractor shall promptly, within 5 working days, give written notice to the Architect of request for adjustments. Requests for adjustments to the Contract shall be submitted in a manner consistent with the terms and conditions of the Contract Documents.
  6. If the Architect, after review, determines that any RFI has been submitted in an incomplete manner, is unnecessary, or does not otherwise comply with the requirements of this Section, the RFI will be returned without action to the Contractor. The Contractor shall delete the original submittal date from the RFI log and enter a new submittal date at the time of re-submittal.
  7. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Submit log weekly. Use software log that is part of Project Web site. Software log with not less than the following:

- a. Project name.
  - b. Name and address of Contractor.
  - c. Name and address of Architect.
  - d. RFI number including RFIs that were returned without action or withdrawn.
  - e. RFI description.
  - f. Date the RFI was submitted.
  - g. Date Architect's response was received.
- 8. On receipt of Architect's action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify Architect within seven days if Contractor disagrees with response.
  - a. Identification of related Minor Change in the Work, Construction Change Directive, and Proposal Request, as appropriate.
- D. RFI-A (Request for Information - Architect) shall be defined as a request by the Architect for information relating to the obligations of the Contractor under the Contract.
  - 1. After receipt of an RFI-A the Contractor shall provide a written response to the Architect within 5 working days. Responses shall be thorough, complete and shall contain all information requested by the Architect.
  - 2. An RFI-A shall be limited to a request by the Architect for information related to the project. The RFI-A shall not be construed as authorizing or directing a change in the Contract or the Contract Documents.
- E. Revisions to Construction Documents: Responses to requests for information (RFI) shall not serve as construction documents; and the Contractor shall not incorporate RFI responses into construction of the Project, unless such answers bear the seal and signature of a licensed design professional.

## **1.5 INFORMATIONAL SUBMITTALS**

- A. Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Include the following information in tabular form:
  - 1. Name, address, and telephone number of entity performing subcontract or supplying products.
  - 2. Number and title of related Specification Section(s) covered by subcontract.
  - 3. Drawing number and detail references, as appropriate, covered by subcontract.
- B. Key Personnel Names: Within 15 days of starting construction operations, submit a list of key personnel assignments, including superintendent and other personnel in attendance at Project site. Identify individuals and their duties and responsibilities; list addresses and telephone numbers, including home, office, and cellular telephone numbers and e-mail addresses. Provide names, addresses, and telephone numbers of individuals assigned as alternates in the absence of individuals assigned to Project.
  - 1. Post copies of list in project meeting room, in temporary field office, and Project Web site. Keep list current at all times.

## **1.6 GENERAL COORDINATION PROCEDURES**

- A. Coordination: Coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations, included in different Sections, that depend on each other for proper installation, connection, and operation.
  - 1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
  - 2. Coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair.
  - 3. Make adequate provisions to accommodate items scheduled for later installation.
- B. Prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings.
  - 1. Prepare similar memoranda for Owner and separate contractors if coordination of their Work is required.
- C. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:
  - 1. Preparation of Contractor's construction schedule.
  - 2. Preparation of the schedule of values.
  - 3. Installation and removal of temporary facilities and controls.
  - 4. Delivery and processing of submittals.
  - 5. Progress meetings.
  - 6. Preinstallation conferences.
  - 7. Project closeout activities.
  - 8. Startup and adjustment of systems.
- D. Conservation: Coordinate construction activities to ensure that operations are carried out with consideration given to conservation of energy, water, and materials.

## **1.7 COORDINATION DRAWINGS**

- A. Coordination Drawings, General: Prepare coordination drawings according to requirements in individual Sections, and additionally where installation is not completely shown on Shop Drawings, where limited space availability necessitates coordination, or if coordination is required to facilitate integration of products and materials fabricated or installed by more than one entity.
  - 1. Content: Project-specific information, drawn accurately to a scale large enough to indicate and resolve conflicts. Do not base coordination drawings on standard printed data. Include the following information, as applicable:
    - a. Use applicable Drawings as a basis for preparation of coordination drawings. Prepare sections, elevations, and details as needed to describe relationship of various systems and components.
    - b. Indicate functional and spatial relationships of components of architectural, structural, civil, mechanical, and electrical systems.

- c. Indicate space requirements for routine maintenance and for anticipated replacement of components during the life of the installation.
  - d. Show location and size of access doors required for access to concealed dampers, valves, and other controls.
  - e. Indicate required installation sequences.
  - f. Indicate dimensions shown on the Drawings. Specifically note dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide alternate sketches to Architect indicating proposed resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.
- B. Coordination Digital Data Files: Prepare coordination digital data files according to the following requirements:
- 1. File Preparation Format: Same digital data software program, version, and operating system as original Drawings.
  - 2. File Submittal Format: Submit or post coordination drawing files using Portable Data File (PDF) format.
  - 3. BIM File Incorporation: When applicable, develop coordination drawing files from Building Information Model (BIM) established for Project.
    - a. Perform three-dimensional component conflict analysis as part of preparation of coordination drawings. Resolve component conflicts prior to submittal. Indicate where conflict resolution requires modification of design requirements by Architect.
  - 4. If approved by Owner, Architect will furnish Contractor one set of digital data files of Drawings for use in preparing coordination digital data files.
    - a. Architect makes no representations as to the accuracy or completeness of digital data files as they relate to Drawings.
    - b. Digital Data Software Program: Drawings are available in Autodesk Revit and/or Autocad; and compatible with Microsoft Windows operating system.
    - c. Distribution: Digital data files shall only be distributed via the HKS Thru site with acceptance of HKS data licensing agreement.

## **1.8 PROJECT WEB SITE**

- A. Use Architect's Project Web site implementing Architect's electronic project management software system for purposes of managing project communication and documentation until Final Completion.
- B. Contractor, subcontractors, and other parties granted access to Project Web site shall execute a data licensing agreement in the form of AIA Document C106.

## **1.9 PROJECT MEETINGS**

- A. General: Schedule and conduct meetings and conferences at Project site unless otherwise indicated.
  - 1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Owner and Architect of scheduled meeting dates and times.

2. Agenda: Prepare the meeting agenda. Distribute the agenda to all invited attendees.
  3. Minutes: Record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner and Architect, within 3 days of the meeting.
  4. Attendance: Document attendance of all participants.
- B. Preconstruction Conference: Architect will schedule and conduct a preconstruction conference before starting construction.
1. Conduct the conference to review responsibilities and personnel assignments.
  2. Attendees: Authorized representatives of Owner, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. Participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
- C. Preinstallation Conferences: Conduct a preinstallation conference at Project site before each construction activity that requires coordination with other construction.
1. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise Architect of scheduled meeting dates.
  2. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration, and coordination with adjacent activities. Prepare agenda appropriate to Work.
  3. Record significant conference discussions, agreements, and disagreements, including required corrective measures and actions.
  4. Reporting: Distribute minutes of the meeting to each party present and to other parties requiring information.
  5. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.
- D. Project Closeout Conference: Schedule and conduct a project closeout conference, at a time convenient to Owner and Architect, at a time to be decided prior to the scheduled date of Substantial Completion.
1. Conduct the conference to review requirements and responsibilities related to Project closeout.
  2. Attendees: Authorized representatives of Owner, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the meeting. Participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
  3. Agenda: Discuss items of significance that could affect or delay Project closeout, including the following:
    - a. Preparation of record documents.
    - b. Procedures required prior to inspection for Substantial Completion and for final inspection for acceptance.
    - c. Submittal of written warranties.
    - d. If applicable, requirements for completing sustainable design documentation.
    - e. Requirements for preparing operations and maintenance data.



- f. Requirements for delivery of material samples, attic stock, and spare parts.
  - g. Requirements for demonstration and training.
  - h. Preparation of Contractor's punch list.
  - i. Procedures for processing Applications for Payment at Substantial Completion and for final payment.
  - j. Submittal procedures.
  - k. If applicable, coordination of separate contracts.
  - l. If applicable, Owner's partial occupancy requirements.
  - m. Installation of Owner's furniture, fixtures, and equipment.
  - n. Responsibility for removing temporary facilities and controls.
4. Minutes: Entity conducting meeting will record and distribute meeting minutes.
- E. Progress Meetings: Conduct progress meetings at regular intervals.
- 1. Coordinate dates of meetings with preparation of payment requests.
  - 2. Attendees: In addition to representatives of Owner and Architect, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
  - 3. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.
    - a. Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's construction schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
      - 1) Review schedule for next period.
    - b. Review present and future needs of each entity present, including the following or as needed:
      - 1) Interface requirements.
      - 2) Sequence of operations.
      - 3) If applicable, resolution of BIM component conflicts.
      - 4) Status of submittals.
      - 5) If applicable, status of sustainable design documentation.
      - 6) Deliveries.
      - 7) Off-site fabrication.
      - 8) Access.
      - 9) Site utilization.
      - 10) Temporary facilities and controls.
      - 11) Work hours.
      - 12) Hazards and risks.
      - 13) Progress cleaning.
      - 14) Quality and work standards.
      - 15) Status of correction of deficient items.

- 16) Field observations.
  - 17) Status of RFIs.
  - 18) Status of proposal requests.
  - 19) Pending changes.
  - 20) Status of Change Orders.
  - 21) Documentation of information for payment requests.
4. Minutes: Entity responsible for conducting the meeting will record and distribute the meeting minutes to each party present and to parties requiring information.
    - a. Schedule Updating: Revise Contractor's construction schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the report of each meeting.
- F. Coordination Meetings: Conduct Project coordination meetings on an as-needed basis. Project coordination meetings are in addition to specific meetings held for other purposes, such as progress meetings and preinstallation conferences.
1. Attendees: Each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the meetings shall be familiar with Project and authorized to conclude matters relating to the Work.
  2. Agenda: Review items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.
    - a. Review present and future needs of each contractor present, including the following:
      - 1) Interface requirements.
      - 2) Sequence of operations.
      - 3) If applicable, resolution of BIM component conflicts.
      - 4) Status of submittals.
      - 5) Deliveries.
      - 6) Off-site fabrication.
      - 7) Access.
      - 8) Site utilization.
      - 9) Temporary facilities and controls.
      - 10) Work hours.
      - 11) Hazards and risks.
      - 12) Progress cleaning.
      - 13) Quality and work standards.
      - 14) Change Orders.

## **PART 2 - PRODUCTS**

### **2.1 ELECTRONIC PROJECT MANAGEMENT SOFTWARE**

- A. General: So as to expedite electronic review process, process all documents through a web-based software service. Sending documents via email, FTP or paper will not be accepted.
  1. Basis of Design (Product Standard):

- a. Newforma, Inc.; Newforma Project Cloud, web-based software.
  - 1) Website: [www.NewformaProjectCloud.com](http://www.NewformaProjectCloud.com)
  - 2) E-mail: [projectcloud@newforma.com](mailto:projectcloud@newforma.com)
  - 3) Phone: (800) 303-4650

B. Performance Requirements:

- 1. Project License:
  - a. Cloud based (no hardware required).
  - b. Unlimited user accounts.
  - c. Functionality to support subcontractors, contractors, architects and consultants.
  - d. Provide access to data for all project team members at no cost to the individual users.
- 2. Training and Support:
  - a. Dedicated project training.
  - b. Phone support.
- 3. Archive:
  - a. Export all data to an offline archive at the completion of the project.
  - b. Provide archive to architect, contractor and owner.
  - c. Archive shall include all attachments, meta data, review comments and time stamp history.
- 4. Submittals and RFIs:
  - a. Customizable logs and reporting accessible by all users.
  - b. Logs shall automatically update as submittals and RFIs are processed.
  - c. Automated routing of submittals and RFIs to design team based on trade.
  - d. Automated email notifications when submittal or RFI has been assigned or returned to a user.
  - e. Automated weekly email to design team users of overdue items.
  - f. Automatic sequential numbering per spec section for submittals.
  - g. Two sets of due dates - one overall due date and a consultant due date.
  - h. Built-in web-based markup tools to support a concurrent review of submittal and RFI.
- 5. Submittal Register:
  - a. Software vendor shall take specifications and build the required list of submittals and import into the software.
- 6. Drawing Management:
  - a. Provide current set of drawings and specifications through a centralized index.
  - b. Automated association of PDFs to the centralized index.
  - c. Manage drawing revisions with customizable review states.
  - d. Drawings shall be accessible offline via mobile devices.

7. File Sharing:
  - a. Integrated file sharing tool (FTP) to transfer any miscellaneous files such as BIM and CAD files.
  - b. Access permissions (view/edit) at a folder level.
8. Punch List and other Field Task Management:
  - a. Unlimited customizable field task types including punch list.
  - b. Locate and assign tasks from a mobile device.
  - c. No additional fees to individual users to access mobile apps.
  - d. Data shall be accessible offline on mobile devices.

**PART 3 - EXECUTION (Not Used)**

**END OF SECTION**

## **SECTION 01 3200**

### **CONSTRUCTION PROGRESS DOCUMENTATION**

#### **PART 1 - GENERAL**

##### **1.1 SUMMARY**

- A. Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work.

##### **1.2 DEFINITIONS**

- A. Activity: A discrete part of a project that can be identified for planning, scheduling, monitoring, and controlling the construction project. Activities included in a construction schedule consume time and resources.
  - 1. Critical Activity: An activity on the critical path that must start and finish on the planned early start and finish times.
  - 2. Predecessor Activity: An activity that precedes another activity in the network.
  - 3. Successor Activity: An activity that follows another activity in the network.
- B. Major Area: A story of construction, a separate building, or a similar significant construction element.
- C. Milestone: A key or critical point in time for reference or measurement.
- D. CPM: Critical path method, which is a method of planning and scheduling a construction project where activities are arranged based on activity relationships. Network calculations determine when activities can be performed and the critical path of Project.
- E. Critical Path: The longest connected chain of interdependent activities through the network schedule that establishes the minimum overall Project duration and contains no float.
- F. Network Diagram: A graphic diagram of a network schedule, showing activities and activity relationships.
- G. Event: The starting or ending point of an activity.
- H. Float: The measure of leeway in starting and completing an activity.
  - 1. Float time is not for the exclusive use or benefit of either Owner or Contractor, but is a jointly owned, expiring Project resource available to both parties as needed to meet schedule milestones and Contract completion date.
  - 2. Free float is the amount of time an activity can be delayed without adversely affecting the early start of the successor activity.
  - 3. Total float is the measure of leeway in starting or completing an activity without adversely affecting the planned Project completion date.
- I. Fragnet: A partial or fragmentary network that breaks down activities into smaller activities for greater detail.

### **1.3 SUBMITTALS**

- A. Format for Submittals: Submit required submittals in the following format:
  - 1. PDF electronic file.
- B. Startup construction schedule.
- C. Startup Network Diagram: Of size required to display entire network for entire construction period. Show logic ties for activities.
- D. Contractor's Construction Schedule: Initial schedule, of size required to display entire schedule for entire construction period.
- E. CPM Reports: Concurrent with CPM schedule, submit each of the following reports. Format for each activity in reports shall contain activity number, activity description, original duration, remaining duration, early start date, early finish date, late start date, late finish date, and total float in calendar days.
  - 1. Activity Report: List of all activities sorted by activity number and then early start date, or actual start date if known.
  - 2. Logic Report: List of preceding and succeeding activities for all activities, sorted in ascending order by activity number and then early start date, or actual start date if known.
  - 3. Total Float Report: List of all activities sorted in ascending order of total float.
  - 4. Earnings Report: Compilation of Contractor's total earnings from the Notice to Proceed until most recent Application for Payment.
- F. Construction Schedule Updating Reports: Submit with Applications for Payment.
- G. Daily Construction Reports: Submit at weekly intervals.
- H. Material Location Reports: Submit at monthly intervals.
- I. Site Condition Reports: Submit at time of discovery of differing conditions.
- J. Special Reports: Submit at time of unusual event.

### **1.4 COORDINATION**

- A. Coordinate preparation and processing of schedules and reports with performance of construction activities and with scheduling and reporting of separate contractors.
- B. Coordinate Contractor's construction schedule with the schedule of values, list of subcontracts, submittal schedule, progress reports, payment requests, and other required schedules and reports.
  - 1. Secure time commitments for performing critical elements of the Work from entities involved.
  - 2. Coordinate each construction activity in the network with other activities and schedule them in proper sequence.

## **PART 2 - PRODUCTS**

### **2.1 CONTRACTOR'S CONSTRUCTION SCHEDULE, GENERAL**

- A. Time Frame: Extend schedule from date established for the Notice to Proceed to date of final completion.
  - 1. Contract completion date shall not be changed by submission of a schedule that shows an early completion date, unless specifically authorized by Change Order.
- B. Activities: Treat each story or separate area as a separate numbered activity for each main element of the Work. Comply with the following:
  - 1. Procurement Activities: Include procurement process activities for the following long lead items and major items, requiring a cycle of more than 60 days, as separate activities in schedule. Procurement cycle activities include, but are not limited to, submittals, approvals, purchasing, fabrication, and delivery.
  - 2. Submittal Review Time: Include review and resubmittal times indicated in Division 01 Section "Submittal Procedures" in schedule. Coordinate submittal review times in Contractor's construction schedule with submittal schedule.
  - 3. Startup and Testing Time: Include no fewer than 7 days for startup and testing.
  - 4. Substantial Completion: Indicate completion in advance of date established for Substantial Completion, and allow time for Architect's administrative procedures necessary for certification of Substantial Completion.
  - 5. Punch List and Final Completion: Include not more than 30 days for completion of punch list items and final completion.
- C. Constraints: Include constraints and work restrictions indicated in the Contract Documents and as follows in schedule (where applicable), and show how the sequence of the Work is affected.
  - 1. Phasing: Arrange list of activities on schedule by phase.
  - 2. Work by Owner: Include a separate activity for each portion of the Work performed by Owner.
  - 3. Products Ordered in Advance: Include a separate activity for each product.
  - 4. Owner-Furnished Products: Include a separate activity for each product.
  - 5. Work Restrictions: Show the effect of the following items on the schedule:
    - a. Coordination with existing construction.
    - b. Limitations of continued occupancies.
    - c. Uninterruptible services.
    - d. Partial occupancy before Substantial Completion.
    - e. Use of premises restrictions.
    - f. Provisions for future construction.
    - g. Seasonal variations.
    - h. Environmental control.
  - 6. Work Stages: Indicate important stages of construction for each major portion of the Work, including, but not limited to, the following:
    - a. Subcontract awards.
    - b. Submittals.
    - c. Purchases.
    - d. Mockups.
    - e. Fabrication.

- f. Sample testing.
  - g. Deliveries.
  - h. Installation.
  - i. Tests and inspections.
  - j. Adjusting.
  - k. Curing.
  - l. Building flush-out.
  - m. Startup and placement into final use and operation.
- 7. Construction Areas: Identify each major area of construction for each major portion of the Work. Indicate where each construction activity within a major area must be sequenced or integrated with other construction activities to provide for the following:
  - a. Structural completion.
  - b. Temporary enclosure and space conditioning.
  - c. Permanent space enclosure.
  - d. Completion of mechanical installation.
  - e. Completion of electrical installation.
  - f. Substantial Completion.
- 8. Other Constraints include but are not limited to the following:
  - a. Roads.
  - b. Parking.
  - c. Landscape.
- D. Milestones: Include milestones indicated in the Contract Documents in schedule, including, but not limited to, the Notice to Proceed, punch list activities, Substantial Completion, and final completion.
- E. Recovery Schedule: When periodic update indicates the Work is 14 or more calendar days behind the current approved schedule, submit a separate recovery schedule indicating means by which Contractor intends to regain compliance with the schedule. Indicate changes to working hours, working days, crew sizes, and equipment required to achieve compliance, and date by which recovery will be accomplished.
- F. Computer Scheduling Software: Prepare schedules using current version of a program that has been developed specifically to manage construction schedules.

## **2.2 STARTUP CONSTRUCTION SCHEDULE**

- A. Bar-Chart Schedule: Submit startup, horizontal, bar-chart-type construction schedule within 14 days of date established for the Notice of Award.
- B. Preparation: Indicate each significant construction activity separately. Identify first workday of each week with a continuous vertical line. Outline significant construction activities for first 60 days of construction. Include skeleton diagram for the remainder of the Work and a cash requirement prediction based on indicated activities.
- C. Startup Network Diagram may be submitted in lieu of Bar-Chart Schedule.



## **2.3 CONTRACTOR'S CONSTRUCTION SCHEDULE (BAR CHART/GANTT CHART)**

- A. Bar Chart/Gantt Chart Schedule: Submit a comprehensive, fully developed, horizontal, Gantt-chart-type, Contractor's construction schedule within 30 days of date established for the Notice to Proceed. Base schedule on the startup construction schedule and additional information received since the start of Project.
- B. Preparation: Indicate each significant construction activity separately. Identify first workday of each week with a continuous vertical line.
  - 1. For construction activities that require three months or longer to complete, indicate an estimated completion percentage in 10 percent increments within time bar.

## **2.4 CONTRACTOR'S CONSTRUCTION SCHEDULE (CPM SCHEDULE)**

- A. General: Prepare network diagrams using AON (activity-on-node) format.
- B. Startup Network Diagram: Submit diagram within 14 days of date established for the Notice to Proceed. Outline significant construction activities for the first 60 days of construction. Include skeleton diagram for the remainder of the Work and a cash requirement prediction based on indicated activities.
- C. CPM Schedule: Prepare Contractor's construction schedule using a time-scaled CPM network analysis diagram for the Work.
  - 1. Develop network diagram in sufficient time to submit CPM schedule so it can be accepted for use no later than 30 days after date established for the Notice to Proceed.
    - a. Failure to include any work item required for performance of this Contract shall not excuse Contractor from completing all work within applicable completion dates, regardless of Architect's approval of the schedule.
  - 2. Conduct educational workshops to train and inform key Project personnel, including subcontractors' personnel, in proper methods of providing data and using CPM schedule information.
  - 3. Establish procedures for monitoring and updating CPM schedule and for reporting progress. Coordinate procedures with progress meeting and payment request dates.
  - 4. Use "one workday" as the unit of time for individual activities. Indicate nonworking days and holidays incorporated into the schedule in order to coordinate with the Contract Time.
- D. CPM Schedule Preparation: Prepare a list of all activities required to complete the Work. Using the startup network diagram, prepare a skeleton network to identify probable critical paths.
  - 1. Activities: Indicate the estimated time duration, sequence requirements, and relationship of each activity in relation to other activities. Include estimated time frames for the following activities:
    - a. Preparation and processing of submittals.
    - b. Purchase of materials.
    - c. Delivery.
    - d. Fabrication.
    - e. Installation.
    - f. Punch list and final completion.

2. Critical Path Activities: Identify critical path activities, including those for interim completion dates. Scheduled start and completion dates shall be consistent with Contract milestone dates.
  3. Processing: Process data to produce output data on a computer-drawn, time-scaled network. Revise data, reorganize activity sequences, and reproduce as often as necessary to produce the CPM schedule within the limitations of the Contract Time.
  4. Format: Mark the critical path. Locate the critical path near center of network; locate paths with most float near the edges.
    - a. Subnetworks on separate sheets are permissible for activities clearly off the critical path.
- E. Contract Modifications: For each proposed contract modification and concurrent with its submission, prepare a time-impact analysis using a network fragment, fragnet, to demonstrate the effect of the proposed change on the overall project schedule.
- F. Initial Issue of Schedule: Prepare initial network diagram from a sorted activity list indicating straight "early start-total float." Identify critical activities. Prepare tabulated reports showing the following:
1. Contractor or subcontractor and the Work or activity.
  2. Description of activity.
  3. Main events of activity.
  4. Immediate preceding and succeeding activities.
  5. Early and late start dates.
  6. Early and late finish dates.
  7. Activity duration in workdays.
  8. Total float or slack time.
  9. Average size of workforce.
  10. Dollar value of activity (coordinated with the schedule of values).
- G. Schedule Updating: Concurrent with making revisions to schedule, prepare tabulated reports showing the following:
1. Identification of activities that have changed.
  2. Changes in early and late start dates.
  3. Changes in early and late finish dates.
  4. Changes in activity durations in workdays.
  5. Changes in the critical path.
  6. Changes in total float or slack time.
  7. Changes in the Contract Time.
- H. Value Summaries: Prepare two cumulative value lists, sorted by finish dates.
1. In first list, tabulate activity number, early finish date, dollar value, and cumulative dollar value.
  2. In second list, tabulate activity number, late finish date, dollar value, and cumulative dollar value.
  3. In subsequent issues of both lists, substitute actual finish dates for activities completed as of list date.
  4. Prepare list for ease of comparison with payment requests; coordinate timing with progress meetings.

- a. In both value summary lists, tabulate "actual percent complete" and "cumulative value completed" with total at bottom.
- b. Submit value summary printouts one week before each regularly scheduled progress meeting.

## **2.5 REPORTS**

- A. Daily Construction Reports: Prepare a daily construction report recording the following information concerning events at Project site:
  - 1. List of subcontractors at Project site.
  - 2. List of separate contractors at Project site.
  - 3. Approximate count of personnel at Project site.
  - 4. High and low temperatures and general weather conditions, including presence of rain or snow.
  - 5. Accidents.
  - 6. Meetings and significant decisions.
  - 7. Unusual events (see special reports).
  - 8. Stoppages, delays, shortages, and losses.
  - 9. Meter readings and similar recordings.
  - 10. Emergency procedures.
  - 11. Orders and requests of authorities having jurisdiction.
  - 12. Change Orders received and implemented.
  - 13. Construction Change Directives received and implemented.
  - 14. Services connected and disconnected.
  - 15. Equipment or system tests and startups.
  - 16. Partial completions and occupancies.
  - 17. Substantial Completions authorized.
- B. Material Location Reports: At monthly intervals, prepare and submit a comprehensive list of materials delivered to and stored at Project site. List shall be cumulative, showing materials previously reported plus items recently delivered. Include with list a statement of progress on and delivery dates for materials or items of equipment fabricated or stored away from Project site.
- C. Site Condition Reports: Immediately on discovery of a difference between site conditions and the Contract Documents, prepare and submit a detailed report. Submit with a Request for Information. Include a detailed description of the differing conditions, together with recommendations for changing the Contract Documents.

## **2.6 SPECIAL REPORTS**

- A. General: Submit special reports directly to Owner within one day~~(s)~~ of an occurrence. Distribute copies of report to parties affected by the occurrence.
- B. Reporting Unusual Events: When an event of an unusual and significant nature occurs at Project site, whether or not related directly to the Work, prepare and submit a special report. List chain of events, persons participating, response by Contractor's personnel, evaluation of results or effects, and similar pertinent information. Advise Owner in advance when these events are known or predictable.

## **PART 3 - EXECUTION**

### **3.1 CONTRACTOR'S CONSTRUCTION SCHEDULE**

- A. Scheduling Consultant: Engage a consultant to provide planning, evaluation, and reporting using CPM scheduling.
  - 1. In-House Option: Owner may waive the requirement to retain a consultant if Contractor employs skilled personnel with experience in CPM scheduling and reporting techniques. Submit qualifications.
  - 2. Meetings: Scheduling consultant shall attend all meetings related to Project progress, alleged delays, and time impact.
- B. Contractor's Construction Schedule Updating: At monthly intervals, update schedule to reflect actual construction progress and activities. Issue schedule one week before each regularly scheduled progress meeting.
  - 1. Revise schedule immediately after each meeting or other activity where revisions have been recognized or made. Issue updated schedule concurrently with the report of each such meeting.
  - 2. Include a report with updated schedule that indicates every change, including, but not limited to, changes in logic, durations, actual starts and finishes, and activity durations.
  - 3. As the Work progresses, indicate final completion percentage for each activity.
- C. Distribution: Distribute copies of approved schedule to Architect-Owner, separate contractors, testing and inspecting agencies, and other parties identified by Contractor with a need-to-know schedule responsibility.
  - 1. Post copies in Project meeting rooms and temporary field offices.
  - 2. When revisions are made, distribute updated schedules to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in performance of construction activities.

### **3.2 CONSTRUCTION PHOTOGRAPHS**

- A. Photographer: Engage a qualified professional commercial photographer to take electronic construction photographs.
- B. Minimum Digital Camera Resolution: 1800 x 1200 dpi (dots per inch) @ 72 dpi resolution.
- C. Acceptable Electronic File Format: .jpg, .tif, .tiff, .tga, .jpe, or .png.
- D. Date Stamp: Unless otherwise indicated, date and time stamp each photograph as it is being taken so stamp is integral to photograph.
- E. Image File Naming Convention (separate by an underscore \_):
  - 1. Project Job Number / Year-Month-Day / Image Number . file extension
- F. Print Format: 8 in (200 mm) by 10 in (250 mm) smooth surface matte prints on single-weight commercial-grade stock, mounted on linen or card stock to allow a 1 in (25 mm) wide margin and enclosed back to back in clear plastic sleeves that are punched for standard 3-ring binder.

- G. Print Identification: On back of each print, provide an applied label or rubber-stamped impression with the following information:
1. Name of Project.
  2. Name and address of photographer.
  3. Name of Architect.
  4. Name of Contractor.
  5. Date photograph was taken.
  6. Description of vantage point, indicating location, direction (by compass point), and elevation or story of construction.
- H. Preconstruction Photographs: Before starting construction, take 4 photographs of Project site and surrounding properties from different vantage points, as directed by Architect. Show existing conditions adjacent to property. Submit prints and CD ROMs with digital files as required under "Submittals" Article.
- I. Periodic Construction Photographs: Take 4 photographs monthly, coinciding with cutoff date associated with each Application for Payment. Photographer shall select vantage points to best show status of construction and progress since last photographs were taken. Submit prints and CD ROMs with digital files as required under "Submittals" Article.
1. Field Office Prints: In addition to prints required to be submitted under "Submittals" Article, make and retain in field office at Project site available at all times for reference, one set of prints of periodic construction photographs. Identify photographs the same as for those submitted to Architect.
- J. Final Completion Construction Photographs: Take 8 photographs after date of Substantial Completion for submission as Project Record Documents. Architect will direct photographer for desired vantage points. Submit prints and CD ROMs with digital files as required under "Submittals" Article.

**END OF SECTION**



**SECTION 013300**  
**SUBMITTAL PROCEDURES**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Section includes requirements for the submittal schedule and administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other submittals.

**1.2 DEFINITIONS**

- A. Action Submittals: Written and graphic information and physical samples that require Architect's review. Architect's responsive action is required.
- B. Digital Signature: A digital signature or digital signature scheme is a mathematical scheme for demonstrating the authenticity of a digital message or document.
- C. Electronic Signature: An electronic signature is any legally recognized electronic means that indicates that a person adopts the contents of an electronic message.
- D. Informational Submittals: Written and graphic information other than action submittals that require Architect's review. Architect's responsive action is required on informational submittals that do not comply with the information given and design concept expressed in the Drawings and Specifications.
- E. Portable Document Format (PDF): An open standard file format licensed by Adobe Systems used for representing documents in a device-independent and display resolution-independent fixed-layout document format.

**1.3 SUBMITTALS**

- A. Submittal Schedule: Submit a schedule of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, ordering, manufacturing, fabrication, and delivery when establishing dates. Include additional time required for making corrections or revisions to submittals noted by Architect and additional time for handling and reviewing submittals required by those corrections.
  - 1. Coordinate submittal schedule with list of subcontracts, the schedule of values, and Contractor's construction schedule.
  - 2. Initial Submittal: Submit concurrently with startup construction schedule. Include submittals required during the first 60 days of construction. List those submittals required to maintain orderly progress of the Work and those required early because of long lead time for manufacture or fabrication.
  - 3. Final Submittal: Submit concurrently with the first complete submittal of Contractor's construction schedule.
    - a. Submit revised submittal schedule to reflect changes in current status and timing for submittals.

4. Format: Arrange the following information in a tabular format:
  - a. Scheduled date for first submittal.
  - b. Specification Section number and title.
  - c. Submittal category: Action; informational.
  - d. Name of subcontractor.
  - e. Description of the Work covered.
  - f. Scheduled date for Architect's final release or approval.

#### **1.4 SUBMITTAL ADMINISTRATIVE REQUIREMENTS**

- A. Architect's Digital Data Files: If approved by the by Owner, Architect will furnish Contractor one set of digital data files of Drawing files for use in preparing submittals. Architect makes no representations as to the accuracy or completeness of digital data files as they relate to Drawings. .
  1. Distribution: Digital data files shall only be distributed via the HKS Thru site with acceptance of HKS data licensing agreement.
- B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.
  1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
  2. Submit all submittal items required for each Specification Section concurrently unless partial submittals for portions of the Work are indicated on approved submittal schedule.
  3. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.
    - a. Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.
- C. Processing Time: Allow sufficient and reasonable time for submittal review, including time for resubmittals. Time for review shall commence on Architect's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.
  1. The Architect's action will be taken in accordance with the submittal schedule approved by the Architect or, in the absence of an approved submittal schedule, with reasonable promptness while allowing sufficient time in the Architect's professional judgment to permit adequate review.
- D. Paper Submittals: Architect reserves the right to require paper submittals.
- E. Electronic Submittals: Identify and incorporate information in each electronic submittal file as follows:
  1. Assemble complete submittal package into a single indexed file incorporating submittal requirements of a single Specification Section and transmittal form with links enabling navigation to each item.
  2. Name file with submittal number, including revision identifier.



- a. File Naming Convention (separate by dashes - or underscores \_):
  - 1) Specification Number / Revision Number / Submittal Sequence (A, B, C, etc.).pdf
3. Provide means for insertion to permanently record Contractor's review and approval markings and action taken by Architect.
4. Transmittal Form for Electronic Submittals: Use software-generated form from electronic project management software or electronic form acceptable to Owner, containing the following information:
  - a. Project name.
  - b. Date.
  - c. Name and address of Architect.
  - d. Name of Contractor.
  - e. Name of firm or entity that prepared submittal.
  - f. Names of subcontractor, manufacturer, and supplier.
  - g. Category and type of submittal.
  - h. Submittal purpose and description.
  - i. Specification Section number and title.
  - j. Specification paragraph number or drawing designation and generic name for each of multiple items.
  - k. Drawing number and detail references, as appropriate.
  - l. Location(s) where product is to be installed, as appropriate.
  - m. Related physical samples submitted directly.
  - n. Indication of full or partial submittal.
  - o. Transmittal number, numbered consecutively.
  - p. Submittal and transmittal distribution record.
  - q. Other necessary identification.
  - r. Remarks.
5. Metadata: Include the following information as keywords in the electronic submittal file metadata:
  - a. HKS Job Number and Add Service Number (e.g. 14424.000)
  - b. Project name.
  - c. Number and title of appropriate Specification Section.
  - d. Manufacturer name.
  - e. Product name.
  - f. Submittal revision number.
6. Utilize electronic project management software program to process submittals when feasible with the type and extent of submittals. Refer to Division 01 Section "Project Management and Coordination" for description of electronic project management software.
- F. Options: Identify options requiring selection by Architect.
- G. Deviations and Additional Information: On page, prepared on Contractor's letterhead, record relevant information, requests for data, revisions other than those requested by Architect on previous submittals, and deviations from requirements in the Contract Documents, including minor variations and limitations. Include same identification information as related submittal.
- H. Resubmittals: Make resubmittals in same form as initial submittal.

1. Note date and content of previous submittal.
  2. Note date and content of revision in file name and clearly indicate extent of revision.
  3. Resubmit submittals until they are marked with notation from Architect's action stamp not requiring additional submittals.
- I. Distribution: Furnish electronic copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.
- J. Use for Construction: Retain complete copies of submittals on Project site. Use only final action submittals that are marked with appropriate notation from Architect's action stamp indicating for construction. Retain a separate copy for Owner to be delivered to Owner with Project Closeout documents.

## **PART 2 - PRODUCTS**

### **2.1 SUBMITTAL PROCEDURES**

- A. General Submittal Procedure Requirements: Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.
1. Submit electronic submittals as PDF electronic files directly to Architect's Project Web site specifically established for Project.
    - a. Architect will return annotated file. Annotate and retain one copy of file as an electronic Project record document file.
    - b. Provide PDF electronic files from scanned paper originals at 300 dpi, minimum.
  2. Certificates and Certifications Submittals: Provide a statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity.
    - a. Provide a digital signature with digital certificate on electronically submitted certificates and certifications where indicated.
    - b. When one or more individual Specification Sections includes requirements for notarized signature on certificates and certifications, provide a notarized statement on original paper copy certificates and certifications where indicated.
- B. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.
1. If information must be specially prepared for submittal because standard published data are not suitable for use, submit as Shop Drawings, not as Product Data.
  2. Mark each copy of each submittal to show which products and options are applicable.
  3. Include the following information, as applicable:
    - a. Manufacturer's written recommendations.
    - b. Manufacturer's installation instructions.
    - c. Mill reports.
    - d. Standard product operating and maintenance manuals.

- e. Certification that products are appropriate for installation indicated.
  - f. Manufacturer's catalog cuts.
  - g. Manufacturer's product specifications.
  - h. Standard color charts.
  - i. Statement of compliance with specified referenced standards.
  - j. Testing by recognized testing agency.
  - k. Application of testing agency labels and seals.
  - l. Notation of coordination requirements.
  - m. Availability and delivery time information.
4. For equipment, include the following in addition to the above, as applicable:
- a. Wiring diagrams showing factory-installed wiring.
  - b. Printed performance curves.
  - c. Operational range diagrams.
  - d. Clearances required to other construction, if not indicated on accompanying Shop Drawings.
5. Submit Product Data before or concurrent with Samples.
6. Submit Product Data in the following format:
- a. PDF electronic file.
- C. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data.
1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:
- a. Identification of products.
  - b. Dimensions.
  - c. Fabrication and installation drawings.
  - d. Roughing-in and setting diagrams.
  - e. Wiring diagrams showing field-installed wiring, including power, signal, and control wiring.
  - f. Shopwork manufacturing instructions.
  - g. Templates and patterns.
  - h. Design calculations.
  - i. Schedules.
  - j. Compliance with specified standards.
  - k. Notation of coordination requirements.
  - l. Notation of dimensions established by field measurement.
  - m. Relationship and attachment to adjoining construction clearly indicated.
  - n. Seal and signature of professional engineer.
2. Wiring Diagrams: Differentiate between manufacturer-installed and field-installed wiring.
3. Sheet Size: Except for templates, patterns, and similar full-size drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches (212 by 275 mm), but no larger than 30 by 42 inches (750 by 1050 mm).
4. Submit Shop Drawings in the following format:
- a. PDF electronic file.

5. BIM File Incorporation: When applicable, develop and incorporate Shop Drawing files into Building Information Model established for Project.
  - a. Prepare Shop Drawings in the following format: Same digital data software program, version, and operating system as the original Drawings.
  - b. Refer to Division 01 Section "Project Management and Coordination" for requirements for coordination drawings.
- D. Samples: Submit Samples for review of kind, color, pattern, and texture for a check of these characteristics with other elements and for a comparison of these characteristics between submittal and actual component as delivered and installed.
  1. Transmit Samples that contain multiple, related components such as accessories together in one submittal package.
  2. Identification: Attach label on unexposed side of Samples that includes the following:
    - a. Generic description of Sample.
    - b. Product name and name of manufacturer.
    - c. Sample source.
    - d. Number and title of applicable Specification Section.
    - e. Specification paragraph number and generic name of each item.
  3. For projects where electronic submittals are required, provide corresponding electronic submittal of Sample transmittal, digital image file illustrating Sample characteristics, and identification information for record. This is in addition to physical samples.
  4. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.
    - a. Samples that may be incorporated into the Work are indicated in individual Specification Sections. Such Samples must be in an undamaged condition at time of use.
    - b. Samples not incorporated into the Work, or otherwise designated as Owner's property, are the property of Contractor.
  5. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available.
    - a. Number of Samples: Submit 4 full set(s) of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Architect will return submittal with options selected.
  6. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.

- a. Number of Samples: Submit 4 sets of Samples. Architect will retain 2 Sample sets; remainder will be returned. Mark up and retain one returned Sample set as a project record sample.
  - 1) Submit a single Sample where assembly details, workmanship, fabrication techniques, connections, operation, and other similar characteristics are to be demonstrated.
  - 2) If variation in color, pattern, texture, or other characteristic is inherent in material or product represented by a Sample, submit at least 4 sets of paired units that show approximate limits of variations.
- E. Coordination Drawing Submittals: Comply with requirements specified in Division 01 Section "Project Management and Coordination."
- F. Contractor's Construction Schedule: Comply with requirements specified in Division 01 Section "Construction Progress Documentation."
- G. Application for Payment and Schedule of Values: Comply with requirements specified in Division 01 Section "Payment Procedures."
- H. Test and Inspection Reports and Schedule of Tests and Inspections Submittals: Comply with requirements specified in Division 01 Section "Quality Requirements."
- I. Closeout Submittals and Maintenance Material Submittals: Comply with requirements specified in Division 01 Section "Closeout Procedures."
- J. Maintenance Data: Comply with requirements specified in Division 01 Section "Operation and Maintenance Data."
- K. Sustainable Construction Submittals: Where applicable, comply with requirements specified in Division 01 sustainable construction requirements Section.
- L. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, contact information of architects and owners, and other information specified.
- M. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of Welding Procedure Specification and Procedure Qualification Record on AWS forms. Include names of firms and personnel certified.
- N. Installer Certificates: Submit written statements on manufacturer's letterhead certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.
- O. Manufacturer Certificates: Submit written statements on manufacturer's letterhead certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.
- P. Product Certificates: Submit written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.

- Q. Material Certificates: Submit written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.
- R. Material Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.
- S. Product Test Reports: Submit written reports indicating that current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.
- T. Research Reports: Submit written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project. Include the following information:
1. Name of evaluation organization.
  2. Date of evaluation.
  3. Time period when report is in effect.
  4. Product and manufacturers' names.
  5. Description of product.
  6. Test procedures and results.
  7. Limitations of use.
- U. Preconstruction Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in the Contract Documents.
- V. Compatibility Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for primers and substrate preparation needed for adhesion.
- W. Field Test Reports: Submit written reports indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.
- X. Design Data: Prepare and submit written and graphic information, including, but not limited to, performance and design criteria, list of applicable codes and regulations, and calculations. Include list of assumptions and other performance and design criteria and a summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Include page numbers.

## **2.2 DELEGATED-ENGINEERING SERVICES**

- A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.
1. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to Architect.

- B. Delegated-Engineering Services Certification: In addition to Shop Drawings, Product Data, and other required submittals, submit digitally signed PDF electronic file and three paper copies of certificate, signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional.
  - 1. Indicate that products and systems comply with performance and design criteria in the Contract Documents. Include list of codes, loads, and other factors used in performing these services.
- C. BIM File Incorporation: Where applicable, incorporate delegated-design drawing and data files into Building Information Model established for Project.
  - 1. Prepare delegated-design drawings in the following format: Same digital data software program, version, and operating system as the original Drawings.

### **PART 3 - EXECUTION**

#### **3.1 CONTRACTOR'S REVIEW**

- A. Action and Informational Submittals: Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Architect.
- B. Project Closeout and Maintenance Material Submittals: See requirements in Division 01 Section "Closeout Procedures."
- C. Approval Stamp: Stamp each submittal with a uniform, approval stamp. Include Project name and location, submittal number, Specification Section title and number, name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

#### **3.2 ARCHITECT'S ACTION**

- A. Action Submittals: Architect will review submittal, make marks to indicate corrections or revisions required, and return it. Architect will stamp and mark submittal appropriately, as follows:
  - 1. Final but Restricted Release: When submittals are marked "Accepted as Noted," the Work covered by the submittal may proceed provided it complies with both the Architect's notations and corrections on the submittal and requirements of the Contract Documents. Final acceptance will depend on that compliance.
  - 2. Returned for Resubmittal: When submittal is marked "Revise Resubmit," do not proceed with the Work covered by the submittal, including purchasing, fabrication, delivery, or other activity. Revise or prepare a new submittal in accordance with the Architect's notations. Resubmit without delay. Repeat if necessary to obtain a different action mark.
    - a. Do not permit submittals marked "Revise Resubmit" to be used at the Project site, or elsewhere where construction is in progress.
  - 3. Submittals Not Required: Where a submittal is primarily for other Contractor activity, the submittal will be returned, marked "Not Reviewed; Submittal not required by Contract Documents."

Documents".

- B. Architect's acceptance of Shop Drawings, Samples or Product Data which deviates from the Contract Documents does not authorize changes to the Contract Sum. Submit in writing at the time of submission any changes to the Contract Sum affected by such Shop Drawings, Samples or Product Data, otherwise, claim for extras will not be considered.
- C. Informational Submittals: Architect will review submittal, and return it in accordance with submittal Processing Time indicated if it does not comply with requirements. Architect will stamp and mark submittal appropriately.
- D. Partial submittals prepared for a portion of the Work will be reviewed when use of partial submittals has received prior approval from Architect. Review shall not be final until complete submittal has been reviewed by Architect.
- E. Incomplete submittals are unacceptable, will be considered nonresponsive, and will be returned for resubmittal without review.
- F. Submittals not required by the Contract Documents may be returned by the Architect without action.
- G. Electronic File of Submittal Documents: Provide Architect with an independent electronic archive of project submittal documents using electronic project management software as defined in Division 01 Section "Project Management and Coordination".

#### **END OF SECTION**



## **SECTION 01 4000**

### **QUALITY REQUIREMENTS**

#### **PART 1 - GENERAL**

##### **1.1 SUMMARY**

- A. Section includes administrative and procedural requirements for quality assurance and quality control.
- B. Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.
  - 1. Specific quality-assurance and -control requirements for individual construction activities are specified in the Sections that specify those activities. Requirements in those Sections may also cover production of standard products.
  - 2. Specified tests, inspections, and related actions do not limit Contractor's other quality-assurance and -control procedures that facilitate compliance with the Contract Document requirements.
  - 3. Requirements for Contractor to provide quality-assurance and -control services required by Architect, Owner, or authorities having jurisdiction are not limited by provisions of this Section.

##### **1.2 DEFINITIONS**

- A. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.
- B. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that actual products incorporated into the Work and completed construction comply with requirements. Services do not include contract enforcement activities performed by Architect.
- C. Mockups: Full-size physical assemblies that are constructed on-site. Mockups are constructed to verify selections made under Sample submittals; to demonstrate aesthetic effects and, where indicated, qualities of materials and execution; to review coordination, testing, or operation; to show interface between dissimilar materials; and to demonstrate compliance with specified installation tolerances. Mockups are not Samples. Mockups establish the standard by which the Work will be judged.
  - 1. Integrated Exterior Mockups: Mockups of the exterior envelope erected separately from the building but on Project site, consisting of multiple products, assemblies, and subassemblies.
  - 2. Room Mockups: Mockups of typical interior spaces complete with wall, floor, and ceiling finishes, doors, windows, millwork, casework, specialties, furnishings and equipment, and lighting.
  - 3. Laboratory Mockups: Full-size physical assemblies constructed at testing facility to verify performance characteristics.

- D. Preconstruction Testing: Tests and inspections performed specifically for Project before products and materials are incorporated into the Work, to verify performance or compliance with specified criteria.
- E. Product Testing: Tests and inspections that are performed by an NRTL (Nationally Recognized Testing Laboratories), an NVLAP (National Voluntary Laboratory Accreditation Program), or a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with specified requirements.
- F. Source Quality-Control Testing: Tests and inspections that are performed at the source, e.g., plant, mill, factory, or shop.
- G. Field Quality-Control Testing: Tests and inspections that are performed on-site for installation of the Work and for completed Work.
- H. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.
- I. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, Subcontractor, or Sub-subcontractor, to perform a particular construction operation, including installation, erection, application, and similar operations.
  - 1. Use of trade-specific terminology in referring to a trade or entity does not require that certain construction activities be performed by accredited or unionized individuals, or that requirements specified apply exclusively to specific trade(s).
- J. Experienced: When used with an entity or individual, "experienced" means having successfully completed a minimum of five previous projects similar in nature, size, and extent to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction and with the qualification requirements of individual specification section governing their work.

### **1.3 CONFLICTING REQUIREMENTS**

- A. Referenced Standards: If compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer conflicting requirements to Architect for a decision before proceeding.
- B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Architect for a decision before proceeding.

### **1.4 CONTRACTOR'S QUALITY-CONTROL PLAN**

- A. Quality-Control Plan, General: Submit quality-control plan prior to preconstruction conference. Submit in format acceptable to Architect. Identify personnel, procedures, controls, instructions, tests, records, and forms to be used to carry out Contractor's quality-assurance and quality-control responsibilities. Coordinate with Contractor's construction schedule.

- B. Quality-Control Personnel Qualifications: Engage qualified full-time personnel trained and experienced in managing and executing quality-assurance and quality-control procedures similar in nature and extent to those required for Project.
  - 1. Project quality-control manager may be the Project superintendent or be an individual with no other Project responsibilities, as accepted by the Architect.
- C. Submittal Procedure: Describe procedures for ensuring compliance with requirements through review and management of submittal process. Indicate qualifications of personnel responsible for submittal review.
- D. Testing and Inspection: In quality-control plan, include a comprehensive schedule of Work requiring testing or inspection, including the following:
  - 1. Contractor-performed tests and inspections including subcontractor-performed tests and inspections. Include required tests and inspections and Contractor-elected tests and inspections.
  - 2. Special inspections required by authorities having jurisdiction and indicated on the "Statement of Special Inspections."
  - 3. Owner-performed tests and inspections indicated in the Contract Documents, including tests and inspections indicated to be performed by the Commissioning Authority when Commissioning is included in the Project.
- E. Continuous Inspection of Workmanship: Describe process for continuous inspection during construction to identify and correct deficiencies in workmanship in addition to testing and inspection specified. Indicate types of corrective actions to be required to bring work into compliance with standards of workmanship established by Contract requirements and approved mockups.
- F. Monitoring and Documentation: Maintain testing and inspection reports including log of approved and rejected results, including Owner acceptance of nonconforming work. Include work Architect has indicated as nonconforming or defective. Indicate corrective actions taken to bring nonconforming work into compliance with requirements. Comply with requirements of authorities having jurisdiction.

## **1.5 REPORTS AND DOCUMENTS**

- A. Test and Inspection Reports: Prepare and submit certified written reports specified in other Sections. Include the following:
  - 1. Date of issue.
  - 2. Project title and number.
  - 3. Name, address, and telephone number of testing agency.
  - 4. Dates and locations of samples and tests or inspections.
  - 5. Names of individuals making tests and inspections.
  - 6. Description of the Work and test and inspection method.
  - 7. Identification of product and Specification Section.
  - 8. Complete test or inspection data.
  - 9. Test and inspection results and an interpretation of test results.
  - 10. Record of temperature and weather conditions at time of sample taking and testing and inspecting.
  - 11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
  - 12. Name and signature of laboratory inspector.
  - 13. Recommendations on retesting and reinspecting.

- B. **Manufacturer's Technical Representative's Field Reports:** Prepare written information documenting manufacturer's technical representative's tests and inspections specified in other Sections. Include the following:
1. Name, address, and telephone number of technical representative making report.
  2. Statement on condition of substrates and their acceptability for installation of product.
  3. Statement that products at Project site comply with requirements.
  4. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
  5. Results of operational and other tests and a statement of whether observed performance complies with requirements.
  6. Statement whether conditions, products, and installation will affect warranty.
  7. Statement whether conditions, products, and installation exceed manufacturer's statements.
  8. Other required items indicated in individual Specification Sections.
- C. **Factory-Authorized Service Representative's Reports:** Prepare written information documenting manufacturer's factory-authorized service representative's tests and inspections specified in other Sections. Include the following:
1. Name, address, and telephone number of factory-authorized service representative making report.
  2. Statement that equipment complies with requirements.
  3. Results of operational and other tests and a statement of whether observed performance complies with requirements.
  4. Statement whether conditions, products, and installation will affect warranty.
  5. Other required items indicated in individual Specification Sections.
- D. **Permits, Licenses, and Certificates:** For Owner's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents, established for compliance with standards and regulations bearing on performance of the Work.

## **1.6 QUALITY ASSURANCE**

- A. **General:** Qualifications paragraphs in this article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.
- B. **Manufacturer Qualifications:** A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- C. **Fabricator Qualifications:** A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- D. **Installer Qualifications:** A firm or individual experienced in installing, erecting, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.
- E. **Professional Engineer Qualifications:** A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or product that is similar in material, design, and extent to those indicated for this Project.

- F. Specialists: Certain Specification Sections require that specific construction activities shall be performed by entities who are recognized experts in those operations. Specialists shall satisfy qualification requirements indicated and shall be engaged for the activities indicated.
1. Requirements of authorities having jurisdiction shall supersede requirements for specialists.
- G. Testing Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspecting indicated, as documented according to ASTM E 329; and with additional qualifications specified in individual Sections; and, where required by authorities having jurisdiction, that is acceptable to authorities.
1. NRTL: A nationally recognized testing laboratory according to 29 CFR 1910.7.
  2. NVLAP: A testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program.
- H. Manufacturer's Technical Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to observe and inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.
- I. Factory-Authorized Service Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.
- J. Preconstruction Testing: Where testing agency is indicated to perform preconstruction testing for compliance with specified requirements for performance and test methods, comply with the following:
1. Contractor responsibilities include the following:
    - a. Provide test specimens representative of proposed products and construction.
    - b. Submit specimens in a timely manner with sufficient time for testing and analyzing results to prevent delaying the Work.
    - c. Provide sizes and configurations of test assemblies, mockups, and laboratory mockups to adequately demonstrate capability of products to comply with performance requirements.
    - d. Build site-assembled test assemblies and mockups using installers who will perform same tasks for Project.
    - e. Build laboratory mockups at testing facility using personnel, products, and methods of construction indicated for the completed Work.
    - f. When testing is complete, remove test specimens, assemblies, mockups, and laboratory mockups; do not reuse products on Project.
  2. Testing Agency Responsibilities: Submit a certified written report of each test, inspection, and similar quality-assurance service to Architect, with copy to Contractor. Interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from the Contract Documents.

- K. Mock-ups: Prior to fabrication and installation, build mock-up for each form of construction and finish required to verify selections made under sample Submittals and to demonstrate aesthetic effects and qualities of materials and execution. Build mock-up to comply with the following requirements, using materials indicated for the completed Work:
1. Build mock-up in the location and of the size indicated or, if not indicated, as directed by Architect. Contractor shall provide structural support framework.
    - a. Show typical components, attachments to building structure, and requirements of installation.
  2. Clean exposed faces of mock-up.
  3. Notify Architect seven days in advance of the dates and times when mock-up will be installed.
  4. Demonstrate the proposed range of aesthetic effects and workmanship.
  5. Protect accepted mock-up from the elements with weather-resistant membrane.
  6. Obtain Architect's acceptance of mock-ups before starting fabrication.
  7. Maintain mock-ups during construction in an undisturbed condition as a standard for review of the completed Work.
  8. Acceptance of mock-ups does not constitute acceptance of deviations from the Contract Documents contained in mock-ups unless such deviations are specifically noted by Contractor, submitted to Architect in writing, and accepted by Architect in writing.
  9. Demolish and remove mock-ups when directed by Architect unless accepted to become part of the completed Work.
- L. Integrated Exterior Mockups: See Division 01 Section "Visual Mock-Up Requirements".
- M. Room Mockups: See Division 01 Section "Visual Mock-Up Requirements".
- N. Laboratory Mockups: See Division 01 Section "Testing Mock-Up for Building Enclosure System".

## **1.7 QUALITY CONTROL**

- A. Owner Responsibilities: Where quality-control services are indicated as Owner's responsibility, Owner will engage a qualified testing agency to perform these services.
1. Owner will furnish Contractor with names, addresses, and telephone numbers of testing agencies engaged and a description of types of testing and inspecting they are engaged to perform.
  2. Costs for retesting and reinspecting construction that replaces or is necessitated by work that failed to comply with the Contract Documents will be charged to Contractor.
- B. Contractor Responsibilities: Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Perform additional quality-control activities required to verify that the Work complies with requirements, whether specified or not.
1. Unless otherwise indicated, provide quality-control services specified and those required by authorities having jurisdiction. Perform quality-control services required of Contractor by authorities having jurisdiction, whether specified or not.
  2. Where services are indicated as Contractor's responsibility, engage a qualified testing agency to perform these quality-control services.

- a. Contractor shall not employ same entity engaged by Owner, unless agreed to in writing by Owner.
  3. Notify testing agencies at least 48 hours in advance of time when Work that requires testing or inspecting will be performed.
  4. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
  5. Testing and inspecting requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
  6. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.
- C. **Manufacturer's Field Services:** Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections. Report results in writing as specified in Division 01 Section "Submittal Procedures."
- D. **Manufacturer's Technical Services:** Where indicated, engage a manufacturer's technical representative to observe and inspect the Work. Manufacturer's technical representative's services include participation in preinstallation conferences, examination of substrates and conditions, verification of materials, observation of Installer activities, inspection of completed portions of the Work, and submittal of written reports.
- E. **Retesting/Reinspecting:** Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and reinspecting, for construction that replaced Work that failed to comply with the Contract Documents.
- F. **Testing Agency Responsibilities:** Cooperate with Architect and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.
1. Notify Architect and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
  2. Conduct and interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from requirements.
  3. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Contractor.
  4. Do not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.
  5. Do not perform any duties of Contractor.
- G. **Associated Services:** Cooperate with agencies performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:
1. Access to the Work.
  2. Incidental labor and facilities necessary to facilitate tests and inspections.
  3. Adequate quantities of representative samples of materials that require testing and inspecting. Assist agency in obtaining samples.
  4. Facilities for storage and field curing of test samples.
  5. Delivery of samples to testing agencies.
  6. Preliminary design mix proposed for use for material mixes that require control by testing agency.
  7. Security and protection for samples and for testing and inspecting equipment at Project site.

- H. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and -control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.
  - 1. Schedule times for tests, inspections, obtaining samples, and similar activities.
- I. Schedule of Tests and Inspections: Prepare a schedule of tests, inspections, and similar quality-control services required by the Contract Documents. Coordinate and submit concurrently with Contractor's construction schedule.
  - 1. Distribution: Distribute schedule to Owner, Architect, testing agencies, and each party involved in performance of portions of the Work where tests and inspections are required.
    - a. Prepare in tabular form and include the following:
      - 1) Specification Section number and title.
      - 2) Entity responsible for performing tests and inspections.
      - 3) Description of test and inspection.
      - 4) Identification of applicable standards.
      - 5) Identification of test and inspection methods.
      - 6) Number of tests and inspections required.
      - 7) Time schedule or time span for tests and inspections.
      - 8) Requirements for obtaining samples.
      - 9) Unique characteristics of each quality-control service.

## **1.8 SPECIAL TESTS AND INSPECTIONS**

- A. Special Tests and Inspections: Owner may engage a qualified to conduct special tests and inspections required by authorities having jurisdiction as the responsibility of Owner, and as follows:
  - 1. Notifying Architect and Contractor promptly of irregularities and deficiencies observed in the Work during performance of its services.
  - 2. Submitting a certified written report of each test, inspection, and similar quality-control service to Architect with copy to Contractor and to authorities having jurisdiction.
  - 3. Submitting a final report of special tests and inspections at Substantial Completion, which includes a list of unresolved deficiencies.
  - 4. Interpreting tests and inspections and stating in each report whether tested and inspected work complies with or deviates from the Contract Documents.
  - 5. Retesting and reinspecting corrected work.

## **PART 2 - PRODUCTS (Not Used)**

## **PART 3 - EXECUTION**

### **3.1 TEST AND INSPECTION LOG**

- A. Test and Inspection Log: Prepare a record of tests and inspections. Include the following:
  - 1. Date test or inspection was conducted.
  - 2. Description of the Work tested or inspected.
  - 3. Date test or inspection results were transmitted to Architect.



4. Identification of testing agency or special inspector conducting test or inspection.
- B. Maintain log at Project site. Post changes and revisions as they occur. Provide access to test and inspection log for Architect's reference during normal working hours.

### **3.2 REPAIR AND PROTECTION**

- A. General: On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.
  1. Provide materials and comply with installation requirements specified in other Specification Sections or matching existing substrates and finishes. Restore patched areas and extend restoration into adjoining areas in a manner that eliminates evidence of patching. Comply with the Contract Document requirements for cutting and patching in Division 01 Section "Execution."
- B. Protect construction exposed by or for quality-control service activities.
- C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

**END OF SECTION**



**SECTION 01 4323**  
**SPECIAL INSPECTIONS**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Section Includes: Special Inspections required by Authorities Having Jurisdiction including supplementary work necessary to complete inspections.

**1.2 RESPONSIBILITY**

- A. Special Inspections do not relieve the Contractor of the responsibility to provide construction in accordance with the Contract Documents.

**1.3 INSPECTOR'S RESPONSIBILITY**

- A. Special Inspector shall be acceptable to the Authorities Having Jurisdiction for this project.
- B. Special Inspector shall be completely familiar with the Contract Documents relating to inspection responsibility.

**1.4 COOPERATION**

- A. Contractor shall cooperate with and assist Special Inspector in performing Special Inspections. Special Inspector shall have access to the project without restriction.
  - 1. Contractor shall advise Special Inspector in advance of construction schedules and planned operations to assure timely and appropriate observation and inspection of items requiring Special Inspections.
  - 2. Contractor shall make available approved Shop Drawings to the Special Inspector at jobsite.

**1.5 OWNER'S RESPONSIBILITY**

- A. Cost of employing the Special Inspector shall be the responsibility of the Owner.
- B. Final interpretation of the Contract Documents shall rest with the Architect and Engineers of Record.

**1.6 GENERAL DUTIES OF SPECIAL INSPECTOR**

- A. Special Inspector shall cooperate with the Contractor on timely observations and inspections of Work. Special Inspector shall not supervise or direct the Work.
- B. Special Inspector shall immediately alert the Contractor of discrepancies and deviations from the Contract Documents and approved Shop Drawings.

- C. Special Inspection Reports shall be submitted within 24 hours of the time and date of the observation and inspection.
  - 1. Special Inspector shall submit his reports to the Authorities Having Jurisdiction for the project. In addition, Special Inspector shall submit copies of reports to the Owner and to the Contractor.
  - 2. Upon completion of the building and prior to the issuance of a Certificate of Occupancy, a signed and sealed statement by the Special Inspector shall be submitted to the Authorities Having Jurisdiction, stating the portion of the project subject to Special Inspections has been constructed in accordance with the Contract Documents. This statement shall be provided in accordance with the governing building codes and ordinances.

#### **1.7 SCHEDULE OF SPECIAL INSPECTIONS**

- A. Refer to attached Schedule of Summary of Special Inspections.

#### **PART 2 - PRODUCTS - Not Used**

#### **PART 3 - EXECUTION - Not Used**

**END OF SECTION**

## **SECTION 01 4339**

### **VISUAL MOCK-UP REQUIREMENTS**

#### **PART 1 - GENERAL**

##### **1.1 SUMMARY**

- A. This Section specifies full size mock-up requirements of building components to verify material selections, demonstrate aesthetic effects and review construction and workmanship.
- B. Approved mock-up shall establish the standard by which the Work will be judged.
- C. Acceptance of mock-up does not constitute approval of deviations from the Contract Documents in mock-up, unless such deviations are specifically approved by Architect in writing.
- D. Retain mock-ups during construction and maintain in an undisturbed condition. Do not demolish alter or remove mock-up until approved by Architect.
- E. Mock-up shall be used to demonstrate quality of materials, finish and workmanship as well as to show compliance with visual criteria.
- F. Submit shop drawings prior to fabrication of visual mock-up, showing plan, elevations and details of mock-up.

#### **PART 2 - PRODUCTS**

##### **2.1 MATERIALS**

- A. As specified in individual Specification Sections.

#### **PART 3 - EXECUTION**

##### **3.1 INSTALLATION**

- A. Use the same workers to do work in conjunction with construction of the mock-up as covered by the work of their respective Contracts.
- B. Provide mock-up complete with corners, splice joints, control joints, sealants, and complete finish with details identical to those proposed for use in the building and as indicated on the drawings.
- C. Do not use special measures or techniques, which are not representative of those to be used in the building. Finish the various components to show the maximum variation that will exist in the actual building construction between adjacent components.
- D. Notify Architect when construction of mock-up begins and when major components are to be installed.
- E. Complete the mock-up and obtain Architect's approval of each component of the mock-up prior to fabrication or purchase of products for the Project.

### 3.2 BUILDING EXTERIOR WALL

- A. Fabricate and erect a visual mock-up of the typical exterior wall condition with one outside corner returning to the window line.
  - 1. Mock-up size: As indicated on drawing elevations.
- B. Provide structural steel frame work for support of visual mock up. Frame work shall be designed by a registered professional or structural engineer licensed in the State where the Project is located.
- C. Coordinate with Architect and Owner for location of mock-up on project site. When directed, demolish mock-ups and remove from Project site.
- D. Construct mock-up in such a manner that each type of exterior finishes will be demonstrated in a layered fashion from one side to the other. The purpose in the layers is to facilitate the review of the multiple activities that are required to accomplish the final finish.
- E. Construct mock-up in phases so that proposed construction methodologies can be observed. Mock-up shall be completely constructed, just as if it were the finished exterior wall. Wall insulation and interior wall finishes are not required.
- F. In addition to specifics in the respective Specification Sections, the mock-up will be reviewed by the Owner and the Architect for the following evaluation purposes:
  - 1. Aesthetic: To review and verify selections made under submittals, as well as to show compliance with visual criteria. Acceptance criteria is for general and specific aesthetic qualities of construction, and includes, but is not limited to, the following:
    - a. Color, texture, and blending of masonry units.
    - b. Consistency of masonry mortar color.
    - c. Tooling of masonry mortar joints.
    - d. Color, texture and finishing of exterior insulation and finish system (EIFS).
    - e. Tooling of sealants.
    - f. Color consistency of aluminum window framing.
    - g. Color and clarity of glass.
    - h. Flatness and alignment of aluminum composite material panels.
  - 2. Installation Execution: To review and verify quality of workmanship, and compliance with Drawings, Specification and submittals. Acceptance criteria is for general and specific erection, installation and application qualities of construction, and includes, but is not limited to, the following:
    - a. Masonry bonding and mortar character.
    - b. Brick cavity cleanliness.
    - c. Brick cavity drainage function.
    - d. Masonry anchor and ties integrity.
    - e. Masonry flashing fabrication and embedment within the masonry.
    - f. Assembly of various components of the exterior insulation and finish system (EIFS), including color, texture and finishing.
    - g. Cold-formed metal framing fabrication and assemblage.
    - h. Glazed aluminum wall system fabrication, anchorage/attachment, and installation quality.
    - i. Glazing integrity.
    - j. Sealant profile consistency and bonding integrity.
    - k. Attachment of aluminum composite material panels.

- I. Dimensional tolerances.

### 3.3 TYPICAL ROOM MOCK-UP

- A. Arrange for the construction of a typical room mock-up located in the building, per mutual agreement between Owner and Contractor.
  - 1. **Typical Restrooms:** At the first installation of a typical office restroom, complete finishes, fixtures and accessories in one restroom module as a visual mock-up.
  - 2. **Typical Patient Room:** At the first installation of a typical hospital patient room, complete finishes, fixtures and accessories in one patient room module as a visual mock-up.
- B. The materials trades Subcontractors shall do all work in conjunction with construction of the mock-up as covered by the work of their respective Contracts.
- C. Typical Room mock-up shall be complete with finishes, fixtures and details identical to those proposed for use in the Project. Do not use special measures or techniques, which are not representative of those to be used in the finish work. Finish the various components to show the quality of material and construction that will exist in the actual construction.
- D. Typical room mock-up shall be of adequate size to contain all samples and demonstrate quality of materials, finish and workmanship as well as to show compliance with visual criteria. Submit shop drawings to show layout of room prior to construction. Mock-up room shall be constructed as soon as sufficient structure is available to allow installation.
- E. Materials or workmanship not approved shall be removed and replaced with acceptable products or workmanship. Fabrication, purchase or installation of materials for the building shall not begin until approved in the mock-up room. Owner's approval of samples will be required on all visual items prior to any contractor's buy-out.
- F. Materials installed in the room mock-up shall include an example of all furnished assemblies, hardware, equipment or accessories required for the Project and shall include, but may not be necessarily limited to the following:
  - 1. Lavatory countertop, complete with sealant, sink, accessories, trim, etc.
  - 2. Flush Wood veneer door
  - 3. Hollow Metal Door Frame
  - 4. Door Hardware
  - 5. Ceramic floor and wall material
  - 6. Vinyl Wall Covering(s)
  - 7. Toilet Compartment complete with partition, side wall, pilaster, door and hardware.
  - 8. Toilet Room Accessories
  - 9. Water closet and trim
  - 10. Urinal and trim
  - 11. Lighting
  - 12. Electrical Devices and Accessories
  - 13. Access Doors or Panels

**END OF SECTION**





## **SECTION 01 4516**

### **FIELD TEST FOR WATER LEAKAGE**

#### **PART 1 - GENERAL**

##### **1.1 SUMMARY**

- A. Section Includes: Field test to determine resistance to water leakage in wall systems in accordance with performance requirements indicated including joints in adjacent construction which are designed to remain permanently closed and watertight.
- B. Contractor will pay costs of testing laboratory for this test.

##### **1.2 DEFINITIONS**

- A. Water Leakage: Any uncontrolled water that appears on any normally exposed interior surfaces, that is not contained or drained back to exterior, or that can cause damage to adjacent materials or finishes. Water contained within drained flashings, gutters, and sills is not considered water leakage.

##### **1.3 SUBMITTALS**

- A. Field Quality Control Reports: Written report of testing and inspection required by "Field Quality Control".
- B. Qualification Data: For testing agency.
  - 1. For firms and persons specified in "Quality Assurance" to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of Architects and Owners, and other information specified.

##### **1.4 QUALITY ASSURANCE**

- A. Testing Agency Qualifications: Qualified according to ASTM E 699 for testing indicated.
- B. Field Water Spray Testing: Selective field testing will be conducted in accordance with AAMA Standard 501.2: "Quality Assurance and Diagnostic Water Leakage Field Check of Installed Storefronts, Curtainwalls, and Sloped Glazing Systems".
  - 1. Water Spray Test without Air Pressure Difference: Designated areas shall be tested according to AAMA 501.2 and shall not evidence water penetration.
  - 2. Test shall be performed prior to installation of interior finishes.

- C. Field Chamber Testing: Selective field testing will be conducted in accordance with ASTM E 1105 "Standard Test Method for Field Determination of Water Penetration of Installed Exterior Windows, Curtain Walls, and Doors by Uniform or Cyclic Static Air Pressure Difference".
  - 1. Water Penetration Test with Static Air Pressure Difference: Designated areas shall be tested according to ASTM E 1105 at a minimum static air pressure differential specified for laboratory testing in "Performance Requirements" and shall not evidence water penetration. Field test to full design static pressure differential with no reduction for field installation.
  - 2. Test chamber shall include adjacent joints and interior/exterior construction.

## 1.5 **CONTRACTOR RESPONSIBILITIES**

- A. Cooperate with Testing Agency. Provide labor, materials and equipment, including but not limited to scaffolding, equipment and water supply for use in testing by testing agency personnel.
  - 1. Contractor shall be responsible for coordinating and scheduling testing.
  - 2. Provide powered scaffold, hose, water supply, communication system and manpower to perform tests Schedule any work necessary, such as out of sequence sealant work, so that wall can be tested.
- B. Satisfactory results of this test do not relieve Contractor from conforming to requirements of Contract Documents, shop drawings, and project specifications, and installation work on remainder of building shall match area checked, unless otherwise instructed in writing.
- C. Pending actual performance, prevalence or absence of water leakage in initial water penetration test, and upon measures adopted by the Contractor to eliminate source of leakage, Architect/Consultant will determine necessity for, and scope of additional tests and test methods. Remedial measures shall maintain standards of quality and durability and are subject to approval.
- D. Remedial measures found necessary and effective in eliminating leakage in area checked shall be used in fabricating and installing remainder of wall on building.
- E. Notify Architect/Consultant and testing agency when wall construction is ready for testing.

## **PART 2 - PRODUCTS**

### **2.1 PERFORMANCE REQUIREMENTS**

- A. Refer to Technical Sections for performance requirements of each system or product to be tested.

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Acceptance of Surfaces and Conditions: Examine substrates 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.

### **3.2 INSTALLATION, GENERAL**

- 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.

### **3.3 PREPARATION**

- A. General: Comply with manufacturer's instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.
- B. Exterior wall construction shall be completed, and shall be fully glazed to provide complete wall installation. Work shall be done in strict accord with approved shop drawings and job specifications.

### **3.4 FIELD QUALITY CONTROL TESTING**

- A. Testing Services, General: Testing and inspecting of representative areas of exterior walls shall take place as installation proceeds to determine compliance of installed assemblies with specified performance requirements.
- B. Testing Agency Field Service: Engage a qualified independent testing agency employed by Contractor and approved by Architect to perform field quality control. Materials and installation failing to meet specified requirements shall be replaced at Contractor's expense. Retesting of materials and installations failing to meet specified requirements shall be done at Contractor's expense.
- C. Architect shall designate test procedure and areas of completed walls to be checked.
  - 1. Field Testing shall be performed at intervals and locations including but not limited to the following:
    - a. Field Water Spray Testing per AAMA 501.2: Perform tests at intervals and locations in each test area as directed by Architect; however, not less than 1-percent of total units or 5 units minimum, whichever is greater, shall be tested for each type of glazing system and configuration.

- b. Field Chamber Testing per ASTM E 1105: Perform tests at intervals and locations in each test area as directed by Architect; however, not less than 3 static water test minimum, shall be tested for each type of glazing system and configuration.
- 2. Systems shall be tested in accordance with definitions and at performance requirements indicated in Technical Sections.
- 3. Test wall at 15-percent, 50-percent, and 75-percent completion unless directed otherwise.
- D. All joints or other conditions within designated areas where leakage may occur will be tested.
- E. Indoor side of wall in this area shall be unfinished and left open and unobstructed, permitting full length of joints to be examined from indoor side.
- F. If operable joints such as those around doors and operable parts of windows occur within wall area involved, appropriate modifications both of procedure and performance requirements will be made in respect to such joints.

### **3.5 TEST REPORTS**

- A. Testing laboratory shall be responsible for conducting and reporting tests, shall state in report whether or not test specimen conforms to requirements of Contract Documents approved drawings, and shall specifically note any deviations.
- B. Testing laboratory shall submit its report directly to Contractor and Architect. Necessary corrections shall be performed in presence of Architect. Tests shall be witnessed by Architect/Consultant. Approval of test assembly and test results rests with the Architect.
- C. Test Reports: Shall be prepared according to testing standard indicated.

### **3.6 REMEDIAL WORK BY CONTRACTOR**

- A. In event of failure to initially meet test requirements called for hereinabove, Contractor and respective subcontractors shall, as required, redesign, rework, and/or re-fabricate, reship and re-erect assemblies until said requirements are met, at no additional cost to Owner.
- B. Wherever leakage has occurred, joints shall be made watertight in manner acceptable to Architect.
- C. Remedial work involving use of curing-type compounds shall be allowed to set for one week before it is re-checked for leakage.
- D. After necessary remedial work has been completed, and required curing time, if any, has elapsed, repaired joints shall be retested.
- E. Should leakage still be found, further remedial measures shall be taken and checking shall be repeated until joints in designated area are found to be satisfactory.
- F. Re-checking, when required, shall be performed by testing laboratory originally employed by Contractor.

**END OF SECTION**





## **SECTION 01 5000**

### **TEMPORARY FACILITIES AND CONTROLS**

#### **PART 1 - GENERAL**

##### **1.1 SUMMARY**

- A. Section includes requirements for temporary utilities, support facilities, and security and protection facilities.

##### **1.2 USE CHARGES**

- A. General: Installation and removal of and use charges for temporary facilities shall be included in the Contract Sum. Allow other entities to use temporary services and facilities without cost, including, but not limited to, Owner's construction forces, Architect, occupants of Project, testing agencies, and authorities having jurisdiction.
  - 1. Cost or use charges for temporary facilities are not chargeable to Owner or Architect.
- B. Sewer Service: Pay sewer-service use charges for sewer usage, indicated by utility company meter readings, by all entities for construction operations.
- C. Water Service: Pay water-service use charges for water used, indicated by utility company meter readings, by all entities for construction operations.
- D. Electric Power Service: Pay electric-power-service use charges for electricity used, indicated by utility company meter readings, by all entities for construction operations.

##### **1.3 INFORMATIONAL SUBMITTALS**

- A. Site Plan: Show temporary facilities, utility hookups, staging areas, and parking areas for construction personnel.
- B. Moisture-Protection Plan: Describe procedures and controls for protecting materials and construction from water absorption and damage.
  - 1. Describe delivery, handling, and storage provisions for materials subject to water absorption or water damage.
  - 2. Indicate procedures for discarding water-damaged materials, protocols for mitigating water intrusion into completed Work, and replacing water-damaged Work.
  - 3. Indicate sequencing of work that requires water, such as sprayed fire-resistive materials, plastering, and terrazzo grinding, and describe plans for dealing with water from these operations. Show procedures for verifying that wet construction has dried sufficiently to permit installation of finish materials.
- C. Dust- and HVAC-Control Plan at Renovation Work: Submit coordination drawing and narrative that indicates the dust- and HVAC-control measures proposed for use, proposed locations, and proposed time frame for their operation. Identify further options if proposed measures are later determined to be inadequate. Include the following:
  - 1. Locations of dust-control partitions at each phase of work.

2. HVAC system isolation schematic drawing.
  3. Location of proposed air-filtration system discharge.
  4. Waste handling procedures.
  5. Other dust-control measures.
- D. Temporary Utility Reports: Make available on request, reports of tests, inspections, meter readings, and similar procedures performed on temporary utilities.
- E. Implementation and Termination Schedule: Make available on request a schedule indicating implementation and termination of each temporary utility.

#### **1.4 QUALITY ASSURANCE**

- A. Standards: Comply with ANSI A10.6 "Requirements for Demolition Operations", NECA's "Temporary Electrical Facilities," and NFPA 241 "Standard for Safeguarding Construction, Alteration, and Demolition Operations".
1. Trade Jurisdictions: Assigned responsibilities for installation and operation of temporary utilities are not intended to interfere with trade regulations and union jurisdictions.
- B. Electric Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.
- C. Tests and Inspections: Arrange for authorities having jurisdiction to test and inspect each temporary utility before use. Obtain required certifications and permits.
- D. Accessible Temporary Egress at Renovation Work: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines and ICC/ANSI A117.1.
- E. Regulations: Comply with industry standards and applicable laws and regulations of authorities having jurisdiction, including but not limited to, the following:
1. Building Code requirements.
  2. Health and safety regulations.
  3. Utility company regulations.
  4. Police, Fire Department and Rescue Squad rules.
  5. Environmental protection regulations.
  6. City ordinances and regulations.

#### **1.5 PROJECT CONDITIONS**

- A. Temporary Use of Permanent Facilities: Engage Installer of each permanent service to assume responsibility for operation, maintenance, and protection of each permanent service during its use as a construction facility before Owner's acceptance, regardless of previously assigned responsibilities.

### **PART 2 - PRODUCTS**

#### **2.1 MATERIALS**

- A. General: Provide new materials. Undamaged, previously used materials in serviceable condition may be used if approved by Architect. Provide materials suitable for use intended.



- B. Materials and equipment may be new or used, but must be adequate in capacity for the required usage, must not create unsafe conditions, and must not violate requirements of applicable codes and standards.
- C. Chain-Link Fencing: Minimum 2 inch (50 mm), 0.148 inch (3.8 mm) thick, galvanized-steel, chain-link fabric fencing; minimum 6 feet (1.8 m) high with galvanized-steel pipe posts; minimum 2-3/8 inch (60 mm) OD line posts and 2-7/8 inch (73 mm) OD corner and pull posts, with 1-5/8 inch (42 mm) OD top rails.
- D. Portable Chain-Link Fencing: Minimum 2 inch (50 mm), 0.148 inch (3.8 mm) thick, galvanized-steel, chain-link fabric fencing; minimum 6 feet (1.8 m) high with galvanized-steel pipe posts; minimum 2-3/8 inch (60 mm) OD line posts and 2-7/8 inch (73 mm) OD corner and pull posts, with 1-5/8 inch (40 mm) OD top and bottom rails. Provide concrete or galvanized-steel bases for supporting posts.
- E. Wood Enclosure Fence: Plywood, 8 feet (2.4 m) high, framed with four 2 by 4 inch (50 by 100 mm) rails, with preservative-treated wood posts spaced not more than 8 feet (2.4 m) apart.
- F. Polyethylene Sheet: Reinforced, fire-resistive sheet, 10 mil (0.25 mm) minimum thickness, with flame-spread rating of 15 or less per ASTM E 84 and passing NFPA 701 Test Method 2.
- G. Polyethylene Sheet: Reinforced, fire-resistive sheet, 6 mil (0.14 mm) minimum thickness, with Class A flame-spread rating per ASTM E 84 and passing NFPA 701 Test Method 2.
  - 1. Basis of Design (Product Standard): Abatement Technologies, Inc.; SAFE-FLEX ICRA Awareness Barrier.
- H. Dust Containment Barrier for Doors: reinforced, fire-resistive polyethylene sheet, 10 mil (0.25 mm) minimum thickness with Class B flame-spread rating per ASTM E 84 and designed to be used for securing temporary construction doors so as to minimize and mitigate particle control during construction.
  - 1. Basis of Design (Product Standard): Abatement Technologies, Inc.; Aire Guardian Door Guard Reusable Barrier.
- I. Dust-Control Adhesive-Surface Walk-off Mats: Provide mats minimum 36 by 60 inches (900 by 1500 mm).
- J. Insulation: Unfaced mineral-fiber blanket, manufactured from glass, slag wool, or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively.

## **2.2 TEMPORARY FACILITIES**

- A. Field Offices, General: Prefabricated or mobile units with serviceable finishes, temperature controls, and foundations adequate for normal loading.
- B. Common-Use Field Office: Of sufficient size to accommodate needs of Owner, Architect, and construction personnel office activities and to accommodate Project meetings specified in other Division 01 Sections. Keep office clean and orderly. Furnish and equip offices as follows:
  - 1. Furniture required for Project-site.
  - 2. Conference room of sufficient size to accommodate. Provide electrical power service and 120-V ac duplex receptacles. Furnish room with conference table, chairs, and tack and marker boards.

3. Drinking water and private toilet.
  4. Heating and cooling equipment necessary to maintain a uniform indoor.
  5. Lighting fixtures capable of maintaining average illumination at desk height.
- C. Storage and Fabrication Sheds: Provide sheds sized, furnished, and equipped to accommodate materials and equipment for construction operations.
1. Store combustible materials apart from building.

## **2.3 EQUIPMENT**

- A. Fire Extinguishers: Portable, UL rated; with class and extinguishing agent as required by locations and classes of fire exposures.
1. Comply with NFPA 10 and NFPA 241 for classification, extinguishing agent, and size required by location and class of fire exposure.
- B. Self-Contained Toilet Units: Single-occupant units of chemical, aerated recirculation, or combustion type; vented; fully enclosed with a glass-fiber-reinforced polyester shell or similar nonabsorbent material.
- C. Drinking-Water Fixtures: Containerized, tap-dispenser, bottled-water drinking-water units, including paper cup supply.
- D. HVAC Equipment: Unless Owner authorizes use of permanent HVAC system, provide vented, self-contained, liquid-propane-gas or fuel-oil heaters with individual space thermostatic control.
1. Use of gasoline-burning space heaters, open-flame heaters, or salamander-type heating units is prohibited.
  2. Heating Units: Listed and labeled for type of fuel being consumed, by a qualified testing agency acceptable to authorities having jurisdiction, and marked for intended location and application.
- E. Air-Filtration Units for Renovation Work: Primary and secondary HEPA-filter-equipped portable units with four-stage filtration. Provide single switch for emergency shutoff. Configure to run continuously.

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION, GENERAL**

- A. Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required by progress of the Work.
- B. Provide each facility ready for use when needed to avoid delay. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

### **3.2 TEMPORARY UTILITY INSTALLATION**

- A. Locate temporary utilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify utilities as required.

- B. Provide each utility ready for use when needed to avoid delay. Maintain and modify as required. Do not remove until utilities are no longer needed or are replaced by authorized use of completed permanent utilities.
- C. Engage appropriate local utility company to install temporary service or connect to existing service. Where utility company provides only part of the service, provide the remainder with matching, compatible materials and equipment. Comply with utility company recommendations.
  - 1. Arrange with utility company, Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.
  - 2. Provide adequate capacity at each stage of construction. Before temporary utility is available, provide trucked-in services.
  - 3. Obtain easements to bring temporary utilities to Project site where Owner's easements cannot be used for that purpose.
- D. Storm Sewers and Drainage: If sewers are available, provide temporary connections to remove effluent that can be discharged lawfully. If sewers are not available or cannot be used, provide drainage ditches, dry wells, stabilization ponds, and similar facilities. If neither sewers nor drainage facilities can be lawfully used for discharge of effluent, provide containers to remove and dispose of effluent off-site in a lawful manner.
  - 1. Filter out excessive soil, construction debris, chemicals, oils, and similar contaminants that might clog sewers or pollute waterways before discharge.
  - 2. Connect temporary sewers to municipal system as directed by sewer department officials.
  - 3. Maintain temporary sewers and drainage facilities in a clean, sanitary condition. After heavy use, restore normal conditions promptly.
  - 4. Provide temporary filter beds, settlement tanks, separators, and similar devices to purify effluent to levels acceptable to authorities having jurisdiction.
- E. Water Service: Install water service and distribution piping in sizes and pressures adequate for construction. Sterilize temporary water piping before use in accordance with requirements of authorities having jurisdiction.
- F. Sanitary Facilities: Provide temporary toilets, wash facilities, and drinking water for use of construction personnel. Comply with requirements of authorities having jurisdiction for type, number, location, operation, and maintenance of fixtures and facilities.
  - 1. Existing Toilets in Occupied Facilities: Use of Owner's existing toilet facilities will not be permitted or allowed.
- G. Heating and Cooling: Provide temporary heating and cooling required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of low temperatures or high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed.
- H. Isolation of Work Areas in Occupied Facilities: Prevent dust, fumes, and odors from entering occupied areas.
  - 1. Prior to commencing work, isolate the HVAC system in area where work is to be performed according to coordination drawings.
    - a. Disconnect supply and return ductwork in work area from HVAC systems servicing occupied areas.

- b. Maintain negative air pressure within work area using HEPA-equipped air-filtration units, starting with commencement of temporary partition construction, and continuing until removal of temporary partitions is complete.
- 2. Maintain dust partitions during the Work. Use vacuum collection attachments on dust-producing equipment. Isolate limited work within occupied areas using portable dust-containment devices.
- 3. Perform daily construction cleanup and final cleanup using approved, HEPA-filter-equipped vacuum equipment.
- I. Ventilation and Humidity Control: Provide temporary ventilation required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed. Coordinate ventilation requirements to produce ambient condition required and minimize energy consumption.
  - 1. Provide dehumidification systems when required to reduce substrate moisture levels to level required to allow installation or application of finishes.
- J. Electric Power Service: Provide electric power service and distribution system of sufficient size, capacity, and power characteristics required for construction operations.
- K. Lighting: Provide temporary lighting with local switching that provides adequate illumination for construction operations, observations, inspections, and traffic conditions.
- L. Telephone Service: Provide temporary telephone service in common-use facilities for use by all construction personnel. Provide telephone line(s) for each field office.
- M. Electronic Communication Service: Provide internet access of not less than 15-Mbps download and 5-Mbps upload speed for use by Architect and Owner to access Project electronic documents and maintain electronic communications

### **3.3 SUPPORT FACILITIES INSTALLATION**

- A. General: Comply with the following:
  - 1. Locate field offices, storage sheds, sanitary facilities, and other temporary construction and support facilities for easy access.
  - 2. Maintain support facilities until Architect schedules Substantial Completion inspection. Remove before Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to Owner.
- B. Temporary Roads and Paved Areas: Construct and maintain temporary roads and paved areas adequate to support loads and to withstand exposure to traffic during construction period. Extend temporary roads and paved areas, within construction limits indicated, as necessary for construction operations.
  - 1. Provide dust-control that is nonpolluting and nontracking. Reapply as required to minimize dust.
- C. Traffic Controls: Provide temporary traffic controls at junction of temporary roads with public roads. Include warning signs for public traffic and "STOP" signs for entrance onto public roads. Comply with requirements of authorities having jurisdiction.

1. Protect existing site improvements to remain including curbs, pavement, and utilities.
  2. Maintain access for fire-fighting equipment and access to fire hydrants.
- D. Parking: Coordinated parking with Owner's requirements.
- E. Dewatering Facilities and Drains: Comply with requirements of authorities having jurisdiction. Maintain Project site, excavations, and construction free of water.
1. Dispose of rainwater in a lawful manner that will not result in flooding Project or adjoining properties or endanger permanent Work or temporary facilities.
  2. Before connection and operation of permanent drainage piping system, provide temporary drainage where roofing or similar construction is completed.
  3. Remove snow and ice as required to minimize accumulations.
- F. Project Signs: Coordinated signs with Owner's requirements and requirements of authorities having jurisdiction.
- G. Waste Disposal Facilities: Comply with requirements specified in Division 01 Section "Construction Waste Management and Disposal."
- H. Comply with progress cleaning requirements in Division 01 Section "Execution."
- I. Existing Elevator Use in Occupied Facilities: Use of Owner's existing elevators will be permitted, provided elevators are cleaned and maintained in a condition acceptable to Owner. At Substantial Completion, restore elevators to condition existing before initial use, including replacing worn cables, guide shoes, and similar items of limited life.
1. Do not load elevators beyond their rated weight capacity.
  2. Provide protective coverings, barriers, devices, signs, or other procedures to protect elevator car and entrance doors and frame. If, despite such protection, elevators become damaged, engage elevator Installer to restore damaged work so no evidence remains of correction work. Return items that cannot be refinished in field to the shop, make required repairs and refinish entire unit, or provide new units as required.
- J. Existing Stair Usage in Occupied Facilities: Use of Owner's existing stairs will be permitted, provided stairs are cleaned and maintained in a condition acceptable to Owner. At Substantial Completion, restore stairs to condition existing before initial use.
1. Provide protective coverings, barriers, devices, signs, or other procedures to protect stairs and to maintain means of egress. If stairs become damaged, restore damaged areas so no evidence remains of correction work.
- K. Temporary Use of Permanent Stairs: Use of new stairs for construction traffic will be permitted, provided stairs are protected and finishes restored to new condition at time of Substantial Completion.

### **3.4 SECURITY AND PROTECTION FACILITIES INSTALLATION**

- A. Protection of Existing Facilities: Protect existing vegetation, equipment, structures, utilities, and other improvements at Project site and on adjacent properties, except those indicated to be removed or altered. Repair damage to existing facilities.

- B. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction as required to comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects.
  - 1. Comply with work restrictions specified in Division 01 Section "Summary."
- C. Temporary Erosion and Sedimentation Control: Provide measures to prevent soil erosion and discharge of soil-bearing water runoff and airborne dust to undisturbed areas and to adjacent properties and walkways, according to requirements of 2003 EPA Construction General Permit or authorities having jurisdiction, whichever is more stringent.
- D. Stormwater Control: Comply with requirements of authorities having jurisdiction. Provide barriers in and around excavations and subgrade construction to prevent flooding by runoff of stormwater from heavy rains.
- E. Tree and Plant Protection: Install temporary fencing located as indicated or outside the drip line of trees to protect vegetation from damage from construction operations. Protect tree root systems from damage, flooding, and erosion.
- F. Pest Control: Engage pest-control service to recommend practices to minimize attraction and harboring of rodents, roaches, and other pests and to perform extermination and control procedures at regular intervals so Project will be free of pests and their residues at Substantial Completion. Perform control operations lawfully, using environmentally safe materials.
- G. Site Enclosure Fence: Before construction operations begin, furnish and install site enclosure fence in a manner that will prevent people and animals from easily entering site except by entrance gates.
  - 1. Extent of Fence: As required to enclose entire Project site or portion determined sufficient to accommodate construction operations.
- H. Barricades, Warning Signs, and Lights: Comply with requirements of authorities having jurisdiction for erecting structurally adequate barricades, including warning signs and lighting.
- I. Temporary Egress: Maintain temporary egress from existing occupied facilities as indicated and as required by authorities having jurisdiction.
- J. Covered Walkway: Erect protective, covered walkway for passage of individuals through or adjacent to Project site. Coordinate with entrance gates, other facilities, and obstructions. Comply with regulations of authorities having jurisdiction and requirements indicated on Drawings.
- K. Temporary Enclosures: Provide temporary, weathertight, enclosures for protection of construction, in progress and completed, including, but not limited to, vertical and horizontal openings, from exposure, foul weather, other construction operations, and similar activities.
- L. Temporary Partitions: Provide floor-to-ceiling dustproof partitions to limit dust and dirt migration and to separate areas from fumes and noise.
  - 1. Construct dustproof partitions with gypsum wallboard with joints taped on occupied side, and fire-retardant-treated plywood on construction operations side.
  - 2. Construct dustproof partitions with two layers of 6 mil (0.14 mm) polyethylene sheet on each side. Cover floor with two layers of 6 mil (0.14 mm) polyethylene sheet, extending

sheets 18 inches (450 mm) up the sidewalls. Overlap and tape full length of joints. Cover floor with fire-retardant-treated plywood.

- a. Construct vestibule and airlock at each entrance through temporary partition with not less than 48 inches (1200 mm) between doors. Maintain walk-off mats in vestibule, for dust control.
  3. Where fire-resistance-rated temporary partitions are indicated or are required by authorities having jurisdiction, construct partitions according to the rated assemblies.
  4. Seal joints and perimeter. Equip partitions with gasketed dustproof doors and security locks where openings are required.
  5. Protect air-handling equipment.
  6. Provide walk-off mats at each entrance through temporary partition.
- M. Temporary Fire Protection: Install and maintain temporary fire-protection facilities of types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 241 and authorities having jurisdiction; manage fire-prevention program.

### **3.5 MOISTURE CONTROL**

- A. Contractor's Moisture-Protection Plan: Avoid trapping water in finished work. Document visible signs of discoloration that may appear during construction.
- B. Exposed Construction Phase: Before installation of weather barriers, when materials are subject to wetting and exposure, protect as follows:
1. Protect porous materials from water damage.
  2. Protect stored and installed material from flowing or standing water.
  3. Keep porous and organic materials from coming into prolonged contact with concrete.
  4. Remove standing water from decks.
  5. Keep deck openings covered or dammed.
- C. Partially Enclosed Construction Phase: After installation of weather barriers but before full enclosure and conditioning of building, when installed materials are still subject to infiltration of moisture, protect as follows:
1. Do not load or install drywall or other porous materials or components, or items with high organic content, into partially enclosed building.
  2. Keep interior spaces reasonably clean and protected from water damage.
  3. Periodically collect and remove waste containing cellulose or other organic matter.
  4. Discard or replace water-damaged material.
  5. Do not install material that is wet.
  6. Discard, replace, or clean stored or installed material that begins to show discoloration.
  7. Perform work in a sequence that allows any wet materials adequate time to dry before enclosing the material in drywall or other interior finishes.
- D. Controlled Construction Phase of Construction: After completing and sealing of the building enclosure but prior to the full operation of permanent HVAC systems, maintain as follows:
1. Control moisture and humidity inside building by maintaining effective dry-in conditions.
  2. Use permanent HVAC system to control humidity.
  3. Comply with manufacturer's written instructions for temperature, relative humidity, and exposure to water limits. Refer to technical specification sections for additional and more stringent criteria.

### **3.6 OPERATION, TERMINATION, AND REMOVAL**

- A. Supervision: Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.
- B. Maintenance: Maintain facilities in good operating condition until removal.
  - 1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.
  - 2. Maintain markers for underground lines. Protect from damage during excavation operations.
- C. Temporary Facility Changeover: Do not change over from using temporary security and protection facilities to permanent facilities until Substantial Completion.
- D. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.
  - 1. Materials and facilities that constitute temporary facilities are property of Contractor.
  - 2. Remove temporary roads and paved areas not intended for or acceptable for integration into permanent construction. Where area is intended for landscape development, remove soil and aggregate fill that do not comply with requirements for fill or subsoil. Remove materials contaminated with road oil, asphalt and other petrochemical compounds, and other substances that might impair growth of plant materials or lawns. Repair or replace street paving, curbs, and sidewalks at temporary entrances, as required by authorities having jurisdiction.
  - 3. At Substantial Completion, repair, renovate, and clean permanent facilities used during construction period. Comply with final cleaning requirements specified in Division 01 Section "Closeout Procedures."

**END OF SECTION**



## **SECTION 016000**

### **PRODUCT REQUIREMENTS**

#### **PART 1 - GENERAL**

##### **1.1 SUMMARY**

- A. Section includes administrative and procedural requirements for selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; and comparable products.

##### **1.2 DEFINITIONS**

- A. Products: Items obtained for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.
  - 1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published product literature that is current as of date of the Contract Documents.
  - 2. New Products: Items that have not previously been incorporated into another project or facility. Products salvaged or recycled from other projects are not considered new products.
  - 3. Comparable Product: Product that is demonstrated and approved through submittal process to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.
- B. Substitutions: Changes in products, materials, and equipment from those required by the Contract Documents and proposed by Contractor. Refer to Division 01 Section "Substitution Procedures".
- C. Basis-of-Design Product Specification: Where a specific manufacturer's product is named and accompanied by the words "Product Standard," including make or model number or other designation, to establish the significant qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics for purposes of evaluating comparable products of other manufacturers
- D. Hazardous Substances Prohibited by Law: Including, but not limited to, any product, material, element, constituent, chemical, substance, compound, or mixture, which is defined in, included under, or regulated by any environmental laws.

- E. Environmental Laws: Applicable local, state, and federal laws, rules, ordinances, codes, regulations, and requirements in effect at the time Contractor's services are rendered, any amendments for Contractor's services rendered after the effective date of any such amendments.

### **1.3 SUBMITTALS**

- A. Comparable Product: Comply with requirements in Division 01 Section "Submittal Procedures." Show compliance with requirements. Submit request for consideration of each comparable product. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
- B. Basis-of-Design Product Specification Submittal: Comply with requirements in Division 01 Section "Submittal Procedures." Show compliance with requirements.
- C. Contractor shall submit an affidavit on construction company letterhead signed by an officer of the company, notarized by a notary public, which certifies compliance with the environmental laws controlling hazardous substances for the construction of this Project.

### **1.4 QUALITY ASSURANCE**

- A. Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, select product compatible with products previously selected, even if previously selected products were also options.
- B. Compliance: Contractor shall take whatever measures deemed necessary to insure that all employees, suppliers, vendors, fabricators, subcontractors, or their assigns, to comply with hazardous substance requirements.

### **1.5 PRODUCT DELIVERY, STORAGE, AND HANDLING**

- A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft and vandalism. Comply with manufacturer's written instructions.
- B. Delivery and Handling:
  - 1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
  - 2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
  - 3. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
  - 4. Inspect products on delivery to ensure compliance with the Contract Documents and to ensure that products are undamaged and properly protected.
- C. Storage:
  - 1. Store products to allow for inspection and measurement of quantity or counting of units.
  - 2. Store materials in a manner that will not endanger Project structure.

3. Store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation.
4. Protect foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.
5. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
6. Protect stored products from damage and liquids from freezing.

## **1.6 PRODUCT WARRANTIES**

- A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.
  1. Manufacturer's Warranty: Written warranty furnished by individual manufacturer for a particular product, required by the Contract Documents to provide specific rights for Owner, and specifically endorsed by manufacturer to Owner.
  2. Warranties: Prepare a written document, on manufacturer's standard form, modified to include Project-specific information, that contains appropriate terms and identification, properly executed.
- B. Submittal Time: Comply with requirements in Division 01 Section "Closeout Procedures."

## **PART 2 - PRODUCTS**

### **2.1 PRODUCT SELECTION PROCEDURES**

- A. General Product Requirements: Provide products that comply with the Contract Documents, are undamaged and, unless otherwise indicated, are new at time of installation.
  1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
  2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
  3. Owner reserves the right to limit selection to products with warranties not in conflict with requirements of the Contract Documents.
  4. Where products are accompanied by the term "as selected," Architect will make selection.
  5. Descriptive, performance, and reference standard requirements in the Specifications establish salient characteristics of products.
  6. Products and materials brought onto the Project Site, and products and materials incorporated into the Work, shall comply with environmental laws.
- B. Product Selection Procedures:
  1. Product: Where Specifications name a single manufacturer and product, provide the named product that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
  2. Manufacturer/Source: Where Specifications name a single manufacturer or source, provide a product by the named manufacturer or source that complies with requirements.

Comparable products or substitutions for Contractor's convenience will not be considered.

3. Products:

- a. Restricted List (Acceptable Manufacturers/Fabricators and Products): Where Specifications include a list of names of both manufacturers and products, provide one of the products listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will be considered unless otherwise indicated.
- b. Nonrestricted List (Available Manufacturers/Fabricators and Products): Where Specifications include a list of names of both available manufacturers and products, provide one of the products listed, or an unnamed product, that complies with requirements. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product.

4. Manufacturers:

- a. Restricted List (Acceptable Manufacturers/Fabricators): Where Specifications include a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will be considered unless otherwise indicated.
- b. Nonrestricted List (Available Manufacturers/Fabricators): Where Specifications include a list of available manufacturers, provide a product by one of the manufacturers listed, or a product by an unnamed manufacturer, that complies with requirements. Comply with requirements in "Comparable Products" Article for consideration of an unnamed manufacturer's product.

5. Basis-of-Design Product (Product Standard): Where Specifications name a product, or refer to a product indicated on Drawings, and include a list of manufacturers, provide the specified or indicated product or a comparable product by one of the other named manufacturers. Drawings and Specifications indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product by one of the other named manufacturers, or unnamed manufacturer's product.

C. Descriptive Specification Requirements: Where Specifications describe a product, or assembly, listing exact characteristics required, without use of a brand or trade name, provide a product, material or assembly that provides the characteristics and otherwise complies with Contract requirements.

D. Performance Specification Requirements: Where Specifications require compliance with performance requirements, provide products that comply with these requirements, and are recommended by the manufacturer for the application indicated. General overall performance of a product is implied where the product or material is specified for a specific application.

- 1. Manufacturer's recommendations may be contained in published product literature, or by the manufacturer's certification of performance.

E. Compliance with Standards, Codes and Regulations: Where Specifications only require compliance with imposed code, standard or regulation, select product that complies with standards, codes or regulations specified.

- F. Visual Matching Specification: Where Specifications require "match Architect's sample", provide a product that complies with requirements and matches Architect's sample. Architect's decision will be final on whether a proposed product matches.
  - 1. If no product available within specified category matches and complies with other specified requirements, comply with requirements in Division 01 Section "Substitution Procedures" for proposal of product.
- G. Visual Selection Specification: Where Specifications include the phrase "as selected by Architect from manufacturer's color, gloss, pattern, density, or texture" or similar phrase, select a product (and manufacturer) that complies with other specified requirements.
  - 1. Standard Range: Where Specifications include the phrase "standard range of colors, patterns, textures" or similar phrase, Architect will select color, pattern, or texture from manufacturer's product line that does not include premium items.
  - 2. Custom Range: Where Specifications include the phrase "custom range of colors, patterns, textures" or similar phrase, Architect will select color, pattern, or texture from manufacturer's product line that includes both standard and premium items.
  - 3. Special Custom Range: Where Specifications include the phrase "special custom range of colors patterns, textures" or similar phrase, Architect will select a new color, pattern, or texture different from those normally produced by the manufacturer.
- A. Allowances (If Applicable): Refer to provisions of individual Specification Sections and of Division 01 Section "Allowance" for allowances that control product selection and for procedures required for processing such selections.

## **2.2 COMPARABLE PRODUCTS**

- A. Conditions for Consideration: Architect will consider Contractor's request for comparable product when the following conditions are satisfied. If the following conditions are not satisfied, Architect may return requests without action, except to record noncompliance with these requirements:
  - 1. Evidence that the proposed product does not require revisions to the Contract Documents; that it is consistent with the Contract Documents and will produce the indicated results, and that it is compatible with other portions of the Work.
  - 2. Detailed comparison of significant qualities of proposed product with those named in the Specifications. Significant qualities include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
  - 3. Evidence that proposed product provides specified warranty.
  - 4. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners, if requested.
  - 5. Samples, if requested.

## **PART 3 - EXECUTION**

### **3.1 RESTRICTION OF HAZARDOUS SUBSTANCES**

- A. Contractor agrees that it shall not knowingly after reasonable diligence and effort, incorporate into the Work any hazardous substance other than as may be lawfully contained within products, except in accordance with applicable environmental laws. Further, in performing any of its obligations hereunder, Contractor shall not cause any release of hazardous substances into, or contamination of, the environment, including soil, the atmosphere, any watercourse or ground water, except in accordance with applicable environmental laws. In the event that Contractor engages in any of the activities prohibited in this paragraph, to the fullest extent permitted by law, Contractor hereby indemnifies and holds harmless Owner and its partners, members, officers, directors, agents, employees and consultants from and against any and all claims, damages, losses, causes of action, suits and liabilities of every kind, including, but not limited to, expenses of litigation, court costs, punitive damages and attorney's fees, arising out of, incidental to or resulting from the activities prohibited.
- B. In the event Contractor observes on the Project Site any substance which Contractor reasonably believes to be a hazardous substance, and which is being introduced into the Work, or exists on the Project Site, in a manner violative of any applicable environmental laws, Contractor shall immediately notify Owner and report the condition to Owner in writing. The Work in the affected area shall not thereafter be resumed except by written authorization of Owner if in fact a hazardous substance has been encountered and has not been rendered harmless. In the event that Contractor fails to give Owner proper notification hereunder, upon knowingly observing a hazardous substance at the Project Site, to the fullest extent permitted by the law, Contractor hereby indemnifies and holds harmless Owner, and all of its partners, members, officers, directors, agents, employees and consultants from and against all claims, damages, losses, causes of action, suits and liabilities of every kind, including, but not limited to, expenses of litigation, court costs, punitive damages and attorneys' fees, arising out of, incidental to, or resulting from Contractor's failure to stop the Work.
- C. If Owner believes that hazardous substances may have been located, generated, manufactured, used or disposed of on or about the Project Site by Contractor or any of its employees, agents, subcontractors, suppliers, or invitees, Owner may have environmental studies of the Project Site conducted as it deems appropriate, and Contractor shall be responsible for the cost of such studies to the extent that Contractor or any of its employees, agents, subcontractors, suppliers or invitees are responsible for the presence of any hazardous substances.

**END OF SECTION**

## **SECTION 01 7300**

### **EXECUTION**

#### **PART 1 - GENERAL**

##### **1.1 SUMMARY**

- A. Section includes general administrative and procedural requirements governing execution of the Work including, but not limited to, the following:
  - 1. Construction layout.
  - 2. Field engineering and surveying.
  - 3. Installation of the Work.
  - 4. Cutting and patching.
  - 5. Coordination of Owner-installed products.
  - 6. Progress cleaning.
  - 7. Starting and adjusting.
  - 8. Protection of installed construction.
  - 9. Correction of the Work.

##### **1.2 DEFINITIONS**

- A. Cutting: Removal of in-place construction necessary to permit installation or performance of other work.
- B. Patching: Fitting and repair work required to restore construction to original conditions after installation of other work.

##### **1.3 SUBMITTALS**

- A. Qualification Data: For land surveyor or professional engineer.
- B. Certificates: Submit certificate signed by land surveyor or professional engineer certifying that location and elevation of improvements comply with requirements.
- C. Cutting and Patching Plan: Submit plan describing procedures at least 10 days prior to the time cutting and patching will be performed, requesting approval to proceed. Include the following information:
  - 1. Extent: Describe reason for and extent of each occurrence of cutting and patching.
  - 2. Changes to In-Place Construction: Describe anticipated results. Include changes to structural elements and operating components as well as changes in building appearance and other significant visual elements.
  - 3. Products: List products to be used for patching and firms or entities that will perform patching work.
  - 4. Dates: Indicate when cutting and patching will be performed.

5. Utilities and Mechanical and Electrical Systems: List services and systems that cutting and patching procedures will disturb or affect. List services and systems that will be relocated and those that will be temporarily out of service. Indicate length of time permanent services and systems will be disrupted.
    - a. Include description of provisions for temporary services and systems during interruption of permanent services and systems.
  6. Structural Elements: Where cutting and patching involve adding reinforcement to structural elements, submit details and engineering calculations showing integration of reinforcement with original structure.
  7. Architect's Approval: Obtain approval of cutting and patching proposal before cutting and patching. Approval does not waive right to later require removal and replacement of unsatisfactory work.
- D. Certified Surveys: Submit two copies signed by land surveyor or professional engineer.
- E. Final Property Survey: Submit 6 copies showing the Work performed and record survey data.

#### **1.4 QUALITY ASSURANCE**

- A. Land Surveyor Qualifications: A professional land surveyor or engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing land-surveying services of the kind indicated.
- B. Cutting and Patching: Comply with requirements for and limitations on cutting and patching of construction elements.
1. Structural Elements: Do not cut and patch structural elements in a manner that could change their load-carrying capacity or increase deflection
  2. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety.
  3. Miscellaneous Elements: Do not cut and patch other construction elements or components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety.
  4. Visual Elements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch exposed construction on the exterior or in occupied spaces in a manner that would, in Architect's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.
    - a. If possible, retain original Installer or fabricator to cut and patch exposed Work listed below. If it is impossible to engage original Installer or fabricator, engage another recognized, experienced, and specialized firm.
- C. Cutting and Patching Conference: Before proceeding, meet at Project site with parties involved in cutting and patching, including mechanical and electrical trades. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.
- D. Manufacturer's Installation Instructions: Obtain and maintain on-site manufacturer's written recommendations and instructions for installation of products and equipment.



## **1.5 WARRANTY**

- A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during cutting and patching operations, by methods and with materials so as not to void existing warranties.

## **PART 2 - PRODUCTS**

### **2.1 MATERIALS**

- A. General: Comply with requirements specified in other Sections.
  - 1. For projects requiring compliance with sustainable design and construction practices and procedures, use products for patching that comply with requirements in Division 01 sustainable construction requirements Section.
- B. In-Place Materials: Use materials for patching identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.
  - 1. If identical materials are unavailable or cannot be used, use materials that, when installed, will provide a match acceptable to Architect for the visual and functional performance of in-place materials.

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Existing Conditions: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework, investigate and verify the existence and location of underground utilities, and other construction affecting the Work.
  - 1. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, and water-service piping; underground electrical services, and other utilities.
  - 2. Furnish location data for work related to Project that must be performed by public utilities serving Project site.
- B. Acceptance of Surfaces and Conditions: Examine substrates 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. Record observations.
  - 1. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
  - 2. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
  - 3. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.

### **3.2 INSTALLATION, GENERAL**

- A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:
  - 1. Respective manufacturer/fabricator's written installation instructions.
  - 2. Accepted submittals.
  - 3. Contract Documents.
- B. Control of Corrosion: Prevent galvanic action and other forms of corrosion by isolating metals and other materials from direct contact with incompatible materials.

### **3.3 PREPARATION**

- A. General: Comply with manufacturer's instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.
- B. Existing Utility Information: Furnish information to local utility that is necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances located in or affected by construction. Coordinate with authorities having jurisdiction.
- A. Existing Utility Interruptions at Renovation Work: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
  - 1. Notify Owner not less than 72 hours in advance of proposed utility interruptions.
  - 2. Do not proceed with utility interruptions without Owner's written permission.
- D. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
- E. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.
- F. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents caused by differing field conditions outside the control of Contractor, submit a request for information to Architect according to requirements in Division 01 Section "Project Management and Coordination."

### **3.4 CONSTRUCTION LAYOUT**

- A. Verification: Before proceeding to lay out the Work, verify layout information shown on Drawings, in relation to the property survey and existing benchmarks. If discrepancies are discovered, notify Architect promptly.
- B. General: Engage a land surveyor or professional engineer to lay out the Work using accepted surveying practices.

1. Establish benchmarks and control points to set lines and levels at each story of construction and elsewhere as needed to locate each element of Project.
  2. Establish dimensions within tolerances indicated. Do not scale Drawings to obtain required dimensions.
  3. Inform installers of lines and levels to which they must comply.
  4. Check the location, level and plumb, of every major element as the Work progresses.
  5. Notify Architect when deviations from required lines and levels exceed allowable tolerances.
  6. Close site surveys with an error of closure equal to or less than the standard established by authorities having jurisdiction.
- C. Site Improvements: Locate and lay out site improvements, including pavements, grading, fill and topsoil placement, utility slopes, and rim and invert elevations.
- D. Building Lines and Levels: Locate and lay out control lines and levels for structures, building foundations, column grids, and floor levels, including those required for mechanical and electrical work. Transfer survey markings and elevations for use with control lines and levels. Level foundations and piers from two or more locations.
- E. Record Log: Maintain a log of layout control work. Record deviations from required lines and levels. Include beginning and ending dates and times of surveys, weather conditions, name and duty of each survey party member, and types of instruments and tapes used. Make the log available for reference by Architect.

### 3.5 FIELD ENGINEERING

- A. Reference Points: Locate existing permanent benchmarks, control points, and similar reference points before beginning the Work. Preserve and protect permanent benchmarks and control points during construction operations.
1. Do not change or relocate existing benchmarks or control points. Report lost or destroyed permanent benchmarks or control points promptly. Report the need to relocate permanent benchmarks or control points to Architect before proceeding.
  2. Replace lost or destroyed permanent benchmarks and control points promptly. Base replacements on the original survey control points.
- B. Benchmarks: Establish and maintain a minimum of 2 permanent benchmarks on Project site, referenced to data established by survey control points. Comply with authorities having jurisdiction for type and size of benchmark.
1. Record benchmark locations, with horizontal and vertical data, on Project Record Documents.
  2. Where the actual location or elevation of layout points cannot be marked, provide temporary reference points sufficient to locate the Work.
  3. Remove temporary reference points when no longer needed. Restore marked construction to its original condition.
- C. Certified Survey: 30 days after completion of each work component/activity, including, but not limited to, foundation walls, major site improvements, and other work requiring field-engineering services, prepare a certified survey showing dimensions, locations, angles, and elevations of construction and sitework.
- D. Final Property Survey: Engage a land surveyor or professional engineer to prepare a final property survey showing significant features (real property) for Project. Include on the survey a

certification, signed by land surveyor or professional engineer, that principal metes, bounds, lines, and levels of Project are accurately positioned as shown on the survey.

1. Show boundary lines, monuments, streets, site improvements and utilities, existing improvements and significant vegetation, adjoining properties, acreage, grade contours, and the distance and bearing from a site corner to a legal point.
2. Recording: At Substantial Completion, have the final property survey recorded by or with authorities having jurisdiction as the official "property survey."

### **3.6 INSTALLATION**

- A. General: Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.
  1. Make vertical work plumb and make horizontal work level.
  2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
  3. Conceal pipes, ducts, and wiring in finished areas unless otherwise indicated.
- B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated, unless indicated otherwise in the Contract Documents.
- C. Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Substantial Completion.
- D. Conduct construction operations so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.
- E. Sequence the Work and allow adequate clearances to accommodate movement of construction items on site and placement in permanent locations.
- F. Tools and Equipment: Do not use tools or equipment that produce harmful noise levels.
- G. Templates: Obtain and distribute to the parties involved templates for work specified to be factory prepared and field installed. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.
- H. Attachment: Provide blocking and attachment plates and anchors and fasteners of adequate size and number to securely anchor each component in place, accurately located, aligned, and coordinated with other portions of the Work. Where size and type of attachments are not indicated, verify size and type required for load conditions.
  1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Architect.
  2. Allow for building movement, including thermal expansion and contraction.
  3. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.
- I. Joints: Make joints of uniform width. Where joint locations in exposed work are not indicated, arrange joints for the best visual effect. Fit exposed connections together to form hairline joints.

- J. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.

### **3.7 CUTTING AND PATCHING**

- A. Cutting and Patching, General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.
  - 1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.
- B. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during installation or cutting and patching operations, by methods and with materials so as not to void existing warranties.
- C. Temporary Support: Provide temporary support of work to be cut.
- D. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.
- E. Adjacent Occupied Areas: Where interference with use of adjoining areas or interruption of free passage to adjoining areas is unavoidable, coordinate cutting and patching according to requirements in Division 01 Section "Summary."
- F. Existing Utility Services and Mechanical/Electrical Systems: Where existing services/systems are required to be removed, relocated, or abandoned, bypass such services/systems before cutting to prevent interruption to occupied areas.
- G. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.
  - 1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots neatly to minimum size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
  - 2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
  - 3. Concrete and Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
  - 4. Excavating and Backfilling: Comply with requirements in applicable Division 31 Sections where required by cutting and patching operations.
  - 5. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
  - 6. Proceed with patching after construction operations requiring cutting are complete.
- H. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other work. Patch with durable seams that are as invisible as practicable. Provide materials and comply with installation requirements specified in other Sections, where applicable.

1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate physical integrity of installation.
  2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will minimize evidence of patching and refinishing.
    - a. Clean piping, conduit, and similar features before applying paint or other finishing materials.
    - b. Restore damaged pipe covering to its original condition.
  3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove in-place floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.
    - a. Where patching occurs in a painted surface, prepare substrate and apply primer and intermediate paint coats appropriate for substrate over the patch, and apply final paint coat over entire unbroken surface containing the patch. Provide additional coats until patch blends with adjacent surfaces.
    - b. Patch fire rated assemblies with materials to match existing and maintain assembly fire rating.
  4. Ceilings: Patch, repair, or rehang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.
  5. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition and ensures thermal and moisture integrity of building enclosure.
- I. Cleaning: Clean areas and spaces where cutting and patching are performed. Remove paint, mortar, oils, putty, and similar materials from adjacent finished surfaces.

### 3.8 OWNER-INSTALLED PRODUCTS

- A. Site Access: As applicable, provide access to Project site for Owner's construction personnel.
- B. Coordination: Coordinate construction and operations of the Work with work performed by Owner's construction personnel.
  1. Construction Schedule: Inform Owner of Contractor's preferred construction schedule for Owner's portion of the Work. Adjust construction schedule based on a mutually agreeable timetable. Notify Owner if changes to schedule are required due to differences in actual construction progress.
  2. Preinstallation Conferences: Include Owner's construction personnel at preinstallation conferences covering portions of the Work that are to receive Owner's work. Attend preinstallation conferences conducted by Owner's construction personnel if portions of the Work depend on Owner's construction.

### 3.9 PROGRESS CLEANING

- A. General: Clean Project site and work areas daily, including common areas. Enforce requirements strictly. Dispose of materials lawfully.
  1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.

2. Do not hold waste materials more than 7 days during normal weather or 3 days if the temperature is expected to rise above 80 deg F (27 deg C).
  3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.
    - a. Use containers specifically intended for holding types of waste materials identified where applicable, e.g. blue colored containers with labeling and symbols for bio-waste.
- B. Site: Maintain Project site free of waste materials and debris.
- C. Work Areas: Clean areas where work is in progress to the level of cleanliness necessary for proper execution of the Work.
1. Remove liquid spills immediately.
  2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.
- D. Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.
- E. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.
- F. Exposed Surfaces in Finished Areas: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.
- G. Waste Disposal: Do not bury or burn waste materials on-site. Do not wash waste materials down sewers or into waterways. Comply with waste disposal requirements in Division 01 Section "Temporary Facilities and Controls." and Division 01 Section "Construction Waste Management and Disposal", whichever is the more restrictive.
- H. Remove construction markings not required and graffiti immediately, repairing or replacing damaged material.
- I. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.
- J. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.
- K. Limiting Exposures: Supervise construction operations to assure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

### **3.10 STARTING AND ADJUSTING**

- A. As applicable, coordinate startup and adjusting of equipment and operating components with commissioning requirements in Division 01 specification sections.

- B. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.
- C. Adjust equipment for proper operation. Adjust operating components for proper operation without binding.
- D. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- E. Manufacturer's Field Service: Comply with qualification requirements in Division 01 Section "Quality Requirements."

### **3.11 PROTECTION OF INSTALLED CONSTRUCTION**

- A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.
- B. Comply with manufacturer's written instructions for temperature and relative humidity.

**END OF SECTION**



## **SECTION 01 7419**

### **CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL**

#### **PART 1 - GENERAL**

##### **1.1 SUMMARY**

- A. Section includes administrative and procedural requirements for the following:
  - 1. Salvaging and/or recycling nonhazardous demolition and construction waste.
  - 2. Disposing of nonhazardous construction waste.

##### **1.2 DEFINITIONS**

- A. Construction Waste: Building and site improvement materials and other solid waste resulting from construction, remodeling, renovation, or repair operations. Construction waste includes packaging.
- B. Disposal: Removal off-site of demolition and construction waste and subsequent sale, recycling, reuse, or deposit in landfill or incinerator acceptable to authorities having jurisdiction.
- C. Salvage / Recycle: Recovery of demolition or construction waste for subsequent processing in preparation for reuse.

##### **1.3 PERFORMANCE REQUIREMENTS**

- A. General: Achieve end-of-Project rates for salvage/recycling of 50 percent by weight of total non-hazardous solid waste generated by the Work. Practice efficient waste management in the use of materials in the course of the Work. Use all reasonable means to divert construction and demolition waste from landfills and incinerators. Facilitate recycling and salvage of materials.

##### **1.4 SUBMITTALS**

- A. Waste Management Plan: Submit plan within 30 days of date established for commencement of the Work.
- B. Waste Reduction Progress Reports: Concurrent with each Application for Payment, submit report. Include the following information:
  - 1. Material category.
  - 2. Generation point of waste.
  - 3. Total quantity of waste in tons (tonnes).
  - 4. Total quantity of waste recovered (salvaged plus recycled) in tons (tonnes).
  - 5. Total quantity of waste recovered (salvaged plus recycled) as a percentage of total waste.
- C. Waste Reduction Calculations: Before request for Substantial Completion, submit calculated end-of-Project rates for salvage, recycling, and disposal as a percentage of total waste generated by the Work.

- D. Recycling and Processing Facility Records: Indicate receipt and acceptance of recyclable waste by recycling and processing facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.
- E. Landfill and Incinerator Disposal Records: Indicate receipt and acceptance of waste by landfills and incinerator facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.
- F. Submittal: Letter signed by Contractor, tabulating total waste material, quantities diverted and means by which it is diverted, and statement that requirements have been met.

## **1.5 QUALITY ASSURANCE**

- A. Regulatory Requirements: Comply with hauling and disposal regulations of authorities having jurisdiction.
- B. Waste Management Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination." Review methods and procedures related to waste management including, but not limited to, the following:
  - 1. Review and discuss waste management plan.
  - 2. Review requirements for documenting quantities of each type of waste and its disposition.
  - 3. Review and finalize procedures for materials separation and verify availability of containers and bins needed to avoid delays.
  - 4. Review procedures for periodic waste collection and transportation to recycling and disposal facilities.
  - 5. Review waste management requirements for each trade.

## **1.6 WASTE MANAGEMENT PLAN**

- A. General: Develop a waste management plan according to ASTM E 1609 and requirements of this Section. Plan shall consist of waste identification, waste reduction work plan, and cost/revenue analysis. Indicate quantities by weight or volume, but use same units of measure throughout waste management plan.
- B. Waste Identification: Indicate anticipated types and quantities of site-clearing and construction waste generated by the Work. Include estimated quantities and assumptions for estimates.
- C. Waste Reduction Work Plan: List each type of waste and whether it will be salvaged, recycled, or disposed of in landfill or incinerator. Include points of waste generation, total quantity of each type of waste, quantity for each means of recovery, and handling and transportation procedures.
  - 1. Recycled Materials: Include list of local receivers and processors and type of recycled materials each will accept. Include names, addresses, and telephone numbers.
  - 2. Disposed Materials: Indicate how and where materials will be disposed of. Include name, address, and telephone number of each landfill and incinerator facility.
  - 3. Handling and Transportation Procedures: Include method that will be used for separating recyclable waste including sizes of containers, container labeling, and designated location on Project site where materials separation will be located.

- D. Cost/Revenue Analysis: Indicate total cost of waste disposal as if there was no waste management plan and net additional cost or net savings resulting from implementing waste management plan. Include the following:
1. Total quantity of waste.
  2. Estimated cost of disposal (cost per unit). Include hauling and tipping fees and cost of collection containers for each type of waste.
  3. Total cost of disposal (with no waste management).
  4. Revenue from salvaged / recycled materials.
  5. Savings in hauling and tipping fees that are avoided.
  6. Handling and transportation costs. Include cost of collection containers for each type of waste.
  7. Net additional cost or net savings from waste management plan.

## **PART 2 - PRODUCTS (Not Used)**

## **PART 3 - EXECUTION**

### **3.1 PLAN IMPLEMENTATION**

- A. General: Implement approved waste management plan. Provide handling, containers, storage, signage, transportation, and other items as required to implement waste management plan during the entire duration of the Contract.
1. Comply with Division 01 Section "Temporary Facilities and Controls" for operation, termination, and removal requirements.
- B. Site Access and Temporary Controls: Conduct waste management operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
1. Designate and label specific areas on Project site necessary for separating materials that are to be salvaged, recycled, reused, donated, and sold.
  2. Comply with Division 01 Section "Temporary Facilities and Controls" for controlling dust and dirt, environmental protection, and noise control.

### **3.2 RECYCLING CONSTRUCTION WASTE**

- A. Preparation of Waste: Prepare and maintain recyclable waste materials according to recycling or reuse facility requirements. Maintain materials free of dirt, adhesives, solvents, petroleum contamination, and other substances deleterious to the recycling process.

### **3.3 DISPOSAL OF WASTE**

- A. General: Except for items or materials to be salvaged, recycled, or otherwise reused, remove waste materials from Project site and legally dispose of them in a landfill or incinerator acceptable to authorities having jurisdiction.
1. Except as otherwise specified, do not allow waste materials that are to be disposed of accumulate on-site.

2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
- B. Burning: Do not burn waste materials.
  - C. Disposal: Transport waste materials off Owner's property and legally dispose of them.

**END OF SECTION**

**SECTION 01 7700**  
**CLOSEOUT PROCEDURES**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:
  - 1. Substantial Completion procedures.
  - 2. Final completion procedures.
  - 3. Warranties.
  - 4. Final cleaning.
  - 5. Repair of the Work.

**1.2 SUBMITTALS**

- A. Contractor's List of Incomplete Items: Initial submittal at Substantial Completion.
- B. Certified List of Incomplete Items: Final submittal at Final Completion.
- C. Certificates of Release: From authorities having jurisdiction.
- D. Certificate of Insurance: For continuing coverage.
- E. Field Report: For pest control inspection.
- F. Schedule of Maintenance Material Items: For maintenance material submittal items specified in other Sections.

**1.3 SUBSTANTIAL COMPLETION PROCEDURES**

- A. Contractor's List of Incomplete Items: Prepare and submit a list of items to be completed and corrected (Contractor's punch list), indicating the value of each item on the list and reasons why the Work is incomplete.
- B. Submittals Prior to Substantial Completion: Complete the following prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.
  - 1. Certificates of Release: Obtain and submit releases from authorities having jurisdiction permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
  - 2. Submit closeout submittals specified in other Division 01 Sections, including project record documents, operation and maintenance manuals, final completion construction photographic documentation, damage or settlement surveys, property surveys, and similar final record information.
  - 3. Submit closeout submittals specified in individual Divisions 02 through 33 Sections, including specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.

4. Submit maintenance material submittals specified in individual Divisions 02 through 33 Sections, including tools, spare parts, extra materials, and similar items, and deliver to location designated by Architect. Label with manufacturer's name and model number where applicable.
    - a. Schedule of Maintenance Material Items: Prepare and submit schedule of maintenance material submittal items, including name and quantity of each item and name and number of related Specification Section. Obtain Owner's signature for receipt of submittals.
  5. Submit test/adjust/balance records.
- C. Procedures Prior to Substantial Completion: Complete the following prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.
1. Advise Owner of pending insurance changeover requirements.
  2. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
  3. Complete startup and testing of systems and equipment.
  4. Perform preventive maintenance on equipment used prior to Substantial Completion.
  5. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems. Submit demonstration and training video recordings specified in Division 01 Section "Demonstration and Training."
  6. Advise Owner of changeover in heat and other utilities.
  7. Participate with Owner in conducting inspection and walkthrough with local emergency responders.
  8. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
  9. Complete final cleaning requirements, including touchup painting.
  10. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.
- D. Inspection: Submit a written request for inspection to determine Substantial. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Architect, that must be completed or corrected before certificate will be issued.
1. Reinspection: Request, in writing, reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
  2. Results of completed inspection will form the basis of requirements for final completion.
- E. Warranties required by the Contract Documents shall commence on the date of Substantial Completion of the Work or designated portion thereof unless otherwise provided in the Certificate of Substantial Completion.

#### **1.4 FINAL COMPLETION PROCEDURES**

- A. Submittals Prior to Final Completion: Before requesting final inspection for determining final completion, complete the following:
1. Submit a final Application for Payment according to Division 01 Section "Payment Procedures."

2. Certified List of Incomplete Items: Submit certified copy of Architect's Substantial Completion inspection list of items to be completed or corrected (punch list). Certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
  3. Certificate of Insurance: Submit evidence of final, continuing insurance coverage complying with insurance requirements.
  4. Submit pest-control final inspection report.
- B. Inspection: Submit a written request for final inspection for acceptance. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.
1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

## **1.5 LIST OF INCOMPLETE ITEMS (PUNCH LIST)**

- A. Organization of List: Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction
1. Organize list of spaces in sequential order, starting with exterior areas first and proceeding from lowest floor to highest floor.
  2. Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems.
  3. Include the following information at the top of each page:
    - a. Project name.
    - b. Date.
    - c. Name of Architect.
    - d. Name of Contractor.
    - e. Page number.
  4. Submit list of incomplete items in the format agreed upon by the Owner and Architect.

## **1.6 SUBMITTAL OF PROJECT WARRANTIES**

- A. Time of Submittal: Submit written warranties for designated portions of the Work where commencement of warranties other than date of Substantial Completion is indicated, or when delay in submittal of warranties might limit Owner's rights under warranty.
- B. Partial Occupancy: Submit properly executed warranties within minimum number days, as required by the Contract, of completion of designated portions of the Work that are completed and occupied or used by Owner during construction period by separate agreement with Contractor.
- C. Organize warranty documents into an orderly sequence based on the table of contents of Project Manual.
1. Warranty Electronic File: Scan warranties and bonds and assemble complete warranty and bond submittal package into a single indexed electronic PDF file with links enabling navigation to each item. Provide bookmarked table of contents at beginning of document.

- D. Provide additional copies of each warranty to include in operation and maintenance manuals.

## **PART 2 - PRODUCTS**

### **2.1 MATERIALS**

- A. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.
  - 1. Use cleaning products that comply with Green Seal's GS-37, or if GS-37 is not applicable, use products that comply with the California Code of Regulations maximum allowable VOC levels.

## **PART 3 - EXECUTION**

### **3.1 FINAL CLEANING**

- A. General: Perform final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.
- B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.
  - 1. Complete the following cleaning operations, as applicable, before requesting inspection for certification of Substantial Completion for entire Project or for a portion of Project:
    - a. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
    - b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
    - c. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.
    - d. Remove tools, construction equipment, machinery, and surplus material from Project site.
    - e. Remove snow and ice to provide safe access to building.
    - f. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
    - g. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
    - h. Sweep concrete floors broom clean in unoccupied spaces.
    - i. Vacuum carpet and similar soft surfaces, removing debris and excess nap; clean according to manufacturer's recommendations if visible soil or stains remain.
    - j. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Polish mirrors and glass, taking care not to scratch surfaces.
    - k. Remove labels that are not permanent.



- l. Remove all graffiti and construction writing.
  - m. Wipe surfaces of mechanical and electrical equipment and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
  - n. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
  - o. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
  - p. Clean ducts, blowers, and coils if units were operated without filters during construction or that display contamination with particulate matter on inspection.
  - q. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency.
  - r. Leave Project clean and ready for occupancy.
- C. Pest Control: Comply with pest control requirements in Division 01 Section "Temporary Facilities and Controls." Prepare written report.
- D. Construction Waste Disposal: Comply with waste disposal requirements in Division 01 Section "Temporary Facilities and Controls." and Division 01 Section "Construction Waste Management and Disposal", whichever is the more restrictive and as follows:
- 1. Comply with safety standards for cleaning. Do not burn waste materials. Do not bury debris or excess materials on Owner's property. Do not discharge volatile, harmful, or dangerous materials into drainage systems. Remove waste materials from Project site and dispose of lawfully.

### **3.2 REPAIR OF THE WORK**

- A. Complete repair and restoration operations before requesting inspection for determination of Substantial Completion.
- B. Repair or remove and replace defective construction. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment. Where damaged or worn items cannot be repaired or restored, provide replacements. Remove and replace operating components that cannot be repaired. Restore damaged construction and permanent facilities used during construction to specified condition.
- 1. Remove and replace chipped, scratched, and broken glass, reflective surfaces, and other damaged transparent materials.
  - 2. Touch up and otherwise repair and restore marred or exposed finishes and surfaces. Replace finishes and surfaces that already show evidence of repair or restoration.
    - a. Do not paint over "UL" and other required labels and identification, including mechanical and electrical nameplates. Remove paint applied to required labels and identification.
  - 3. Replace parts subject to operating conditions during construction that may impede operation or reduce longevity.
  - 4. Replace all lamps and starters to comply with requirements for new fixtures.
- C. All Warranties remain in effect.

**END OF SECTION**

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2019-02-08

CLOSEOUT PROCEDURES

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## **SECTION 01 7823**

### **OPERATION AND MAINTENANCE DATA**

#### **PART 1 - GENERAL**

##### **1.1 SUMMARY**

- A. Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:
  - 1. Operation and maintenance documentation directory.
  - 2. Emergency manuals.
  - 3. Operation manuals for systems, subsystems, and equipment.
  - 4. Product maintenance manuals.
  - 5. Systems and equipment maintenance manuals.

##### **1.2 DEFINITIONS**

- A. System: An organized collection of parts, equipment, or subsystems united by regular interaction.
- B. Subsystem: A portion of a system with characteristics similar to a system.

##### **1.3 CLOSEOUT SUBMITTALS**

- A. Manual Content: Operations and maintenance manual content is specified in individual Specification Sections to be reviewed at the time of Section submittals. Submit reviewed manual content formatted and organized as required by this Section.
- B. Format: Submit operations and maintenance manuals in the following format:
  - 1. PDF electronic file. Assemble each manual into a composite electronically indexed file. Submit on digital media acceptable to Owner.
    - a. Name each indexed document file in composite electronic index with applicable item name. Include a complete electronically linked operation and maintenance directory.
    - b. Enable inserted reviewer comments on draft submittals.
- C. Initial Manual Submittal: Submit draft copy of each manual at least 30 days before commencing demonstration and training. Architect will comment on whether general scope and content of manual are acceptable.
- D. Final Manual Submittal: Submit each manual in final form prior to requesting inspection for Substantial Completion and before commencing demonstration and training. Architect will return copy with comments.
  - 1. Correct or revise each manual to comply with Architect's comments. Submit copies of each corrected manual prior to commencing demonstration and training.

## **PART 2 - PRODUCTS**

### **2.1 OPERATION AND MAINTENANCE DOCUMENTATION DIRECTORY**

- A. Directory: Prepare a single, comprehensive directory of emergency, operation, and maintenance data and materials, listing items and their location to facilitate ready access to desired information. Include a section in the directory for each of the following:
  - 1. List of documents.
  - 2. List of systems.
  - 3. List of equipment.
  - 4. Table of contents.
- B. List of Systems and Subsystems: List systems alphabetically. Include references to operation and maintenance manuals that contain information about each system.
- C. List of Equipment: List equipment for each system, organized alphabetically by system. For pieces of equipment not part of system, list alphabetically in separate list.
- D. Tables of Contents: Include a table of contents for each emergency, operation, and maintenance manual.
- E. Identification: In the documentation directory and in each operation and maintenance manual, identify each system, subsystem, and piece of equipment with same designation used in the Contract Documents. If no designation exists, assign a designation according to ASHRAE Guideline 4, "Preparation of Operating and Maintenance Documentation for Building Systems."

### **2.2 REQUIREMENTS FOR EMERGENCY, OPERATION, AND MAINTENANCE MANUALS**

- A. Organization: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:
  - 1. Title page.
  - 2. Table of contents.
  - 3. Manual contents.
- B. Title Page: Include the following information:
  - 1. Subject matter included in manual.
  - 2. Name and address of Project.
  - 3. Name and address of Owner.
  - 4. Date of submittal.
  - 5. Name and contact information for Contractor.
  - 6. Name and contact information for Architect.
  - 7. Names and contact information for major consultants to the Architect that designed the systems contained in the manuals.
  - 8. Cross-reference to related systems in other operation and maintenance manuals.

- C. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.
  - 1. If operation or maintenance documentation requires more than one volume to accommodate data, include comprehensive table of contents for all volumes in each volume of the set.
- D. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder.
- E. Manuals, Electronic Files: Submit manuals in the form of a multiple file composite electronic PDF file for each manual type required.
  - 1. Electronic Files: Use electronic files prepared by manufacturer where available. Where scanning of paper documents is required, configure scanned file for minimum readable file size.
  - 2. File Names and Bookmarks: Enable bookmarking of individual documents based on file names. Name document files to correspond to system, subsystem, and equipment names used in manual directory and table of contents. Group documents for each system and subsystem into individual composite bookmarked files, then create composite manual, so that resulting bookmarks reflect the system, subsystem, and equipment names in a readily navigated file tree. Configure electronic manual to display bookmark panel on opening file.

## **2.3 EMERGENCY MANUALS**

- A. Content: Organize manual into a separate section for each of the following:
  - 1. Type of emergency.
  - 2. Emergency instructions.
  - 3. Emergency procedures.
- B. Type of Emergency: Where applicable for each type of emergency indicated below, include instructions and procedures for each system, subsystem, piece of equipment, and component:
  - 1. Fire.
  - 2. Flood.
  - 3. Gas leak.
  - 4. Water leak.
  - 5. Power failure.
  - 6. Water outage.
  - 7. System, subsystem, or equipment failure.
  - 8. Chemical release or spill.
- C. Emergency Instructions: Describe and explain warnings, trouble indications, error messages, and similar codes and signals. Include responsibilities of Owner's operating personnel for notification of Installer, supplier, and manufacturer to maintain warranties.

D. Emergency Procedures: Include the following, as applicable:

1. Instructions on stopping.
2. Shutdown instructions for each type of emergency.
3. Operating instructions for conditions outside normal operating limits.
4. Required sequences for electric or electronic systems.
5. Special operating instructions and procedures.

## **2.4 OPERATION MANUALS**

A. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and the following information:

1. System, subsystem, and equipment descriptions. Use designations for systems and equipment indicated on Contract Documents.
2. Performance and design criteria if Contractor has delegated design responsibility.
3. Operating standards.
4. Operating procedures.
5. Operating logs.
6. Wiring diagrams.
7. Control diagrams.
8. Piped system diagrams.
9. Precautions against improper use.
10. License requirements including inspection and renewal dates.

B. Descriptions: Include the following:

1. Product name and model number. Use designations for products indicated on Contract Documents.
2. Manufacturer's name.
3. Equipment identification with serial number of each component.
4. Equipment function.
5. Operating characteristics.
6. Limiting conditions.
7. Performance curves.
8. Engineering data and tests.
9. Complete nomenclature and number of replacement parts.

C. Operating Procedures: Include the following, as applicable:

1. Startup procedures.
2. Equipment or system break-in procedures.
3. Routine and normal operating instructions.
4. Regulation and control procedures.
5. Instructions on stopping.
6. Normal shutdown instructions.
7. Seasonal and weekend operating instructions.
8. Required sequences for electric or electronic systems.
9. Special operating instructions and procedures.

D. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.

- E. Piped Systems: Diagram piping as installed, and identify color-coding where required for identification.

## **2.5 PRODUCT MAINTENANCE MANUALS**

- A. Content: Organize manual into a separate section for each product, material, and finish. Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, as described below.
- B. Source Information: List each product included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.
- C. Product Information: Include the following, as applicable:
  - 1. Product name and model number.
  - 2. Manufacturer's name.
  - 3. Color, pattern, and texture.
  - 4. Material and chemical composition.
  - 5. Reordering information for specially manufactured products.
- D. Maintenance Procedures: Include manufacturer's written recommendations and the following:
  - 1. Inspection procedures.
  - 2. Types of cleaning agents to be used and methods of cleaning.
  - 3. List of cleaning agents and methods of cleaning detrimental to product.
  - 4. Schedule for routine cleaning and maintenance.
  - 5. Repair instructions.
- E. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.
- F. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
  - 1. Include procedures to follow and required notifications for warranty claims.

## **2.6 SYSTEMS AND EQUIPMENT MAINTENANCE MANUALS**

- A. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranty and bond information, as described below.
- B. Source Information: List each system, subsystem, and piece of equipment included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.

- C. **Manufacturers' Maintenance Documentation:** Manufacturers' maintenance documentation including the following information for each component part or piece of equipment:
  - 1. Standard maintenance instructions and bulletins.
  - 2. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
  - 3. Identification and nomenclature of parts and components.
  - 4. List of items recommended to be stocked as spare parts.
- D. **Maintenance Procedures:** Include the following information and items that detail essential maintenance procedures:
  - 1. Test and inspection instructions.
  - 2. Troubleshooting guide.
  - 3. Precautions against improper maintenance.
  - 4. Disassembly, component removal, repair, and replacement; and reassembly instructions.
  - 5. Aligning, adjusting, and checking instructions.
  - 6. Demonstration and training video recording, if available.
- E. **Maintenance and Service Schedules:** Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.
  - 1. **Scheduled Maintenance and Service:** Tabulate actions for daily, weekly, monthly, quarterly, semiannual, and annual frequencies.
  - 2. **Maintenance and Service Record:** Include manufacturers' forms for recording maintenance.
- F. **Spare Parts List and Source Information:** Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.
- G. **Maintenance Service Contracts:** Include copies of maintenance agreements with name and telephone number of service agent.
- H. **Warranties and Bonds:** Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
  - 1. Include procedures to follow and required notifications for warranty claims.

## **PART 3 - EXECUTION**

### **3.1 MANUAL PREPARATION**

- A. **Emergency Manual:** Assemble a complete set of emergency information indicating procedures for use by emergency personnel and by Owner's operating personnel for types of emergencies indicated.
- B. **Product Maintenance Manual:** Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.



- C. Operation and Maintenance Manuals: Assemble a complete set of operation and maintenance data indicating operation and maintenance of each system, subsystem, and piece of equipment not part of a system.
  - 1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
  - 2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.
- D. Manufacturers' Data: Where manuals contain manufacturers' standard printed data, include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.
  - 1. Prepare supplementary text if manufacturers' standard printed data are not available and where the information is necessary for proper operation and maintenance of equipment or systems.
- E. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with information contained in record Drawings to ensure correct illustration of completed installation.
  - 1. Do not use original project record documents as part of operation and maintenance manuals.
  - 2. Comply with requirements of newly prepared record Drawings in Division 01 Section "Project Record Documents."
- F. Comply with Division 01 Section "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

**END OF SECTION**



## **SECTION 01 7839**

### **PROJECT RECORD DOCUMENTS**

#### **PART 1 - GENERAL**

##### **1.1 SUMMARY**

- A. Section includes administrative and procedural requirements for project record documents, including the following:
  - 1. Record Drawings.
  - 2. Record Specifications.
  - 3. Record Product Data.
  - 4. Miscellaneous record submittals.

##### **1.2 SUBMITTALS**

- A. Record Drawings: Comply with the following:
  - 1. Number of Copies: Submit copies of record Drawings as follows:
    - a. Initial Submittal:
      - 1) Submit PDF electronic files of scanned record.
      - 2) Architect will indicate whether general scope of changes, additional information recorded, and quality of drafting are acceptable.
    - b. Final Submittal:
      - 1) Submit PDF electronic files of scanned record.
- B. Record Specifications: Submit annotated PDF electronic files of Project's Specifications, including addenda and contract modifications.
- C. Record Product Data: Submit annotated PDF electronic files and directories of each submittal.
- D. Miscellaneous Record Submittals: See other Specification Sections for miscellaneous record-keeping requirements and submittals in connection with various construction activities. Submit annotated PDF electronic files and directories of each submittal.

#### **PART 2 - PRODUCTS**

##### **2.1 ELECTRONIC PROJECT MANAGEMENT SOFTWARE**

- A. Electronic File of Project Record Documents: Provide Architect with an independent electronic archive of accepted project record documents using electronic project management software as defined in Division 01 Section "Project Management and Coordination", in addition to the printed documents described elsewhere in this Section.

## **2.2 RECORD DRAWINGS**

- A. Record Prints: Maintain one set of marked-up paper copies of the Contract Drawings and Shop Drawings, incorporating new and revised drawings as modifications are issued.
1. Preparation: Mark record prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to provide information for preparation of corresponding marked-up record prints.
    - a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
    - b. Accurately record information in an acceptable drawing technique.
    - c. Record data as soon as possible after obtaining it.
    - d. Record and check the markup before enclosing concealed installations.
    - e. Cross-reference record prints to corresponding archive photographic documentation.
  2. Content: Types of items requiring marking include, but are not limited to, the following:
    - a. Dimensional changes to Drawings.
    - b. Revisions to details shown on Drawings.
    - c. Depths of foundations below first floor.
    - d. Locations and depths of underground utilities.
    - e. Revisions to routing of piping and conduits.
    - f. Revisions to electrical circuitry.
    - g. Actual equipment locations.
    - h. Duct size and routing.
    - i. Locations of concealed internal utilities.
    - j. Changes made by Change Order or Construction Change Directive.
    - k. Changes made following Architect's written orders.
    - l. Details not on the original Contract Drawings.
    - m. Field records for variable and concealed conditions.
    - n. Record information on the Work that is shown only schematically.
  3. Mark the Contract Drawings and Shop Drawings completely and accurately. Use personnel proficient at recording graphic information in production of marked-up record prints.
  4. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
  5. Mark important additional information that was either shown schematically or omitted from original Drawings.
  6. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.

## **2.3 RECORD SPECIFICATIONS**

- A. Preparation: Mark Specifications to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications.
1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
  2. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.

3. Record the name of manufacturer, supplier, Installer, and other information necessary to provide a record of selections made.
  4. Note related Change Orders, record Product Data, and record Drawings where applicable.
- B. Format: Submit record Specifications as scanned PDF electronic file(s) of marked-up paper copy of Specifications.

## **2.4 RECORD PRODUCT DATA**

- A. Preparation: Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submittal.
1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
  2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
  3. Note related Change Orders, record Specifications, and record Drawings where applicable.
- B. Format: Submit record Product Data as scanned PDF electronic file(s) of marked-up paper copy of Product Data.
1. Include record Product Data directory organized by Specification Section number and title, electronically linked to each item of record Product Data.

## **2.5 MISCELLANEOUS RECORD SUBMITTALS**

- A. Assemble miscellaneous records required by other Specification Sections for miscellaneous record keeping and submittal in connection with actual performance of the Work. Bind or file miscellaneous records and identify each, ready for continued use and reference.
- B. Format: Submit miscellaneous record submittals as scanned PDF electronic file(s) of marked-up miscellaneous record submittals.
1. Include miscellaneous record submittals directory organized by Specification Section number and title, electronically linked to each item of miscellaneous record submittals.

# **PART 3 - EXECUTION**

## **3.1 RECORDING AND MAINTENANCE**

- A. Recording: Maintain one copy of each submittal during the construction period for project record document purposes. Post changes and revisions to project record documents as they occur; do not wait until end of Project.
- B. Maintenance of Record Documents and Samples: Store record documents and Samples in the field office apart from the Contract Documents used for construction. Do not use project record documents for construction purposes. Maintain record documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to project record documents for Architect's reference during normal working hours.

### **END OF SECTION**



## **SECTION 01 8111**

### **SUSTAINABLE CONSTRUCTION REQUIREMENTS**

#### **PART 1 - GENERAL**

##### **1.1 SUMMARY**

- A. Section includes general requirements and procedures for compliance with sustainable construction requirements.
  - 1. Designed to Earn Energy Star: This Project is designed to achieve an EPA rating of 75 or higher. The designer has filed a Statement of Energy Design Intent, generated from Target Finder, with the U.S. Environmental Protection Agency.
    - a. The Contractor shall adhere to the design intent for products and systems indicated in the Contract Documents. Substitutions that may alter Energy Performance Goals will not be approved and no substitution shall be permitted without approval of the Design Team.

##### **1.2 DEFINITIONS**

- A. Chain-of-Custody Certificates: Certificates signed by manufacturers certifying that wood used to make products was obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship." Certificates shall include evidence that manufacturer is certified for chain of custody by an FSC-accredited certification body.
- B. Project Materials Cost Data: Statement indicating total cost for building materials used for Project, excluding mechanical, electrical, and plumbing components, and specialty items such as elevators and equipment.
- C. Regional Materials: Materials that have been extracted, harvested, or recovered, as well as manufactured, within 500 miles (800 km) of Project site. If only a fraction of a product or material is extracted/harvested/recovered and manufactured locally, then only that percentage (by weight) shall contribute to the regional value.
  - 1. Mechanical, electrical and plumbing components and specialty items such as elevators and equipment shall not be included.
- D. Recycled Content: The recycled content value of a material assembly shall be determined by weight. The recycled fraction of the assembly is then multiplied by the cost of assembly to determine the recycled content value.
  - 1. "Post-consumer" material is defined as waste material generated by households or by commercial, industrial, and institutional facilities in their role as end users of the product, which can no longer be used for its intended purpose.
  - 2. "Pre-consumer" material is defined as material diverted from the waste stream during the manufacturing process. Excluded is reutilization of materials such as rework, regrind, or scrap generated in a process and capable of being reclaimed within the same process that generated it.

- E. Inside Weatherproofing System: Materials and products that are installed on site within rooms, spaces, and portions of Project in which air is conditioned by Heating, Ventilation and Air Conditioning Systems.

### **1.3 SUBMITTALS**

- A. General: Sustainable construction submittals are in addition to other submittals.
- B. Sustainable Construction Action Plans: Provide action plan within 30 days of date established for commencement of the Work indicating how the following requirements will be met:
  - 1. Construction Waste Management: Waste management plan complying with Division 01 Section "Construction Waste Management and Disposal."
  - 2. Recycled Content: List of proposed materials with recycled content. Indicate cost, post-consumer recycled content, and pre-consumer recycled content for each product having recycled content.
  - 3. Regional Materials: List of proposed regional materials. Identify each regional material, including its source, cost, and the fraction by weight that is considered regional.
  - 4. Certified Wood: List of proposed certified wood products. Indicate each product containing certified wood, including its source and cost of certified wood products.
  - 5. Construction Indoor-Air-Quality Management Plan: Provide plan indicating how requirements will be met during construction.
- C. Sustainable Construction Progress Reports: Concurrent with each Application for Payment, submit reports comparing actual construction and purchasing activities with sustainable construction action plans for the following:
  - 1. Construction Waste Management: Waste reduction progress reports complying with Division 01 Section "Construction Waste Management and Disposal."
  - 2. Recycled content.
  - 3. Regional materials.
  - 4. Certified wood products.
- D. Sustainable Construction Documentation Submittals:
  - 1. Construction Waste Management: Comply with Division 01 Section "Construction Waste Management and Disposal."
  - 2. Recycled Content: Product data and certification letter indicating percentages by weight of post-consumer and pre-consumer recycled content for products having recycled content. Include statement indicating costs for each product having recycled content.
  - 3. Regional Materials: Product data for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.



4. Certified Wood: Product data and chain-of-custody certificates for products containing certified wood. Include statement indicating cost for each certified wood product.
5. Indoor Air Quality During Construction:
  - a. Construction indoor-air-quality management plan.
  - b. Product data for temporary filtration media.
  - c. Product data for filtration media used during occupancy.
  - d. Construction Documentation: Six photographs at three different times during the construction period, along with a brief description of the SMACNA approach employed, documenting implementation of the indoor-air-quality management measures, such as protection of ducts and on-site stored or installed absorptive materials.
6. Low Emitting Materials – Interior Adhesives and Sealants: Product data for adhesives and sealants used inside the weatherproofing system indicating VOC content of each product used. Indicate VOC content in g/L calculated according to 40 CFR 59, Subpart D (EPA Method 24).
7. Low Emitting Materials – Interior Paints and Coatings: Product data for paints and coatings used inside the weatherproofing system indicating chemical composition and VOC content of each product used. Indicate VOC content in g/L calculated according to 40 CFR 59, Subpart D (EPA Method 24).
8. Low Emitting Materials; Carpet Systems:
  - a. For carpet, documentation indicating compliance with testing and product requirements of CRI's "Green Label Plus" program.
  - b. For carpet cushion, documentation indicating compliance with testing and product requirements of CRI's "Green Label" program.
  - c. For installation adhesive, including printed statement of VOC content.

## **PART 2 - PRODUCTS**

### **2.1 RECYCLED CONTENT OF MATERIALS**

- A. Recycled Content: Provide building materials with recycled content such that post-consumer recycled content plus one-half of pre-consumer recycled content constitutes a minimum of 10 percent of cost of materials used for Project.
  1. Cost of post-consumer recycled content of an item shall be determined by dividing weight of post-consumer recycled content in the item by total weight of the item and multiplying by cost of the item.
  2. Cost of post-consumer recycled content plus one-half of pre-consumer recycled content of an item shall be determined by dividing weight of post-consumer recycled content plus one-half of pre-consumer recycled content in the item by total weight of the item and multiplying by cost of the item.
  3. Do not include mechanical and electrical components in the calculation.

### **2.2 REGIONAL MATERIALS**

- A. Regional Materials: Provide 10 percent of building materials (by cost) that are regional materials.

- B. Regionally Manufactured Materials: Provide 20 percent of building materials (by cost) that are regionally manufactured materials.
- C. Regionally Extracted and Manufactured Materials: Provide 10 percent of building materials (by cost) that are regionally extracted and manufactured materials.

### **2.3 CERTIFIED WOOD (OPTIONAL)**

- A. Certified Wood: Provide a minimum of 50 percent (by cost) of wood-based materials that are produced from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship."
  - 1. Wood-based materials include, but are not limited to, the following materials when made from wood, engineered wood products, or wood-based panel products:
    - a. Rough carpentry.
    - b. Miscellaneous carpentry.
    - c. Heavy timber construction.
    - d. Wood decking.
    - e. Metal-plate-connected wood trusses.
    - f. Structural glued-laminated timber.
    - g. Finish carpentry.
    - h. Architectural woodwork.
    - i. Wood paneling.
    - j. Wood veneer wall covering.
    - k. Wood flooring.
    - l. Wood lockers.
    - m. Wood cabinets.
    - n. Furniture.

### **2.4 LOW-EMITTING MATERIALS**

- A. Adhesives and Sealants: For field applications that are inside the weatherproofing system, use adhesives and sealants that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
  - 1. Wood Glues: 30 g/L.
  - 2. Metal to Metal Adhesives: 30 g/L.
  - 3. Adhesives for Porous Materials (Except Wood): 50 g/L.
  - 4. Subfloor Adhesives: 50 g/L.
  - 5. Plastic Foam Adhesives: 50 g/L.
  - 6. Carpet Adhesives: 50 g/L.
  - 7. Carpet Pad Adhesives: 50 g/L.
  - 8. VCT and Asphalt Tile Adhesives: 50 g/L.
  - 9. Cove Base Adhesives: 50 g/L.
  - 10. Gypsum Board and Panel Adhesives: 50 g/L.
  - 11. Rubber Floor Adhesives: 60 g/L.
  - 12. Ceramic Tile Adhesives: 65 g/L.
  - 13. Multipurpose Construction Adhesives: 70 g/L.
  - 14. Fiberglass Adhesives: 80 g/L.
  - 15. Contact Adhesive: 80 g/L.
  - 16. Structural Glazing Adhesives: 100 g/L.
  - 17. Wood Flooring Adhesive: 100 g/L.

18. Structural Wood Member Adhesive: 140 g/L.
19. Special Purpose Contact Adhesive (contact adhesive that is used to bond melamine covered board, metal, unsupported vinyl, Teflon, ultra-high molecular weight polyethylene, rubber or wood veneer 1/16 inch or less in thickness to any surface): 250 g/L.
20. Top and Trim Adhesive: 250 g/L.
21. Plastic Cement Welding Compounds: 350 g/L.
22. ABS Welding Compounds: 400 g/L.
23. CPVC Welding Compounds: 490 g/L.
24. PVC Welding Compounds: 510 g/L.
25. Adhesive Primer for Plastic: 650 g/L.
26. Sheet Applied Rubber Lining Adhesive: 850 g/L.
27. Aerosol Adhesive, General Purpose Mist Spray: 65 percent by weight.
28. Aerosol Adhesive, General Purpose Web Spray: 55 percent by weight.
29. Special Purpose Aerosol Adhesive (All Types): 70 percent by weight.
30. Other Adhesives: 250 g/L.
31. Architectural Sealants: 250 g/L.
32. Nonmembrane Roof Sealants: 300 g/L.
33. Single-Ply Roof Membrane Sealants: 450 g/L.
34. Other Sealants: 420 g/L.
35. Sealant Primers for Nonporous Substrates: 250 g/L.
36. Sealant Primers for Porous Substrates: 775 g/L.
37. Modified Bituminous Sealant Primers: 500 g/L.
38. Other Sealant Primers: 750 g/L.

B. Interior Paints and Coatings: For field applications that are inside the weatherproofing system, use paints and coatings that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24) and the following chemical restrictions:

1. Flat Interior Topcoat Paints: VOC not more than 50 g/L.
2. Nonflat Interior Topcoat Paints: VOC not more than 150 g/L.
3. Anticorrosive and Antirust Paints Applied to Ferrous Metals: VOC not more than 250 g/L.
4. Clear Wood Finishes, Varnishes and Sanding Sealers: VOC not more than 350 g/L.
5. Clear Wood Finishes, Lacquers: VOC not more than 550 g/L.
6. Floor Coatings: VOC not more than 100 g/L.
7. Shellacs, Clear: VOC not more than 730 g/L.
8. Shellacs, Pigmented: VOC not more than 550 g/L.
9. Stains: VOC not more than 250 g/L.
10. Primers, Sealers, and Undercoaters: VOC not more than 200 g/L.
11. Dry-Fog Coatings: VOC not more than 400 g/L.
12. Zinc-Rich Industrial Maintenance Primers: VOC not more than 340 g/L.
13. Pretreatment Wash Primers: VOC not more than 420 g/L.
14. Aromatic Compounds: Paints and coatings shall not contain more than 1.0 percent by weight total aromatic compounds (hydrocarbon compounds containing one or more benzene rings).
15. Restricted Components: Paints and coatings shall not contain any of the following:
  - a. Acrolein.
  - b. Acrylonitrile.
  - c. Antimony.
  - d. Benzene.
  - e. Butyl benzyl phthalate.
  - f. Cadmium.
  - g. Di (2-ethylhexyl) phthalate.

- h. Di-n-butyl phthalate.
- i. Di-n-octyl phthalate.
- j. 1,2-dichlorobenzene.
- k. Diethyl phthalate.
- l. Dimethyl phthalate.
- m. Ethylbenzene.
- n. Formaldehyde.
- o. Hexavalent chromium.
- p. Isophorone.
- q. Lead.
- r. Mercury.
- s. Methyl ethyl ketone.
- t. Methyl isobutyl ketone.
- u. Methylene chloride.
- v. Naphthalene.
- w. Toluene (methylbenzene).
- x. 1,1,1-trichloroethane.
- y. Vinyl chloride.

C. Carpet Systems:

- 1. Emissions: Provide carpet and cushion that complies with testing and product requirements of CRI's "Green Label" program.
- 2. Emissions: Provide carpet and cushion that complies with the product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

### **PART 3 - EXECUTION**

#### **3.1 CONSTRUCTION WASTE MANAGEMENT**

- A. Construction Waste Management: Comply with Division 01 Section "Construction Waste Management and Disposal."

#### **3.2 CONSTRUCTION INDOOR-AIR-QUALITY MANAGEMENT**

- A. Indoor Air Quality During Construction: Comply with SMACNA's "SMACNA IAQ Guideline for Occupied Buildings under Construction."
  - 1. If Owner authorizes use of permanent heating, cooling, and ventilating systems during construction period as specified in Division 01 Section "Temporary Facilities and Controls," install filter media having a MERV 8 according to ASHRAE 52.2 at each return-air inlet for the air-handling system used during construction.
  - 2. Replace all air filters immediately prior to occupancy.

### **END OF SECTION**





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Cherokee Nation  
Childers Architect  
2019-02-08**

**SUSTAINABLE CONSTRUCTION  
REQUIREMENTS**

01 8111 - 10



## **SECTION 01 9113**

### **GENERAL COMMISSIONING REQUIREMENTS**

#### **PART 1 - GENERAL**

##### **1.1 RELATED DOCUMENTS**

- A. OPR and BoD documentation are included by reference for information only.

##### **1.2 SUMMARY**

- A. Section includes general requirements that apply to implementation of commissioning without regard to specific systems, assemblies, or components.
- B. Related Documents:
  - 1. OPR and BoD documentation are included by reference for information only.

##### **1.3 DEFINITIONS**

- A. BoD: Basis of Design. A document that records concepts, calculations, decisions, and product selections used to meet the OPR and to satisfy applicable regulatory requirements, standards, and guidelines. The document includes both narrative descriptions and lists of individual items that support the design process.
- B. Commissioning Plan: A document that outlines the organization, schedule, allocation of resources, and documentation requirements of the commissioning process.
- C. CxA: Commissioning Authority.
- D. OPR: Owner's Project Requirements. A document that details the functional requirements of a project and the expectations of how it will be used and operated. These include Project goals, measurable performance criteria, cost considerations, benchmarks, success criteria, and supporting information.
- E. Systems, Subsystems, Equipment, and Components: Where these terms are used together or separately, they shall mean "as-built" systems, subsystems, equipment, and components.

##### **1.4 COMMISSIONING TEAM**

- A. Members Appointed by Contractor(s): Individuals, each having the authority to act on behalf of the entity he or she represents, explicitly organized to implement the commissioning process through coordinated action. The commissioning team shall consist of, but not be limited to, representatives of Contractor, including Project superintendent and subcontractors, installers, suppliers, and specialists deemed appropriate by the CxA.
- B. Members Appointed by Owner:

1. CxA: The designated person, company, or entity that plans, schedules, and coordinates the commissioning team to implement the commissioning process. Owner will engage the CxA under a separate contract.
2. Representatives of the facility user and operation and maintenance personnel.
3. Architect and engineering design professionals.

#### **1.5 OWNER'S RESPONSIBILITIES**

- A. Provide the OPR documentation to the CxA and Contractor for information and use.
- B. Assign operation and maintenance personnel and schedule them to participate in commissioning team activities.
- C. Provide the BoD documentation, prepared by Architect and approved by Owner, to the CxA and Contractor for use in developing the commissioning plan, systems manual, and operation and maintenance training plan.

#### **1.6 CONTRACTOR'S RESPONSIBILITIES**

- A. Contractor shall assign representatives with expertise and authority to act on its behalf and shall schedule them to participate in and perform commissioning process activities including, but not limited to, the following:
  1. Evaluate performance deficiencies identified in test reports and, in collaboration with entity responsible for system and equipment installation, recommend corrective action.
  2. Cooperate with the CxA for resolution of issues recorded in the Issues Log.
  3. Integrate and coordinate commissioning process activities with construction schedule.
  4. Review and accept construction checklists provided by the CxA.
  5. Review and accept commissioning process test procedures provided by the Commissioning Authority.
  6. Complete commissioning process test procedures.

#### **1.7 CxA'S RESPONSIBILITIES**

- A. Organize and lead the commissioning team.
- B. Provide commissioning plan.
- C. Convene commissioning team meetings.
- D. Provide Project-specific construction checklists and commissioning process test procedures.
- E. Verify the execution of commissioning process activities using random sampling. The sampling rate may vary from 1 to 100 percent. Verification will include, but is not limited to, equipment submittals, construction checklists, training, operating and maintenance data, tests, and test reports to verify compliance with the OPR. When a random sample does not meet the requirement, the CxA will report the failure in the Issues Log.
- F. Prepare and maintain the Issues Log.
- G. Prepare and maintain completed construction checklist log.

- H. Witness systems, assemblies, equipment, and component startup.
- I. Compile test data, inspection reports, and certificates; include them in the systems manual and commissioning process report.

**PART 2 - PRODUCTS (Not Used)**

**PART 3 - EXECUTION (Not Used)**

**END OF SECTION**



## **SECTION 01 7900**

### **DEMONSTRATION AND TRAINING**

#### **PART 1 - GENERAL**

##### **1.1 SUMMARY**

- A. Section includes administrative and procedural requirements for instructing Owner's personnel, including the following:
  - 1. Demonstration of operation of systems, subsystems, and equipment.
  - 2. Training in operation and maintenance of systems, subsystems, and equipment.

##### **1.2 SUBMITTALS**

- A. Instruction Program: Submit outline of instructional program for demonstration and training, including a list of training modules and a schedule of proposed dates, times, length of instruction time, and instructors' names for each training module. Include learning objective and outline for each training module.
  - 1. Indicate proposed training modules using manufacturer-produced demonstration and training video recordings for systems, equipment, and products.
- B. Qualification Data: For instructor.
- C. Attendance Record: For each training module, submit list of participants and length of instruction time.
- D. Evaluations: For each participant and for each training module, submit results and documentation of performance-based test.

##### **1.3 QUALITY ASSURANCE**

- A. Instructor Qualifications: A factory-authorized service representative, complying with requirements in Division 01 Section "Quality Requirements," experienced in operation and maintenance procedures and training.
- B. Preinstruction Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination." Review methods and procedures related to demonstration and training including, but not limited to, the following:
  - 1. Inspect and discuss locations and other facilities required for instruction.
  - 2. Review and finalize instruction schedule and verify availability of educational materials, instructors' personnel, audiovisual equipment, and facilities needed to avoid delays.
  - 3. Review required content of instruction.
  - 4. For instruction that must occur outside, review weather and forecasted weather conditions and procedures to follow if conditions are unfavorable.

## **1.4 COORDINATION**

- A. Coordinate instruction schedule with Owner's operations. Adjust schedule as required to minimize disrupting Owner's operations and to ensure availability of Owner's personnel.
- B. Coordinate instructors, including providing notification of dates, times, length of instruction time, and course content.
- C. Coordinate content of training modules with content of approved emergency, operation, and maintenance manuals.

## **PART 2 - PRODUCTS**

### **2.1 INSTRUCTION PROGRAM**

- A. Program Structure: Develop an instruction program that includes individual training modules for each system and for equipment not part of a system, as required by individual Specification Sections.
- B. Training Modules: Develop a learning objective and teaching outline for each module. Include a description of specific skills and knowledge that participant is expected to master. For each module, include instruction for the following as applicable to the system, equipment, or component:
  - 1. Basis of System Design, Operational Requirements, and Criteria: Include the following:
    - a. System, subsystem, and equipment descriptions.
    - b. Performance and design criteria if Contractor is delegated design responsibility.
    - c. Operating standards.
    - d. Regulatory requirements.
    - e. Equipment function.
    - f. Operating characteristics.
    - g. Limiting conditions.
    - h. Performance curves.
  - 2. Documentation: Review the following items in detail:
    - a. Emergency manuals.
    - b. Operations manuals.
    - c. Maintenance manuals.
    - d. Project record documents.
    - e. Identification systems.
    - f. Warranties and bonds.
    - g. Maintenance service agreements and similar continuing commitments.
  - 3. Emergencies: Include the following, as applicable:
    - a. Instructions on meaning of warnings, trouble indications, and error messages.
    - b. Instructions on stopping.
    - c. Shutdown instructions for each type of emergency.
    - d. Operating instructions for conditions outside of normal operating limits.
    - e. Sequences for electric or electronic systems.
    - f. Special operating instructions and procedures.

4. Operations: Include the following, as applicable:
  - a. Startup procedures.
  - b. Equipment or system break-in procedures.
  - c. Routine and normal operating instructions.
  - d. Regulation and control procedures.
  - e. Control sequences.
  - f. Safety procedures.
  - g. Instructions on stopping.
  - h. Normal shutdown instructions.
  - i. Operating procedures for emergencies.
  - j. Operating procedures for system, subsystem, or equipment failure.
  - k. Seasonal and weekend operating instructions.
  - l. Required sequences for electric or electronic systems.
  - m. Special operating instructions and procedures.
5. Adjustments: Include the following:
  - a. Alignments.
  - b. Checking adjustments.
  - c. Noise and vibration adjustments.
  - d. Economy and efficiency adjustments.
6. Troubleshooting: Include the following:
  - a. Diagnostic instructions.
  - b. Test and inspection procedures.
7. Maintenance: Include the following:
  - a. Inspection procedures.
  - b. Types of cleaning agents to be used and methods of cleaning.
  - c. List of cleaning agents and methods of cleaning detrimental to product.
  - d. Procedures for routine cleaning
  - e. Procedures for preventive maintenance.
  - f. Procedures for routine maintenance.
  - g. Instruction on use of special tools.
8. Repairs: Include the following:
  - a. Diagnosis instructions.
  - b. Repair instructions.
  - c. Disassembly; component removal, repair, and replacement; and reassembly instructions.
  - d. Instructions for identifying parts and components.
  - e. Review of spare parts needed for operation and maintenance.

## **PART 3 - EXECUTION**

### **3.1 PREPARATION**

- A. Assemble educational materials necessary for instruction, including documentation and training module. Assemble training modules into a training manual organized in coordination with requirements in Division 01 Section "Operations and Maintenance Data."
- B. Set up instructional equipment at instruction location.

### **3.2 INSTRUCTION**

- A. Engage qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.
  - 1. Owner will furnish Contractor with names and positions of participants.
- B. Scheduling: Provide instruction at mutually agreed on times. For equipment that requires seasonal operation, provide similar instruction at start of each season.
  - 1. Schedule training with Owner with at least seven days' advance notice.
- C. Training Location and Reference Material: Conduct training on-site in the completed and fully operational facility using the actual equipment in-place. Conduct training using final operation and maintenance data submittals.
- D. Evaluation: At conclusion of each training module, assess and document each participant's mastery of module by use of a demonstration performance-based test.
- E. Cleanup: Collect used and leftover educational materials and remove from Project site. Remove instructional equipment. Restore systems and equipment to condition existing before initial training use.

**END OF SECTION**



## SECTION 02 4113

### SELECTIVE SITE DEMOLITION

#### 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 SELECTIVE SITE DEMOLITION 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 SELECTIVE SITE DEMOLITION shall be included in the bid prices for the work

##### 1.03 SECTION INCLUDES

- A. Demolition and removal of buildings and site improvements.
- B. Disconnecting, capping or sealing, and abandoning in-place and removing site utilities.
- C. Salvaging items for reuse by Owner.

##### 1.04 RELATED SECTIONS

- A. 31 1000 Site Clearing
- B. 31 2300 Excavation and Fill
- C. 31 2500 Erosion and Sedimentation Controls

##### 1.05 DEFINITIONS

- A. Remove - Detach items from existing construction and legally dispose of them off-site unless indicated to be removed and salvaged or removed and reinstalled.
- B. Remove and Salvage - Carefully detach from existing construction, in a manner to prevent damage, and deliver to OWNER.

##### 1.06 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.
- B. Schedule of Building Demolition Activities; Indicate the following:
  - 1. Temporary interruption of utility services.
  - 2. Shutoff and capping or re-routing of utility services.

##### 1.07 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.
- 2. Inspect and discuss condition of construction to be demolished.

3. Review structural load limitations of existing structures.
4. Review and finalize building demolition schedule and verify availability of demolition personnel, equipment, and facilities needed to make progress and avoid delays.
5. Review and finalize protection requirements.
6. Review procedures for dust control.
7. Review procedures for protection of adjacent buildings.
8. Review items to be salvaged and returned to Owner.

#### 1.08 REGULATORY REQUIREMENTS

- A. All materials and methods shall comply with the requirements of the AHJ.

#### 1.09 PERMITS

- A. CONTRACTOR shall make application, pay permit fees, and obtain any and all demolition permits.

#### 1.10 MATERIALS OWNERSHIP

- A. Unless otherwise indicated, demolition waste becomes property of CONTRACTOR.

#### 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 FIELD CONDITIONS

- A. Notify ENGINEER of discrepancies between existing conditions and Drawings before proceeding with selective demolition.
- B. Buildings to be demolished will be vacated and their use discontinued before start of the Work.
  - 1. Buildings immediately adjacent to demolition area will be occupied. Conduct building demolition so operations of occupied buildings will not be disrupted.
  - 2. Provide not less than 72 hours' notice of activities that will affect operations of adjacent occupied buildings.
  - 3. Maintain access to existing walkways, exits, and other facilities used by occupants of adjacent buildings.
    - a. Do not close or obstruct walkways, exits, or other facilities used by occupants of adjacent buildings without written permission from authorities having jurisdiction.
- C. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.
  - 1. Before building demolition, coordinate with the Owner of any items Owner will remove prior to demolition and any items Owner wants CONTRACTOR to salvage for Owner's reuse.
- D. On-site storage or sale of removed items or materials is not permitted.

#### 1.14 COORDINATION

- A. Arrange demolition schedule so as not to interfere with Owner's on-site operations or operations of adjacent occupied buildings.

#### 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 PERFORMANCE REQUIREMENTS

- A. Comply with governing CITY, STATE, and FEDERAL notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.
- B. Standards: Comply with ANSI/ASSE A10.6 "Safety Requirements for Demolition Operations" from the American National Standard for Construction and Demolition Operations, and NFPA 241 "Standard for Safeguarding Construction, Alteration, and Demolition Operations".

### 2.02 SOIL MATERIALS

- A. Satisfactory Soils: Comply with requirements in Section 31 23 00 Excavation and Fill.

## PART 3 - EXECUTION

### 3.01 PRE-DEMOLITION WORK

- A. Contact OKIE (811 or 1-800-522-OKIE) prior to construction for locating existing utilities.
- B. 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. CONTRACTOR shall also coordinate the construction activities with the utility companies to ensure compliance with the project schedule.
- C. 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.
- D. 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 demolition. 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.
- E. Verify that utilities have been disconnected and capped before starting selective demolition operations.
- F. Photograph, record on video, or both the existing conditions of the Project site and adjoining property.

### 3.02 CONSTRUCTION CONTROL

- A. 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.

- B. 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.

### 3.03 EXAMINATION

- A. Verify that utilities have been disconnected and capped before starting demolition operations.
- B. Review Project Record Documents of existing construction or other existing condition and hazardous material information provided by Owner. Owner does not guarantee that existing conditions are same as those indicated in Project Record Documents.
- C. Perform an engineering survey of condition of building to determine whether removing any element might result in structural deficiency or unplanned collapse of any portion of structure or adjacent structures during building demolition operations.
- D. Steel Tendons: Locate tensioned steel tendons and include recommendations for de-tensioning.
- E. Verify that hazardous materials have been remediated before proceeding with building demolition operations.
- F. Inventory and record the condition of items to be removed and salvaged. Provide photographs or video of conditions that might be misconstrued as damage caused by salvage operations.

### 3.04 TEMPORARY EROSION CONTROLS

- A. See 31 25 00 Erosion and Sedimentation Controls
- B. Comply with the City, State, and Federal requirements for the minimization and control of sediment erosion and site run-off in storm water resulting from construction activities. Install temporary erosions controls prior to SITE CLEARING. Comply with the requirements of the Storm Water Pollution Prevention Plan and the permit(s) issued by the City and State.

### 3.05 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

- A. Existing Utilities to be Disconnected: Locate, identify, disconnect, and seal or cap off utilities serving buildings and structures to be demolished.
  - 1. Arrange to shut off utilities with utility companies.
  - 2. If removal, relocation, or abandonment of utility services will affect adjacent occupied buildings, then provide temporary utilities that bypass buildings and structures to be demolished and that maintain continuity of service to other buildings and structures.
  - 3. Cut off pipe or conduit a minimum of 36 inches below grade. Cap, valve, or plug and seal remaining portion of pipe or conduit after bypassing according to requirements of authorities having jurisdiction.
  - 4. Do not start demolition work until utility disconnecting and sealing have been completed and verified in writing.

### 3.06 PROTECTION

- A. Existing Facilities: Protect adjacent walkways, loading docks, building entries, and other building facilities during demolition operations. Maintain exits from existing buildings.
- B. Temporary Shoring: Provide and maintain interior and exterior shoring, bracing, or structural support to preserve stability and prevent unexpected movement or collapse of construction being demolished.
  - 1. Strengthen or add new supports when required during progress of demolition.
- C. Existing Utilities to Remain: Maintain utility services to remain and protect from damage during demolition operations.
  - 1. Do not interrupt existing utilities serving adjacent occupied or operating facilities unless authorized in writing by Owner and authorities having jurisdiction.
    - a. Provide temporary services during interruptions to existing utilities, as acceptable to Owner and authorities having jurisdiction.
  - 2. Provide at least 72 hours' notice to occupants of affected buildings if shutdown of service is required during changeover.
- D. Temporary Protection: Erect temporary protection, such as walks, fences, railings, canopies, and covered passageways, where required by authorities having jurisdiction and as indicated.
  - 1. Protect adjacent buildings and facilities from damage due to demolition activities.
  - 2. Protect existing site improvements, appurtenances, and landscaping to remain.
  - 3. Erect a plainly visible fence around drip line of individual trees or around perimeter drip line of groups of trees to remain.
  - 4. Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.
  - 5. Provide protection to ensure safe passage of people around building demolition area and to and from occupied portions of adjacent buildings and structures.
  - 6. Protect walls, windows, roofs, and other adjacent exterior construction that are to remain and that are exposed to building demolition operations.
  - 7. Erect and maintain dustproof partitions and temporary enclosures to limit dust, noise, and dirt migration to occupied portions of adjacent buildings.
- E. Remove temporary barriers and protections where hazards no longer exist. Where open excavations or other hazardous conditions remain, leave temporary barriers and protections in place.

### 3.06 DEMOLITION, GENERAL

- A. General: Demolish indicated buildings and site improvements completely. Use methods required to complete the Work within limitations of governing regulations and as follows:
  - 1. Do not use cutting torches until work area is cleared of flammable materials. Maintain portable fire-suppression devices during flame-cutting operations.
  - 2. Maintain fire watch during and for at least 2 hours after flame-cutting operations.
  - 3. Maintain adequate ventilation when using cutting torches.
  - 4. Locate building demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.

- B. Site Access and Temporary Controls: Conduct building demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
  - 1. Do not close or obstruct streets, walks, walkways, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed trafficways if required by authorities having jurisdiction.
  - 2. Use water mist and other suitable methods to limit spread of dust and dirt. Comply with governing environmental-protection regulations. Do not use water when it may damage adjacent construction or create hazardous or objectionable conditions, such as ice, flooding, and pollution.
- C. Explosives: Use of explosives is not permitted.

### 3.07 DEMOLITION BY MECHANICAL MEANS

- A. Proceed with demolition of structural framing members systematically, from higher to lower level. Complete building demolition operations above each floor or tier before disturbing supporting members on the next lower level.
- B. Remove debris from elevated portions of the building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.
  - 1. Remove structural framing members and lower to ground by method suitable to minimize ground impact and dust generation.
- C. Salvage: Items to be removed and salvaged are indicated below:
  - 1. Coordinate with Owner prior to demolition.
- D. Below-Grade Construction: Demolish foundation walls and other below-grade construction.
  - 1. Remove below-grade construction, including basements, foundation walls, and footings, completely.
- E. Existing Utilities: Demolish existing utilities and below-grade utility structures that are within 8 feet outside footprint indicated for new construction. Abandon utilities outside this area.
  - 1. Fill abandoned utility structures with satisfactory soil materials according to backfill requirements in Section 31 23 00 Excavation and Fill.
- F. Hydraulic Elevator Systems: Demolish and remove elevator system, including cylinder, plunger, well assembly, steel well casing and liner, oil supply lines, and tanks.
- G. Pavement: Demolish pavement in sections. Cut pavement full depth at junctures with construction to remain and at regular intervals using power-driven saw, then remove pavement between saw cuts. Pavement shall be saw cut in straight lines.

### 3.08 SITE RESTORATION

- A. Below-Grade Areas: Rough grade below-grade areas ready for further excavation or new construction.
- B. Site Grading: Uniformly rough grade area of demolished construction to a smooth surface, free from irregular surface changes. Provide a smooth transition between adjacent existing grades and new grades.

3.09 REPAIRS

- A. Promptly repair damage to adjacent buildings caused by demolition operations.

3.10 DISPOSAL OF DEMOLISHED MATERIALS

- A. Remove demolition waste materials from Project site and dispose of them in an EPA-approved construction and demolition waste landfill acceptable to authorities having jurisdiction.
  - 1. Do not allow demolished materials to accumulate on-site.
  - 2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
- B. Do not burn demolished materials.

3.11 CLEANING

- A. Clean adjacent structures and improvements of dust, dirt, and debris caused by building demolition operations. Return adjacent areas to condition existing before building demolition operations began.
  - 1. Clean roadways of debris caused by debris transport.

END OF SECTION



## SECTION 03 1000

### CONCRETE FORMING AND ACCESSORIES

#### PART 1 - GENERAL

##### 1.1 WORK INCLUDED

- A. This section includes formwork for cast-in-place concrete, including water stops, and installation of embedded items.

##### 1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Concrete Reinforcement - Section 03 2000
- B. Cast-In-Place Concrete - Section 03 3000
- C. **Under-Slab Vapor Retarder – Section 07 2600**

##### 1.3 QUALITY ASSURANCE

- A. Comply with the American Concrete Institute Standard, ACI 347-04, Recommended Practice for Concrete Formwork.

##### 1.4 REFERENCE STANDARDS

- A. American Society for Testing and Materials (ASTM), latest versions.
  - 1. ASTM D 226                      Specification for Asphalt - Saturated Organic Felt used in Roofing and Waterproofing"
  - 2. ASTM D 1751                  Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)

#### PART 2 - PRODUCTS

##### 2.1 MATERIALS

- A. Forms for Exposed Finish Concrete: Plywood complying with Voluntary Product Standard PS 1-07 "B-B (Concrete Form) Plywood", Class I, Exterior Grade or better or metal, metal-framed plywood or other acceptable panel-type materials. Plywood shall be mill-oiled and edge-sealed, with each piece bearing legible inspection trademark. Furnish in largest practicable sizes to minimize number of joints. Provide form material with sufficient thickness to withstand pressure of newly placed concrete without bow or deflection.
- B. Forms for Unexposed Finish Concrete: Use plywood, lumber, metal or other acceptable material. Provide lumber dressed on at least 2 edges and one side for tight fit.
- C. Form Coatings: Commercial formulation that will not bond with, stain, or adversely affect concrete surfaces, and will not impair subsequent treatments of concrete surfaces.
- D. Chamfer Strips: ¾ inch by ¾ inch wood, PVC, or rubber.

- E.     Preformed Construction Joint: 24-gage steel, galvanized, shaped to form a continuous tongue and groove key.
- F.     Preformed Control Joint: Rigid plastic or metal strip with removable top section.
- G.     Expansion Joint Material: Asphalt saturated fiberboard, ½ inch thick, meeting the requirements of ASTM D 1751.
- H.     Felt: Asphalt-saturated organic felt, weighing 30 pounds per 100 square feet, meeting the requirements of ASTM D 226.
- I.     Water stops: Volclay RX manufactured by Colloid Environmental Technologies Co. (CETCO).
- J.     Recycled Content: Minimum 5 percent post-consumer content, or minimum 20 percent pre-consumer recycled content at contractor's option.

## **PART 3 - EXECUTION**

### **3.1     COORDINATION**

- A.     Coordinate the installation of joint materials and moisture barriers with placement of forms and reinforcing steel. Set screeds accurately. Embedded items shall be accurately aligned and adequately supported. Verify installation of mechanical, plumbing, and electrical items to be embedded in concrete. Correct any unsatisfactory condition before proceeding further.

### **3.2     PREPARATION**

- A.     Form Coating: Coat contact surfaces of forms with a form coating compound before reinforcement is placed. Thin form-coating compounds with thinning agent and apply as specified in manufacturer's instructions. Do not allow excess form-coating material to accumulate in forms or to come into contact with concrete surfaces against which fresh concrete will be placed.

### **3.3     INSTALLATION**

- A.     Formwork: Formwork shall support vertical and lateral loads that are applied until such loads can be supported by concrete structure. Formwork shall be readily removable without impact, shock or damage to cast-in-place concrete surfaces and adjacent materials. Construct forms to sizes, shapes, lines and dimensions shown. Perform surveys to obtain accurate alignment. Provide for recesses, chamfers, blocking, anchorages, inserts, and other features required in work. Select materials to obtain required finishes. Butt joints solidly and provide backup at joints to prevent leakage of cement paste.
- B.     Chamfer Strips: Provide at exposed corners and edges.
- C.     Form Ties: Use factory fabricated, adjustable-length, removable or snap-off metal form ties, designed to prevent form deflection and to prevent spalling concrete surfaces upon removal.
- D.     Cleaning and Tightening: Thoroughly clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, or other debris before concrete is placed. Retighten forms and bracing after concrete placement as required to eliminate mortar leaks and maintain proper alignment.

### **3.4 INSTALLATION OF EMBEDDED ITEMS**

- A. General: Set anchorage devices and other embedded items accurately. Use setting drawings, diagrams, templates and printed instructions provided by supplier. Secure embedded items such that they are not displaced during placement of concrete.
- B. Water stops: Install according to manufacturers printed instructions. Splice water stop sections using square cut butt joints and fuse sections together with indirect heat from preheated splicing iron. Use of direct flame is prohibited.
  - 1. Place water stops in all concrete construction joints in basement walls around the building perimeter that are exposed to soil, weather, or moisture, and in any other construction joints that have the potential to allow water infiltration into the building.

### **3.5 JOINTS**

- A. Construction Joints in Elevated Slabs and Beams: Construction joints in Elevated Slabs, Beams, Grade Beams, and other flexural members shall only be made as shown in the contract drawings or as approved by the Engineer of Record. Joints shall be constructed in accordance with ACI 318 Section 6.4 with provisions made for the transfer of shear and other forces. Reinforcement shall be continuous through these joints unless noted otherwise.
- B. Construction Joints in Walls, Foundations, and Slabs on Grade: Provide keyways at least 1 ½ inches deep in vertical construction joints in walls and construction joints in slabs on grade and foundations. Discontinue every other horizontal bar through slab on grade construction joints unless noted otherwise.
- C. Preformed Construction Joint for Slabs on Grade: Secure with galvanized steel stakes, 1/8 inch thick by 1-1/8 inches wide with ½ inch deep rib and tapered point. Splice adjoining joints with 24 gage steel, galvanized splice plates.
- D. Isolation Joints in Slabs on Grade: Construct isolation joints in interior slabs using 30 lb. felt. Provide isolation joints at points of contact between slabs on grade and vertical surfaces, such as column pedestals, foundation walls, grade beams and elsewhere as indicated. Construct isolation joints on exterior slabs abutting vertical surfaces with ½ inch thick expansion joint material.
- E. Control Joints in Slabs-on-Grade:
  - 1. Preformed Strip: Insert premolded rigid plastic, or metal strip into fresh concrete. Cut groove for strip using 10-foot long straight edge cutting tool. Depths of strip shall be one fourth of slab thickness. Press strip into groove such that top of strip is level with the concrete surface. Pull off removable top section, if any, prior to troweling.
  - 2. Saw Cut: Contractor may saw cut control joints instead of using preformed strips. Saw cut joints shall be 1/8 inch wide. Saw cut depth should equal 1/4 of slab depth. Cut joints after concrete has hardened sufficiently to prevent raveling; usually 4 to 12 hours after slab has been cast and finished. Use diamond or silicone-carbide blades.
- F. Control Joints in Walls: Create weakened planes in cantilevered retaining walls at 25 feet on center. Use preformed strips, placed vertically, full height in each face of wall. Depth of strips shall be one inch. All joints shall be sealed with continuous pliable sealant.

### **3.6 REMOVAL OF FORMWORK**

- A. General: Prevent excessive deflection, distortion, and damage to concrete when forms are stripped. Provide crush plates or wrecking plates where stripping may damage cast concrete surfaces.
- B. Formwork and supports at sides of concrete shall remain in place for 24 hours after concrete placement. This period represents cumulative number of hours, not necessarily consecutive, during which the temperature of the air surrounding the concrete is above 50 degrees F. Formwork and shoring which support the weight of concrete shall not be removed until concrete has attained its specified compressive strength.
- C. Ensure safety of the structure. Do not superimpose any load on concrete until forms are removed and concrete is cured.

### **3.7 RE-USE OF FORMS**

- A. General: Clean and repair surfaces of forms to be re-used in work. Split, frayed, delaminated, or otherwise damaged form facing material will not be acceptable for exposed surfaces. Apply new form coating compound as specified for new formwork.

When forms are intended for successive concrete placement, thoroughly clean surfaces and remove fins and latence. Align and secure joints to avoid offsets. Do not use "patched" forms for exposed concrete surfaces.

**END OF SECTION**

## SECTION 03 2000

### CONCRETE REINFORCEMENT

#### PART 1 - GENERAL

##### 1.1 WORK INCLUDED

- A. This section includes fabrication and installation of deformed bar and welded wire fabric reinforcing steel.

##### 1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Concrete Forming and Accessories - Section 03 1000.
- B. Cast In Place Concrete - Section 03 3000.

##### 1.3 QUALITY ASSURANCE

- A. Reference Standards:
  - 1. American Concrete Institute (ACI), latest versions.
    - a. ACI 301                      Specifications for Structural Concrete for Buildings
    - b. ACI 315                      Details and Detailing of Concrete Reinforcement
    - c. ACI 318                      Building Code Requirements for Structural Concrete
  - 2. American Society for Testing and Materials (ASTM)
    - a. ASTM A 82/  
A82M                      Standard Specification for Steel Wire, plain, for Concrete Reinforcement
    - b. ASTM A 185/  
A185M                      Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete
    - c. ASTM A 615/  
A 615M                      Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
  - 3. Concrete Reinforcing Steel Institute (CRSI). Design Handbook - latest Edition

##### 1.4 SUBMITTALS

- A. Shop Drawings: Submit shop drawings for reinforcing steel. Comply with ACI 315 requirements showing layout, bar schedules, stirrup spacing, diagrams of bent bars, and arrangement of reinforcing steel. Shop Drawings shall not be made by reproduction of the Contract Drawings.

#### PART 2 - PRODUCTS

##### 2.1 MATERIALS

- A. Reinforcing Bars: ASTM A 615, Grade 60. Stirrups and ties may be Grade 40.
- B. Welded Wire Fabric: ASTM A 185, flat sheets.
- C. Steel Wire: ASTM A 82, 16 gage.
- D. Supports for Reinforcing Steel: Wire bar type and precast concrete block type meeting the requirements of CRSI Manual of Standard Practice.

## **2.2 FABRICATION**

- A. Fabricate reinforcing steel in accordance with fabricating tolerances in ACI 315.
- B. Do not fabricate reinforcing steel until shop drawings are approved.

## **PART 3 - EXECUTION**

### **3.1 PLACING BAR SUPPORTS**

- A. General: Provide bar supports meeting the requirements of CRSI Specification for Placing Bar Supports.
- B. Slabs-on-grade: Use supports with sand plates or precast concrete blocks or horizontal runners where base material will not support chair legs.

### **3.2 PLACING REINFORCING STEEL**

- A. General: Comply with CRSI Code of Standard Practice for "Placing Reinforcing Bars".
- B. Clean reinforcing steel of loose rust and mill scale, earth, ice, and other materials, which reduce or destroy bond with concrete.
- C. Accurately position, support and secure reinforcing steel against displacement by formwork, construction, or concrete placement operations. Place reinforcing steel to obtain minimum coverages. Arrange, space and securely tie bars and bar supports to hold reinforcing steel in position during concrete placement operations. Set wire ties so ends are directed into concrete, not toward exposed concrete surfaces.

#### **Concrete Cover:**

Concrete cast against and permanently exposed to earth 3 inches

Concrete exposed to earth or weather:

Bars larger than No. 5

2 inches

Bars No. 5 or smaller.

1 ½ inches

- D. Rebar Splices: Locate at points of minimum stress or as shown on contract drawings. Unless noted otherwise, provide lap splices 30 bar diameters (18 inches minimum) in length.
- E. Welded Wire Fabric Splices: Lap one complete wire spacing.
- F. Corner Reinforcing: Provide corner bars of same size and spacing as horizontal reinforcing steel. Lap with horizontal reinforcing 30 bar diameters or 18 inches minimum length.

- G. Reinforcing at Construction/Control Joints: Continue reinforcing steel through construction joints unless noted otherwise. Discontinue reinforcing steel 2 inches from preformed construction joints in slabs-on-grade. Cut alternate longitudinal bars at weakened plane control joints in walls.

**END OF SECTION**

## SECTION 03 3000

### CAST IN PLACE CONCRETE

#### PART 1 - GENERAL

##### 1.1 WORK INCLUDED

- A. This section covers cast-in-place concrete including finishing, surface repair and curing.

##### 1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Concrete Forming and Accessories - Section 03 1000  
B. Concrete Reinforcement - Section 03 2000  
C. Under Slab Vapor Retarder – Section 07 2600

##### 1.3 QUALITY ASSURANCE

- A. Reference Standards: Meet the requirements of the following codes, specifications and standards.
1. American Concrete Institute (ACI) Publications, latest versions;
    - a. ACI 301 Specifications for Structural Concrete for Buildings
    - b. ACI 306.1 Standard Specification for Cold Weather Concreting
    - c. ACI 318 Building Code Requirements for Structural Concrete.
  2. ASTM International (ASTM);
    - a. ASTM C 31/  
C31M Standard Practice for Making and Curing Concrete Test Specimens in the Field
    - b. ASTM C 33/  
C33M Standard Specification for Concrete Aggregates
    - c. ASTM C 39/  
C39M Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens
    - d. ASTM C 94/  
C 94M Standard Specification for Ready-Mixed Concrete
    - e. ASTM C 131 Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
    - f. ASTM C 136 Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates



g.	ASTM C 143 C 143M	Standard Test Method for Slump of Hydraulic Cement Concrete
h.	ASTM C 150/ C150M	Standard Specification for Portland Cement
i.	ASTM C 171	Standard Specification for Sheet Materials for Curing Concrete
j.	ASTM C 172/ C172M	Standard Practice for Sampling Freshly Mixed Concrete
k.	ASTM C 173/ C 173M	Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method
l.	ASTM C 231/ C231M	Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method
m.	ASTM C 260/ C260M	Standard Specification for Air Entraining Admixtures for Concrete
n.	ASTM C 309	Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete
o.	ASTM C 330/ 330M	Standard Specification for Lightweight Aggregates for Structural Concrete
p.	ASTM C 494/ C 494M	Standard Specification for Chemical Admixtures for Concrete
q.	ASTM C 567	Standard Test Method for Determining Density of Structural Lightweight Concrete
r.	ASTM C 618	Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete
s.	ASTM D 4318	Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils

B. Environmental Requirements: Manufacturer and Contractor shall conform to Federal, State, and Local V.O.C. (Volatile Organic Compound) Regulations in area where Project is located. Notify A/E in writing if variations to Specifications herein are required.

1. V.O.C. content shall be a maximum 250 (55) gm/liter, unless more stringent codes or laws apply.

#### 1.4 SUBMITTALS

A. Product Data: Submit manufacturer's product data with application and installation instructions for proprietary materials and admixtures.

- B. Concrete Mix Design:
  - 1. Submit mix design in accordance with ACI-301, Section 4.
  - 2. Submit with mix design results of laboratory tests performed within previous 12 months indicating aggregates from the proposed source comply with the requirements of ASTM C 33 or C 330 as applicable.
  - 3. Submit the proposed area of use for each mix design submitted (footings, stemwalls, slabs, walls, columns, etc.).
- C. Granular Base Course: Submit gradation, plasticity index, and wear information.
- D. Test Reports: Submit copies of test reports for concrete compressive strength, air content, temperature and slump. Submit copies of granular base course test reports.

## **1.5 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.  
Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."
- B. Environmental Requirements: Manufacturer and Contractor shall conform to Federal, State, and Local V.O.C. (Volatile Organic Compound) Regulations in area where Project is located. Notify A/E in writing if variations to Specifications herein are required.
  - 1. V.O.C. content shall be a maximum 250 (55) gm/liter, unless more stringent codes or laws apply.

## **PART 2 - PRODUCTS**

### **2.1 MATERIALS**

- A. Portland Cement: ASTM C 150, Type I or II, low alkali. Use one brand of cement throughout project.
- B. Normal Weight Aggregates: ASTM C 33. Provide aggregates from a single source for exposed concrete.
- C. Water: Potable.
- D. Air-Entraining Admixture: ASTM C 260.
- E. Water Reducing Admixture: ASTM C 494.
- F. Fly-Ash: ASTM C 618, Class C.
- G. Concrete Admixture: Concure Systems Admixture for waterproofing in all concrete for slabs-on-grade and elevated slabs to receive floor finishes.
- H. Crystalline Waterproofing Admixture: By Xypex, BASF or W.R. Meadows

- I. Moisture-Retaining Cover: Provide waterproof paper, polyethylene film, or polyethylene-coated burlap meeting the requirements of ASTM C 171.
- J. Liquid Membrane-Forming Curing Compound: Liquid type membrane-forming curing compound meeting the requirements of ASTM C 309; Type 1-D with fugitive dye for interior concrete and foundations; Type 2, white pigmented, for exposed exterior concrete except exposed exterior Architectural concrete, use Type 1-D.  
  
Curing compound shall NOT be used on interior slabs, except exposed integrally colored concrete slabs. Curing compound to be used on integrally colored concrete slabs shall be approved by the manufacturer of the color.
- K. Vapor Retarder shall comply with Section 07 26 00 of these Specifications.
- L. Granular base shall meet the following grading requirements when tested in accordance with ASTM C 136.  
  
Granular base shall meet the gradation and material properties requirements as listed in the General Structural Notes.  
  
The plasticity Index shall be no greater than 3 when tested in accordance with ASTM D 4318. The coarse aggregate shall have a percent wear of 50 or less when tested in accordance with ASTM C 131.

## **2.2 PROPORTIONING AND DESIGN OF MIXES**

- A. Prepare design mixes for each type and strength of concrete by either laboratory trial mixture or field experience methods as specified in ACI 301, Section 4. If trial mixture method is used, employ an independent testing facility, acceptable to Architect, for preparing and reporting proposed mix designs.
- B. Submit written reports to Architect, or Engineer, of each proposed mix for each class of concrete at least 15 days prior to start of work. Do not begin concrete production until mixes have been approved.
- C. Refer to the General Structural Notes for concrete strengths.
- D. Slabs-on-ground or on vapor retarder shall have a water/total cementitious ratio not to exceed 0.45.
- E. Admixtures
  - 1. Use water reducing admixture conforming to ASTM C 494, Type A, in all concrete unless approved otherwise by the Structural Engineer.
  - 2. All other admixtures shall have the written approval of the Architect or Structural Engineer.
  - 3. Calcium chloride is not permitted.
  - 4. All admixtures, except high range water reducers, shall be added to the concrete at the batch plant.
  - 5. Use Concure Systems Admixture for waterproofing in all interior concrete for slabs-on-grade and interior elevated slabs to receive floor finishes.

6. Use crystalline waterproofing admixture in all exterior exposed concrete for balcony slabs.

## **PART 3 - EXECUTION**

### **3.1 COORDINATION**

- A. Coordinate the installation of joint materials and moisture barriers with placement of forms and reinforcing steel. Set screeds accurately. Embedded items shall be accurately aligned and adequately supported. Verify installation of mechanical, plumbing, and electrical items to be embedded in concrete. Correct any unsatisfactory condition before proceeding further.

### **3.2 PREPARATION**

- A. Before placing concrete, clean and roughen surface of previously placed concrete. Clean reinforcing steel. Remove debris, providing clean-outs at bottom of forms when necessary. Moisten surfaces to receive concrete unless otherwise prepared. Remove excess water before placing concrete.

### **3.3 CONCRETE PLACEMENT**

- A. General: Comply with ACI 301.
- B. Place concrete continuously in layers not deeper than 24 inches. Concrete shall not be placed against concrete which has hardened sufficiently to cause the formation of seams or planes of weakness. If a section cannot be placed continuously, provide construction joints. Deposit concrete as nearly as practicable to its final location to avoid segregation. Do not use vibrators to transport concrete.
- C. Maintain reinforcing in proper position during concrete placement operations.
- D. Consolidate concrete, immediately after placing, by mechanical vibrating equipment supplemented by hand-spading, rodding or tamping. Use equipment and procedures for consolidation of concrete in accordance with ACI recommended practices.
- E. Bring slab surfaces to correct level with straightedge and strikeoff. Use bull floats or darbies to smooth surface. Do not disturb slab surfaces prior to beginning finishing operations.
- F. Cold Weather Concreting: Protect concrete work from physical damage or reduced strength caused by frost, freezing or low temperatures. Comply with ACI 306.1.
- G. Hot Weather Concreting: When hot weather conditions exist that would impair quality and strength of concrete, reduce delivery time of ready mix concrete, lower the temperature of materials, or add retarder to ensure that the concrete is plastic. Retempering with water is not allowed. Comply with ACI 305R.

### **3.4 FINISH OF FORMED SURFACES**

- A. Rough Form Finish: Provide where formed concrete surfaces are not exposed to view. Tie holes and surface imperfections shall be repaired and patched and fins and other projections exceeding ¼ inch in height rubbed down or chipped off.

### **3.5 FINISH OF HORIZONTAL SURFACES**

- A. At tops of foundation walls and grade beams finish with a texture matching adjacent formed surfaces unless otherwise indicated.

### **3.6 SLAB FINISHES**

- A. Float Finish: Begin floating when surface water has disappeared and when concrete has stiffened sufficiently to permit operation of power-driven or hand floats. Consolidate surface with power-driven floats, or by hand-floating if area is small or inaccessible to power units. Check and level surface plane to a tolerance not exceeding 1/4 inch in 10 feet when tested with a 10 foot straightedge.
- B. Scratch Finish: Apply scratch finish to slab surfaces that are to receive floor topping. Roughen surface before final set, using stiff brushes, or brooms.
- C. Trowel Finish: Apply trowel finish to all slab surfaces unless noted otherwise. After floating, begin first trowel finish using a power-driven or hand trowel. Finish concrete surface by a final hand-trowel operation, free of trowel marks, and uniform in texture and appearance. The final surface finish for slabs-on-grade shall have a minimum FF = 25 and a minimum FL = 20 per ACI requirements. The final surface finish for elevated slabs shall have a minimum FF = 25. Verify with Architectural requirements.
- D. Broom Finish: Apply on exterior slabs, ramps, steps, and sidewalks. Immediately after concrete has received a float finish, draw a broom or burlap belt across the surface to give a coarse transverse scored texture.

### **3.7 CONCRETE CURING AND PROTECTION**

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Start initial curing as soon as free water has disappeared from concrete surface after placing and finishing. Continue curing for at least 7 days.
- B. Moisture-retaining Cover curing: All interior concrete slabs, except exposed integrally colored concrete slabs, are to be cured with a moisture retaining cover for the first 7 days. After that time, the cover shall be removed and the slab should be allowed to dry. Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width with sides and ends lapped at least 3 inches and sealed. Repair any holes or tears in cover during curing period.
- C. Curing compound: At contractor's option, exterior concrete slabs may be cured using curing compound. All vertical concrete (walls, beams, etc...) shall be cured using curing compound – apply compound to the vertical surface as soon as the forms are removed. Apply curing compound uniformly in accordance with the manufacturer's printed instructions. Curing compound shall NOT be used on interior slabs, except exposed integrally colored concrete slabs.
- D. Exposed integrally colored concrete slabs: Use curing compound recommended by the concrete supplier. Apply with and airless sprayer.

### **3.8 CONCRETE SURFACE REPAIRS**

- A. Patching Surface Imperfections: Remove loose material and patch surface imperfections and holes left by tie rods with cement mortar. Surface imperfections include honeycomb, excessive air voids, sand streaking and cracks.

### **3.9 FOR EXPOSED-TO-VIEW SURFACES**

- A. Blend white portland cement and standard portland cement so that, when dry, patching mortar will match color surrounding. Provide test areas at inconspicuous location to verify mixture and color match before proceeding with patching. Compact mortar in place and strike-off slightly higher than surrounding surface.

### **3.10 FIELD QUALITY CONTROL**

- A. The Owner shall employ the services of a qualified testing laboratory to perform tests and submit test reports.
- B. Sampling Fresh Concrete: ASTM C 172.
- C. Slump: ASTM C 143; one test for each set of compressive strength test specimens.
- D. Air Content: ASTM C 173 or C 231 for each set of compressive strength test specimens.
- E. Concrete Temperature: Test hourly when air temperature is 40 degrees F. and below, when 80 degrees F and above; and when compression test specimens are made.
- F. Compression Test Specimen: ASTM C 31, one set of 4 standard cylinders for each compressive strength test, unless otherwise directed. Mold and store cylinders for laboratory cured test specimens except when field cure test specimens are required. Mold one set of standard cylinders for volume of concrete specified below or fraction thereof.
  - 1. At least once a day
  - 2. At least once for each 150 cubic yds
  - 3. At least once for each 5000 square feet of surface area for slabs or walls. (This amounts to 61 cubic yards for a 4 inch slab, 77 cubic yards for a 5 inch slab and 124 cubic yards for an 8 inch wall.)
- G. Compressive Strength Tests: ASTM C 39; test 1 specimen at 7 days, 2 specimens at 28 days, and retain one specimen in reserve for later testing. Additional Tests: The testing laboratory will make additional tests of in-place concrete when test results indicate specified concrete strengths and other characteristics have not been attained in the structure as directed by the Architect. The testing laboratory may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42 or by other methods as directed by the Architect or Engineer. The Owner shall pay for such tests conducted, and any other additional testing as may be required, when unacceptable concrete is verified.
- H. Granular Base Course: ASTM C 136 and ASTM D 4318 for every 500 square yards of building slab area.

**END OF SECTION**

## SECTION 04 2200

### REINFORCED UNIT MASONRY

#### PART 1 - GENERAL

##### 1.1 WORK INCLUDED

- A. This section includes the construction of reinforced hollow core unit masonry, masonry veneer and special shapes. It includes all split face units and smooth face units, as well as masonry mortar and grout.

##### 1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Concrete Reinforcement - Section 03 2000
- B. Division 07 Section "Water Repellents" for water repellents applied to unit masonry assemblies.
- C. Division 07 Section "Sheet Metal Flashing and Trim" for exposed sheet metal flashing.
- D. Division 07 Section "Fire stopping" for fire stopping at tops of masonry walls and at openings in masonry walls.
- E. Division 08 Section "Louvers and Vents" for wall vents (brick vents).
- F. Products furnished, but not installed, under this Section include the following:
  - 1. Anchor sections of adjustable masonry anchors for connecting to structural frame, installed under Division 05 Section "Structural Steel" and Division 13 Section "Metal Building Systems".
- G. Products installed, but not furnished, under this Section include the following:
  - 1. Cast-stone trim, furnished under Division 04 Section "Cast Stone".
  - 2. Steel lintels for unit masonry, furnished under Division 05 Section "Metal Fabrications".
  - 3. Manufactured reglets in masonry joints for metal flashing, furnished under Division 07 Section "Sheet Metal Fabrications".
  - 4. Hollow-metal frames in unit masonry openings, furnished under Division 08 Section "Steel Doors and Frames".

##### 1.3 QUALITY ASSURANCE

- A. Reference Standards
  - 1. ASTM International (ASTM), latest versions.
    - a. ASTM A 615/  
A615M      Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
    - b. ASTM C 90      Standard Specification for Load bearing Concrete Masonry Units

- c.      ASTM C 780                      Standard Test Methods for Preconstruction and Construction Evaluation of Mortars for Plain and reinforced Masonry
- d.      ASTM C 270                      Standard Specification for Mortar for Unit Masonry
- e.      ASTM C 476                      Standard Specification for Grout for Masonry
- f.      ASTM C 1019                      Standard Test Method for Sampling and Testing Grout
- 2.      American Concrete Institute (ACI), latest version.
  - a.      ACI 530.1                      Specification for Masonry Structures

#### **1.4 SUBMITTALS**

- A.      Product Data: Submit sample of exposed masonry unit of each color and texture to be used to complete the work. Submit copies of test reports performed within last 12 months for representative specimens to be used in accordance with ASTM C 140 for strength, absorption and moisture content, and ASTM C 426 for drying shrinkage.
- B.      Test Reports: Submit copies of test reports for masonry units, mortar and grout.

#### **1.5 PRODUCT DELIVERY, STORAGE, AND HANDLING**

- A.      Store masonry units above ground on level platforms, which allows air circulation under stacked units.
- B.      Cover and protect against wetting prior to use.
- C.      Handle units on pallets or flat bed barrows.
- D.      Store cementitious ingredients in weather-tight enclosures.
- E.      Waste Management and Disposal: As specified in Division 01 Section "Construction Waste Management" and as follows:
  - 1.      Separate and recycle waste materials in accordance with the Waste Management Plan and to the maximum extent economically feasible.
    - a.      Fold up metal banding; flatten and place in designated area for recycling.
    - b.      Collect wood packing shims and pallets; place in designated area.
  - 2.      Recycling: Undamaged, excess masonry materials are Contractor's property and shall be removed from the Project site for his use.
  - 3.      Disposal as Fill Material: Dispose of clean masonry waste, including broken masonry units, waste mortar, and excess or soil contaminated sand, by crushing and mixing with fill material as fill is placed.
    - a.      Crush masonry waste to less than 2 inches in greatest dimension.



- b. Mix masonry waste with at least 2 parts specified fill material for each part masonry waste. Fill material is specified in Division 31 Section "Earth Moving".
  - c. Do not dispose of masonry waste as fill within 18 inches of finished grade.
- 4. Excess Masonry Waste: Remove excess, clean masonry waste that cannot be used as fill, as described above, and other masonry waste and legally dispose of off Owner's property.

## **PART 2 - PRODUCTS**

### **2.1 MATERIALS**

- A. Hollow Core Split Faced Scored Units: ASTM C 90, see architectural drawings for locations.
- B. Hollow Core Units: ASTM C90.
- C. Burnished, see architectural drawings for locations.
- D. Aggregate: Scoria, natural color at exposed block.
- E. Aggregate: Natural color at concealed block.
- F. Mortar: ASTM C 270 "Standard Specification for Mortar for Unit Masonry," Type S, f'c = 1800psi.
- G. Grout: ASTM C 476 "Standard Specification for Grout for Masonry."
- H. Cell Reinforcing: ASTM A 615 "Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement," Grade 60. Comply with Section 03 20 00.
- I. Bond Beam and Lintel Reinforcing: ASTM A 615, Grade 60. Comply with Section 03 20 00.
- J. Joint Reinforcing: Hot Dipped Galvanized, Standard Ladder Type 9 Gage Wire Dur-O-Wal or approved equal.
- K. Control Joint Material: Rubber, neoprene or PVC joint material for use with standard sash block by Dur-O-Wal or approved equal.
- L. Vertical Bar Positioner: Steel by Dur-O-Wal or approved equal.
- M. Mortar Plasticizer: Easy Spread by American Colloid Company or approved equal.

## **PART 3 - EXECUTION**

### **3.1 GENERAL**

- A. Provide jamb, header, lintel, bond beam, etc. units as required to complete the work. Lay only dry and unfrozen masonry units.
- B. All exposed masonry shall be scoria aggregate, split face, scored finish unless noted otherwise on the drawings. Masonry not exposed to view may be smooth finished.

- C. Discard any broken, chipped, or discolored masonry units.
- D. Use masonry saws to cut and fit masonry units.
- E. Lay units in running bond pattern with vertical joints located at center of masonry units in alternate course below.
- F. Set units plumb, true to line and with level courses accurately spaced.
- G. Adjust masonry unit to final position while mortar is soft and plastic.
- H. Anchors, flashing accessories and similar devices shall be built in as masonry progresses.

### **3.2 MORTAR**

- A. Mix all cementitious materials and sand in a mechanical batch mixer for a minimum of 5 minutes. Adjust the consistency of the mortar to the satisfaction of the mason, but add only as much water as is compatible with convenience in using the mortar. If the mortar begins to stiffen from evaporation or from absorption of a pat if the mixing water, re-temper the mortar immediately by adding water, and remix the mortar.
- B. Mortar for exterior walls shall have waterproofing added in accordance with the manufacturer's recommendations.
- C. Addition of admixtures or re-tempering of mortar at the mixer to extend its use will not be permitted.

### **3.3 RE-TEMPERING**

- A. All mortar shall be used within 2-1/2 hours of initial mixing and no mortar shall be used after it has begun to set. Re-tempering of mortar in which setting has saturated will not be permitted. However, mortar shall be re-tempered, except as above qualified, as necessary to keep it plastic.

### **3.4 JOINTS**

- A. Provide joints 3/8 inch nominal thickness and tooled unless shown otherwise on drawings.
- B. Construct uniform joints.
- C. Units shall be placed with sufficient pressure to extrude mortar and provide a tight joint.

### **3.5 REINFORCEMENT**

- A. Reinforcement shall be secured against displacement prior to grouting at a spacing not greater than 4 feet.
- B. Provide rebar lap lengths specified in the General Structural Notes on the drawings. Provide 6 inches minimum lap for all ladder type joint reinforcing.

### **3.6 GROUTING**

- A. Grout all cells, which are below grade.
- B. Grout lintel blocks over masonry openings and each jamb of masonry openings.

- C. Grout pours shall not exceed 5 feet in height.
- D. Grout all cells solid, which contain reinforcing.

Grout shall have a slump range of 8 to 11 inches tested in accordance with ASTM C143.

Consolidate grout pours 12 inches or less in height by mechanical vibration or by puddling. Consolidate pours exceeding 12 inches in height by mechanical vibration and reconsolidate by mechanical vibration after initial water loss and settlement has occurred. Typically this occurs within 2-4 minutes of placement of grout.

Place grout within 1-1/2 hours from introducing water in the mixture and prior to initial set.

### **3.7 POINTING AND CLEANING**

- A. At completion of unit masonry work, fill holes in joints and tool.
- B. Cut out and repoint defective joints.
- C. Dry brush masonry surface after mortar has set, at end of each day's work and after final pointing.
- D. Leave work and surrounding surfaces clean and free of mortar spots and droppings.

### **3.8 PROTECTION OF WORK**

- A. Protect sills, ledges, and offsets from mortar drippings or other damage during construction.
- B. Remove misplaced mortar or grout immediately.
- C. Cover top of walls with non-staining waterproof coverings when work is not in progress.
- D. Provide adequate bracing during construction to prevent damage from wind loads.

### **3.9 WEATHER CONDITIONS**

- A. Do not place concrete masonry units when air temperature is below 20 degrees F.
- B. For temperatures between 20 degrees F and 40 degrees F, sand and mixing water shall be heated to produce mortar temperatures between 40 degrees F and 120 degrees F. Mortar shall be maintained above 32 degrees F during placement.
- C. Masonry shall be protected from freezing for 24 hours after placement.

### **3.10 FIELD QUALITY CONTROL**

- A. The Owner shall employ the services of a qualified testing laboratory to perform tests and submit test reports.
- B. Concrete Masonry Units (CMU): Test in accordance with ASTM C 140. "Standard Test Methods of Sampling and Testing Concrete Masonry Units." Six units shall be sampled and tested for each lot of 10,000 units or less delivered to the job site. Twelve units shall be sampled from each lot of more than 10,000 units and less than 100,000 units.

- C. Mortar: By proportions according to ASTM C 780 "Standard Test Method for Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Masonry."
- D. Grout: Mold and test 4 test specimens in accordance with ASTM C 1019 "Test Method for Sampling and Testing Grout" from each day's grout placement. Test grout slump prior to each day's grouting process. Submit slump value with test specimen results. See General Structural Notes for required strength.

**END OF SECTION**

**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

- 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  $F_y=35$  ksi
- D. Rectangular or Square Hollow Structural Section: ASTM A 500, Grade B,  $F_y = 46$  ksi.
- E. Round Hollow Structural Sections: ASTM A 500, Grade B,  $F_y=42$  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 lightgauge framing. Submit shop drawings for all prefabricated lightgauge 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**

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**COLD FORMED METAL FRAMING**



## 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                      Standard Specification for Steel Castings, Carbon, for General Application
    - b. ASTM A 36/                      Standard Specification for Carbon-Structural Steel
    - c. ASTM A 47/                      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  $\frac{3}{4}$  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  $\frac{1}{32}$  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<sup>2</sup>) 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<sup>2</sup>) 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 07 1352**

### **MODIFIED BITUMINOUS SHEET WATERPROOFING**

#### **PART 1 - GENERAL**

##### **1.1 SUMMARY**

- A. Section Includes: Modified bituminous sheet waterproofing system and supplementary items necessary for installation at the following applications:
  - 1. Vertical positive side applications at foundation walls.
  - 2. Horizontal positive side applications at above grade split slabs.
  - 3. Horizontal positive side applications at earth covered horizontal decks.

##### **1.2 ACTION SUBMITTALS**

- A. Product Data: Manufacturer's technical literature for each product or system indicated.
  - 1. Include manufacturer's specifications for materials and installation instructions.
  - 2. Include manufacturer's written instructions for evaluating, preparing, and treating substrate.
- 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. Include in shop drawings substrate joint and crack treatments, waterproofing applications, flashings, penetrations, inside and outside corners, tie-ins with adjoining waterproofing, and other termination conditions.

##### **1.3 INFORMATIONAL SUBMITTALS**

- A. Manufacturer's Project Acceptance Document: Certification by the manufacturer that its product(s) are approved, acceptable, suitable for use in specific locations, for specific details, and for applications indicated, specified, or required, and that a warranty will be issued.
- B. Product Test Reports: Written reports based on evaluation of comprehensive tests performed by qualified testing agency indicating that each product complies with requirements.
- C. Field Quality Control Reports: Written report of testing and inspection required by "Field Quality Control".
- D. Pre-Construction Test Report: Written reports of manufacturer's testing required by "Quality Assurance" Article.
- E. Qualification Data:
  - 1. For firms and persons specified in "Quality Assurance" to demonstrate their capabilities and experience. Include list of completed projects.
- F. Warranty: Sample of warranty.

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

#### **1.4 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.
- C. Mock-Ups: Before beginning Work of this Section, install minimum 100 sf (9.3 sm) of waterproofing system using materials indicated for the completed Work; incorporating substrate construction, sealing at penetrations, and seaming to demonstrate installation of system. Acceptance of mock-ups does not constitute acceptance of deviations from the Contract Documents contained in mock-ups unless such deviations are specifically accepted by Architect in writing. Apply mock-ups to set quality standards for materials and execution.
  1. Demonstrate surface preparation, crack, joint, and corner treatments.
  2. If Architect determines mock-up does not comply with requirements, reconstruct mock-ups until accepted.
  3. Accepted mock-ups may become part of completed Work if undisturbed at time of Substantial Completion.
- D. Pre-Construction Subsoil Water Testing:
  1. General Requirements: Test subsoil water for compatibility with waterproofing materials.
  2. Test Method: Use manufacturer's standard test method to test for acids, alkalis, brine, or other contaminants that may inhibit performance of waterproofing materials.
  3. Specimen Quantity: Obtain and submit as many subsoil water samples required from Project at approximate locations where waterproofing will be installed.
  4. Reports: Interpret test results and certify reports indicating requirements for use of waterproofing materials and for corrective measures necessary.

#### **1.5 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.

#### **1.6 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver liquid materials to Project site in original packages with seals unbroken, labeled with manufacturer's name, product brand name and type, date of manufacture, and directions for storing and mixing with other components.
- B. Store liquid materials in their original undamaged packages in a clean, dry, protected location and within temperature range required by waterproofing manufacturer.
- C. Remove and replace liquid materials that cannot be applied within their stated shelf life.
- D. Store rolls according to manufacturer's written instructions.
- E. Protect stored materials from direct sunlight.

#### **1.7 PROJECT CONDITIONS**

- A. Environmental Limitations: Apply waterproofing within the range of ambient and substrate temperatures recommended by manufacturer. Do not apply waterproofing to a damp or wet substrate or during high humidity conditions including snow, rain, fog, or mist.

#### **1.8 COORDINATION**

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

#### **1.9 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. Warranty Period: Manufacturer shall warrant the products to be free from material and labor Defects for a period of 10 years form date of Substantial Completion.
  2. Include Work provided under Division 07 Section "Pre-Applied Sheet Waterproofing" in

warranty.

- B. Installer's Warranty: Furnish installer's written workmanship warranty signed by an authorized representative using installer's standard form agreeing to provide labor required to repair or replace work which exhibits workmanship defects. "Defects" is defined to include but not limited to deterioration or failure to perform as required.
  - 1. Warranty Period: Installer shall warrant the installation to be free from workmanship Defects for a period of 2 years from date of Substantial Completion.

## **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".

### **2.2 MATERIALS, GENERAL**

- A. Single Source Responsibility: Furnish each type of product from single manufacturer. Provide secondary materials only as recommended by manufacturer of primary materials.

### **2.3 PERFORMANCE REQUIREMENTS**

- A. General: Provide modified bituminous sheet waterproofing that prevents the passage of liquid water and complies with the following minimum physical requirements as demonstrated by testing performed by an independent testing agency of manufacturer's current waterproofing membrane formulations.
  - 1. Tensile Strength: 250 psi (1.7 MPa) according to ASTM D 412, Die C, modified.
  - 2. Ultimate Elongation: 300 percent minimum according to ASTM D 412, Die C, modified.
  - 3. Low-Temperature Flexibility: Pass at minus 20 deg F (minus 29 deg C) according to ASTM D 1970.
  - 4. Crack Cycling: Unaffected after 100 cycles of 1/8 in (3 mm) movement according to ASTM C 836.
  - 5. Puncture Resistance: 40 lbf (180 N) minimum according to ASTM E 154.
  - 6. Hydrostatic-Head Resistance: 150 ft (45 m) minimum according to ASTM D 5385.
  - 7. Water Absorption: 0.15 percent weight-gain maximum after 48-hour immersion at 70 deg F (21 deg C) according to ASTM D 570.
  - 8. Vapor Permeance: 0.05 perms (2.9 ng/Pa x s x sq. m) according to ASTM E 96, Water Method.
- B. Material Compatibility: Provide waterproofing materials that are compatible with one another under conditions of service and application required, as demonstrated by manufacturer based on testing and field experience.

## **2.4 MODIFIED BITUMINOUS SHEET WATERPROOFING MATERIALS**

- A. Modified Bituminous Sheet Waterproofing: 60 mils (1.5 mm) thick, self-adhering sheet consisting of 56 mils (1.4 mm) of rubberized asphalt laminated to a 4 mils (0.10 mm) thick, polyethylene film with release liner on adhesive side.

1. Manufacturers and Products:

- a. American Hydrotech, Inc.; VM60.
- b. Carlisle Coatings & Waterproofing Inc.; CCW MiraDRI 860/861.
- c. CETCO Building Materials Group; Envirosheet.
- d. Grace Construction Products; Bituthene 3000.
- e. Henry Company; Blueskin WP 200.
- f. Meadows, W. R., Inc.; Mel-Rol.
- g. Polyguard Products, Inc.; Polyguard 650.
- h. Sika Corporation; SikaBit S-60.
- i. Tamko Roofing Products, Inc.; TW-60.

2. Manufacturers and Products:

- a. CETCO Building Materials Group; Envirosheet.
- b. Grace Construction Products; Bituthene 3000.
- c. Sika Corporation; SikaBit S-60.

## **2.5 ACCESSORY MATERIALS**

- A. General: Furnish accessory materials recommended by waterproofing system manufacturer for intended use and compatible with waterproofing.
- B. Primer: Liquid primer suitable for substrate provided by waterproofing manufacturer.
- C. Surface Conditioner: Liquid surface conditioner suitable for substrate provided by waterproofing manufacturer.
- D. Liquid Membrane: Elastomeric, two-component liquid, cold fluid applied, trowel grade or low viscosity provided by waterproofing manufacturer.
- E. Substrate Patching Membrane: Low-viscosity, two-component, asphalt-modified coating provided by waterproofing manufacturer.
- F. Sheet Strips: Self-adhering, rubberized-asphalt sheet strips of same material and thickness as sheet waterproofing provided by waterproofing manufacturer.
- G. Mastic and Adhesives: Liquid mastic and adhesives provided by waterproofing manufacturer.
- H. Termination Bars: ASTM A 666, Type 304 formed stainless steel bars; 2 types, one flat and one flat with upper flange shaped to receive sealant, locations as indicated; 1 in by 1/8 in (25 mm by 3 mm) thick; predrilled at 8 in (200 mm) centers; with stainless steel fasteners. No aluminum or plastic bars allowed.

## **2.6 BOARD INSULATION**

- A. Extruded Polystyrene Board Insulation: As specified in Division 07 Section "Thermal

Insulation".

## **2.7 MOLDED-SHEET DRAINAGE PANELS**

### **A. Molded-Sheet Drainage Panels; Vertical Applications:**

1. Description: Pre-fabricated composite with drainage core faced with geotextile filter fabric on dimpled side (facing earth) and protective covering on flat side (facing waterproofing).
2. Protective Covering: Smooth polymeric film.
3. Drainage Core: Three-dimensional, non-biodegradable, molded polypropylene or polystyrene.
  - a. Minimum Compressive Strength: 15,000 lbf/sf (718 kPa) according to ASTM D 1621.
  - b. Minimum In-Plane Flow Rate: 15 gpm/ft (188 L/min per m) of unit width at hydraulic gradient of 1.0 and compressive stress of 25 psig (172 kPa) according to ASTM D 4716.
4. Geotextile Filter Fabric: Non-woven needle-punched geotextile, manufactured for subsurface drainage, made from polypropylene, polyolefin, or polyester; complying with following properties according to AASHTO M 288:
  - a. Survivability: Class 2.
  - b. Permittivity: 0.1 per second, minimum.
5. Manufacturers and Products:
  - a. American Hydrotech; Hydrodrain 420.
  - b. American Wick Drain Corporation; AmeriDrain 520.
  - c. Carlisle Coatings & Waterproofings; CCW MiraDRAIN 6200.
  - d. Grace Construction Products; Hydroduct 220.
  - e. Henry Company; DB 520.
  - f. JDR Enterprises, Inc.; J-Drain 420.
  - g. Polyguard Products, Inc.; Flow 15P.
  - h. Sika Corporation; SikaDrainage Mat 420.
  - i. Tremco Commercial Sealants & Waterproofing; TREMDrain 1000.

### **B. Molded-Sheet Drainage Panels; Horizontal Applications (as indicated below):**

1. Location:
  - a. Horizontal positive side applications at above grade split slabs.
  - b. Horizontal positive side applications at earth covered horizontal decks.
2. Description: Pre-fabricated composite with drainage core faced with geotextile filter fabric on dimpled side (facing earth) and protective covering on flat side (facing waterproofing).
3. Protective Covering: Smooth polymeric film.
4. Drainage Core: Three-dimensional, non-biodegradable, molded polypropylene or polystyrene.

- a. Minimum Compressive Strength: 18,000 lbf/sf (862 kPa) according to ASTM D 1621.
  - b. Minimum In-Plane Flow Rate: 18 gpm/ft (225 L/min per m) of unit width at hydraulic gradient of 1.0 and compressive stress of 25 psig (172 kPa) according to ASTM D 4716.
- 5. Filter Fabric: Non-woven needle-punched geotextile, manufactured for subsurface drainage, made from polypropylene, polyolefin, or polyester; complying with following properties according to AASHTO M 288:
  - a. Survivability: Class 2.
  - b. Permittivity: 0.1 per second, minimum.
- 6. Available Manufacturers and Products:
  - a. American Hydrotech, Inc.; Hydrodrain 700.
  - b. American Wick Drain Corporation; AmeriDrain 654.
  - c. Carlisle Coatings & Waterproofings; CCW MiraDRAIN 9800.
  - d. Grace Construction Products; Hydroduct 660.
  - e. Henry Company; DB 650n with G100s/s base/protection sheet.
  - f. Polyguard Products, Inc.; Flow 18-H.
  - g. Sika Corporation; SikaDrainage Mat 700.
  - h. Tremco Commercial Sealants & Waterproofing; TREMDrain 2000.
- A. Adhesive for Bonding Drainage Panels: Product compatible with drainage panels being bonded and with demonstrated capability to bond securely to substrates indicated without damaging substrates.
- B. Miscellaneous Accessories: As required by manufacturer for complete installation assembly, including flanges around piping penetrations and expanded base and tie-in fittings as necessary to coordination with foundation drainage system.
- C. Foundation Drainage System: As specified in Division 33 Section "Foundation Drainage System".

## **PART 2 - EXECUTION**

### **2.1 EXAMINATION**

- A. Acceptance of Surfaces and Conditions: Examine substrates 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.

### **2.2 INSTALLATION, GENERAL**

- A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:
  - 1. ASTM D 6135.
  - 2. Respective manufacturer's written installation instructions.

3. Accepted submittals.
4. Contract Documents.

## 2.3 PREPARATION

- A. General: Comply with manufacturer's instructions, recommendations and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.
- B. Excavation Dewatering: Verify that the waterproofing application area is dry and free of standing and uncontrolled water. Should the dewatering system fail at any time during application of waterproofing system, the materials shall be completely removed and work shall start over with new materials once the area is dry and free of water again.
- C. Concrete Surfaces:
  1. Verify concrete has cured and aged for minimum time period recommended by waterproofing manufacturer.
  2. Verify that substrate is visibly dry and within the moisture limits recommended in writing by manufacturer. Test for capillary moisture by plastic sheet method according to ASTM D 4263.
  3. Remove fins, ridges, mortar, and other projections.
  4. Verify honeycomb voids, rock pockets, form tie holes, and other defects are filled by other Division 03 Sections.
  5. Remove dust and dirt from joints and cracks according to ASTM D 4258.
  6. Remove debris, oily substances, mud, grease, oil, bitumen, form-release agents, paints, curing compounds, penetrating contaminants or film-forming coatings from concrete, and similar substances.

## 2.4 MODIFIED BITUMINOUS SHEET WATERPROOFING INSTALLATION

- A. General Installation Performance Requirements: Install waterproofing system to prevent passage of liquid water under hydrostatic pressure.
- B. Joint and Crack Treatment: Prepare, treat, rout, and fill joints and cracks in substrate.
- C. Primer: Apply to substrates at required rate and allow to dry. Limit priming to areas that will be covered by waterproofing in same day. Reprime areas exposed for more than 24 hours.
- D. Waterproofing Tie-Ins: Install waterproofing and accessories to tie into adjacent waterproofing to ensure watertight installation.
- E. Termination and Penetration Treatment: Prepare vertical and horizontal surfaces at terminations and penetrations through waterproofing and at expansion joints, drains, and sleeves.
- F. Waterproofing Application: Apply and firmly adhere sheets over area to receive waterproofing.
  1. Accurately align sheets and maintain uniform 2-1/2 in (63 mm) minimum lap widths and end laps. Overlap and seal seams and stagger end laps to ensure watertight installation.

2. Treat inside and outside corners. Install sheet strips centered over vertical inside corners. Install 3/4 in (19 mm) fillets of liquid membrane on horizontal inside corners and as follows:
    - a. At footing-to-wall intersections, extend liquid membrane each direction from corner or install sheet strip centered over corner.
    - b. At deck-to-wall intersections, extend liquid membrane or sheet strips onto deck waterproofing and to finished height of sheet flashing.
  3. Apply sheets firmly without wrinkles, buckles or kinks.
  4. Apply sheets so that direction of flow of water is over and not against laps.
  5. Apply sheet strips under waterproofing membrane at, but not limited to, following locations:
    - a. Expansion joints.
    - b. Discontinuous deck-to-wall and deck-to-deck joints.
    - c. Under clamping ring at drains.
    - d. Wall angles and corners.
    - e. Substrate cracks.
    - f. Penetrations.
    - g. Isolation, construction and contraction joints.
    - h. Where waterproofing membrane may be subject to unusual strain.
  6. Apply liquid membrane fillet at interior corners under sheet strips.
  7. If not indicated otherwise, terminate top edges of sheets under metal counterflashings or with metal termination bars and sealants.
  8. Apply mastic or liquid membrane to vertical and horizontal terminations.
  9. Seal exposed edges of sheets at terminations not concealed by metal counterflashings or metal termination bars and sealants.
- G. Damaged Waterproofing: Repair waterproofing not complying with requirements and patch with sheet waterproofing patch extending 6 in (150 mm) beyond repaired areas in each direction, pressed or rolled in place, with edges sealed with mastic.
1. Patch tears, voids, misaligned or inadequately lapped seams.
  2. Slit fishmouths and blisters, overlap flaps, and patch.

## **2.5 BOARD INSULATION INSTALLATION**

- A. Extruded Polystyrene Board Insulation: As specified in Division 07 Section "Thermal Insulation".

## **2.6 MOLDED-SHEET DRAINAGE PANEL INSTALLATION**

- A. Installation: Place and secure molded-sheet drainage panels with adhesive, with geotextile filter fabric facing away from waterproofed surface. Lap edges and ends of geotextile filter fabric to maintain continuity. Protect installed drainage panels during subsequent construction.

## 2.7 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Manufacturer's qualified technical representative shall periodically inspect Work to ensure installation is proceeding in accordance with manufacturer'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. Testing Agency: The Owner may employ and pay a qualified independent testing agency to perform field quality control. Materials and installation failing to meet specified requirements shall be replaced at Contractor's expense. Retesting of materials and installations failing to meet specified requirements shall be done at Contractor's expense.
- C. Testing: Provide one of the following testing methods:
1. Flood Testing: Flood test each deck area for leaks, according to recommendations in ASTM D 5957, after completing waterproofing and flashing, but before overlaying construction is placed. Install temporary containment assemblies, plug or dam drains, and flood with potable water.
- a. Flood to an average depth of 2-1/2 in (65 mm) with a minimum depth of 1 in (25 mm) and not exceeding a depth of 4 in (100 mm). Maintain minimum of 2 in (50 mm) of clearance from top of base flashing.
- b. Flood each area for 24 hours.
- c. After flood testing, repair leaks, repeat flood tests, and make further repairs until waterproofing and flashing installation is watertight.
2. Electronic Water Testing, Electronic Field Vector Mapping (EFVM): Perform leak testing by an electronic detection process to verify entire waterproofing membrane is free of holes, open seams, and capillary defects that allow water to pass. Administer EFVM by a qualified testing agency as follows:
- a. Leak detection of horizontal waterproofing membrane shall be done prior to placement of protection board and remaining system components.
- 1) Place conductor wire on bare membrane. Secure wire with small strips of waterproofing or other compatible membrane or tape.
- 2) Thoroughly wet waterproofing membrane with potable water in area of test. Wetting can be accomplished by hand or mechanical spray devices. Membrane shall be wet during testing procedures.
- 3) Technician shall mark on waterproofing membrane or surface exact location of defect and assign an identification number to each location.
- 4) Visually inspect entire waterproofing membrane area and repair breaches found. An EFVM retest shall be performed to confirm integrity of repair(s).
- b. Technician shall prepare a report of each day's test results containing a written description and photograph of defect(s) located and a schematic CAD drawing indicating location of conductor wire and of defect(s) located in testing field to within 1 in (25 mm) of accuracy. This report shall be made available in hard copy.



- c. Report results of tests, both successful and unsuccessful. In addition to results, report shall include date of test, project name, list of products being applied and tested, name of applicator, name of Contractor, and conditions causing failure of waterproofing membrane in event of an unsuccessful test.
  - d. Materials and installations failing to meet specified requirements shall be replaced at Contractor's expense. Retesting of materials and installations failing to meet specified requirements shall be done at Contractor's expense.
- D. Correction of Deficiencies: Correct deficiencies in or remove waterproofing that does not comply with requirements, repair substrates, reapply waterproofing, and repair flashing.
  - 1. After tests, repair leaks and make further repairs until waterproofing installation is watertight.
- E. Final Inspection: Arrange for waterproofing system manufacturer's qualified technical representative to inspect waterproofing installation on completion of waterproofing membrane and flashing. Notify Architect and Owner 48 hours in advance of date and time of final inspection.

## **2.8 CLEANING AND PROTECTION**

- A. Protect waterproofing from damage and wear during remainder of construction period.
- B. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

### **END OF SECTION**

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Cherokee Nation  
Childers Architect  
2019-04-22**

**MODIFIED BITUMINOUS  
SHEET WATERPROOFING**

**07 1352 - 12**

**THERMAL INSULATION**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Section Includes: Thermal insulation products and systems and supplementary items necessary for installation.

**1.2 DEFINITIONS**

- A. Mineral Fiber: Insulation composed principally of fibers manufactured from rock, slag or glass, with or without binders.
- B. Mineral Wool: A synthetic vitreous fiber insulation made by melting predominantly igneous rock, and or furnace slag, and other inorganic material, and then physically forming the melt into fibers

**1.3 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.

**1.4 INFORMATIONAL SUBMITTALS**

- A. Qualification Data:
  - 1. For firms and persons specified in "Quality Assurance" to demonstrate their capabilities and experience. Include list of completed projects
- B. Manufacturer's Project Acceptance Document: Certification by the manufacturer that its product(s) are approved, acceptable, suitable for use in specific locations, for specific details, and for applications indicated, specified, or required.

**1.5 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.

## **1.6 DELIVERY, STORAGE, AND HANDLING**

- A. Protect insulation materials from physical damage and from deterioration by moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.
- B. Protect plastic insulation as follows:
  1. Do not expose to sunlight, except to extent necessary for period of installation and concealment.
  2. Protect against ignition at all times. Do not deliver plastic insulating materials to Project site before installation time.
  3. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

## **1.7 COORDINATION**

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

# **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 Conditions of the Contract and Division 01 Section "Substitution Procedures".
- B. 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.

## **2.2 MATERIALS, GENERAL**

- A. Single Source Responsibility: Furnish each type of product from single manufacturer. Provide secondary materials only as recommended by manufacturer of primary materials.
- B. General: Provide insulating materials that comply with requirements and referenced standards in sizes to fit applications indicated, selected from manufacturer's standard thicknesses, widths, and lengths.

## **2.3 PERFORMANCE REQUIREMENTS**

- A. Plenum Rating: Provide glass mineral fiber (fiberglass) insulation to be installed within ceiling plenums rated as follows for use in plenums as determined by testing identical products per "Erosion Test" and "Mold Growth and Humidity Test" described in UL 181, or by comparable tests from another standard acceptable to authorities having jurisdiction.
  - 1. Erosion Test Results: No visible evidence of cracking, flaking, peeling, or delamination of interior surface of duct assembly, after testing for 4 hours at 2500 fpm (13 m/s) air velocity.
  - 2. Mold Growth and Humidity Test Results: No evidence of mold growth, delamination, or other deterioration due to the effects of high humidity, after inoculation with Chaetomium globosum on all surfaces and storing for 60 days at 100 percent relative humidity in the dark.
- B. Fire-Test-Response Characteristics:
  - 1. Fire Resistance Ratings: Materials and construction identical to assemblies tested for fire resistance according to ASTM E 119/NFPA 251/UL 263 and included under Categories listed below that are published in Underwriters Laboratories, Inc. (UL) "Fire Resistance Directory"; or listing of another testing and inspecting agency acceptable to authorities having jurisdiction.
    - a. Polystyrene Insulation: Category CCVW.
    - b. Mineral Fiber Insulation: Category BZJZ
  - 2. Surface Burning Characteristics: Materials and construction identical to assemblies tested for fire resistance according to ASTM E 84/NFPA 255/UL 723 by an independent testing and inspecting agency acceptable to authorities having jurisdiction listed below. Identify products with appropriate markings of applicable testing agency.
  - 3. Fire Rated Assembly Design: Selected from Product Category BXUV published in UL's "Fire Resistance Directory", or design of other testing agency acceptable to authorities having jurisdiction.
  - 4. Combustion Characteristics: Materials and construction identical to assemblies tested for fire resistance according to ASTM E 136 by an independent testing and inspecting agency acceptable to authorities having jurisdiction

## **2.4 GLASS MINERAL FIBER (FIBERGLASS) BATT INSULATION**

- A. Unfaced Insulation:
  - 1. Description: ASTM C 665, Type I, ASTM C553, Type II. Unfaced blankets produced by bonding inorganic glass mineral fibers with a thermosetting binder; free of formaldehyde.
  - 2. Manufacturers and Products:

- a. CertainTeed Corporation; CertaPro Sustainable Insulation.
  - b. Johns Manville; Unfaced Batts for Metal Framing.
  - c. Knauf Insulation; EcoBatt with ECOSE Technology.
  - d. Owens-Corning; EcoTouch Thermal Batts for Metal Frame Construction.
- 3. Surface Burning Characteristics per ASTM E 84:
  - a. Flame spread: 25 or less.
  - b. Smoke developed: 50 or less.
- 4. Thickness: Full depth of metal stud cavity.

## **2.5 GLASS MINERAL FIBER (FIBERGLASS) SEMI-RIGID INSULATION**

- A. Description: ASTM C 612, Type IA or Types IA and IB. Unfaced, semi-rigid boards produced by bonding inorganic glass mineral fibers with a thermosetting binder.
- B. Manufacturers and Products:
  - 1. CertainTeed Corporation; CB-300.
  - 2. Johns Manville; Insul-SHIELD 300.
  - 3. Knauf Insulation; Insulation Board with Ecosse Technology; 3.00 PCF.
  - 4. Owens-Corning; 703.
- C. deg F (29.8 K x m/W at 24 deg C).
- D. Surface-Burning Characteristics per ASTM E 84:
  - 1. Flame spread: 25 or less.
  - 2. Smoke developed:
    - a. Exposed-to-View or Concealed Spaces other than Return Air Plenums: 450 or less.
    - b. Return Air Plenums: 50 or less.
- E. Thickness: As indicated but not less than 2 in (50 mm).
- F. Other-than-Cavity Wall Locations:
  - 1. Unfaced: ASTM C 612, Types IA and IB. Unfaced rock mineral wool board insulation.
    - a. Location: Typical unless noted to be foil-faced.
  - 2. Foil-Faced: ASTM C 612, Types IA and IB. Rock mineral wool board insulation faced with foil-scrim-kraft vapor-retarder membrane.
    - a. Location: Where indicated on drawings for non-fire-rated perimeter conditions and/or for spandrel insulation.
  - 3. Density: Nominal density of 4 lb/cu. ft. (64 kg/cu. m), thermal resistivity of 4 deg F x h x sq. ft./Btu x in. at 75 deg F (27.7 K x m/W at 24 deg C).
  - 4. Surface Burning Characteristics per ASTM E 84:
    - a. Flame spread: 25 or less.

- b. Smoke developed: 50 or less.
- 5. Thickness: As indicated on drawings but not less than required for an R-value of 19.
- 6. Fiber Color: Regular color, unless otherwise indicated.
- 7. Manufacturers:
  - a. Rock Wool Manufacturing Company.
  - b. Roxul, Inc.
  - c. Themafiber, Inc.

## **2.6 EXTRUDED POLYSTYRENE RIGID INSULATION**

- A. Description: Unfaced, rigid, cellular polystyrene thermal insulation formed from polystyrene base resin by an extrusion process, and with other requirements indicated in this Article.
  - 1. Surface Burning Characteristics per ASTM E 84:
    - a. Flame Spread: 25 or less.
    - b. Smoke Developed: 450 or less.
  - 2. Adhesive for Bonding Insulation: Product compatible with insulation being bonded and with demonstrated capability to bond insulation securely to substrates indicated without damaging insulation or substrates.
- B. Cavity Wall Locations:
  - 1. Product Quality Standard: ASTM C 578, Type IV, 25 psi minimum compressive strength.
  - 2. Size: 2 in (50 mm) thick by 16 in (400 mm) high by 96 in (2400 mm) long, square edges.
  - 3. R-Value: 10
  - 4. U-Value: 0.1
  - 5. Manufacturers and Products:
    - a. Dow Chemical Company; Styrofoam CavityMate Plus
    - b. Owens Corning; FOAMULAR CW25
    - c. Pactiv Building Products Division; GreenGuard Type IV 25.
- C. Other-than-Cavity Wall Locations:
  - 1. Product Quality Standard: ASTM C 578 of following type and minimum compressive strength for the following locations:
    - a. Slabs-on-Grade: Type VI, 40 psi (276 kPa).
    - b. Backfilled Walls: Type IV, 25 psi (173 kPa).
  - 2. Manufacturers and Products:
    - a. Type IV:
      - 1) DiversiFoam Products; CertiFoam 25.
      - 2) Dow Chemical Company; STYROFOAM Square Edge.
      - 3) Owens Corning; FOAMULAR 250.
      - 4) Pactiv Building Products Division; GreenGuard Type IV 25.

b. Type VI:

- 1) DiversiFoam Products; CertiFoam 40.
- 2) Dow Chemical Company; STYROFOAM Roofmate or Highload 40.
- 3) Owens Corning; FOAMULAR 400 or 404.

3. Thickness: As indicated but not less than 2 in (50 mm).

## **2.7 POLYISOCYANURATE RIGID INSULATION**

- A. Refer to Division 07 roofing section(s) for polyisocyanurate rigid insulation used as roofing insulation.

## **2.8 SPRAYED FOAM INSULATING GAP FILLER**

- A. As specified in Division 07 Section "Joint Sealants".

## **2.9 SPRAY-APPLIED THERMAL INSULATION**

- A. Spray-Applied Thermal Insulation:

1. Description: Glass mineral fiber insulation spray applied for thermal or acoustic applications.

- a. Thermal Resistance: ASTM C 518; R-Factor = 4 per 1 in (25 mm).
- b. Noise Reduction Coefficient: ISO 354; NRC 0.75 at 1 in (25 mm), 0.95 at 2 in (50 mm)

2. Surface Burning Characteristics:

- a. Flame spread: Class A; 25 or less.
- b. Smoke developed:

- 1) Exposed-to-View or Concealed Spaces other than Return Air Plenums: 450 or less.
- 2) Return Air Plenums: 50 or less.

3. Thickness: As indicated on drawings but not less than required for an R-value of 19.

4. Density: As required for application.

5. Manufacturer and Product: Monoglass Incorporated; Monoglass Spray-On Insulation, white color.

- B. Spray-Applied Protective Coating: Manufacturers' standard protective coating for sealing a tamped insulation surface.

1. Locations: Installations exposed to view in finished construction and for installations in crawl spaces; and not indicated to have a vapor retarder.

2. Manufacturer and Product: Monoglass Incorporated; Insulseal, medium coating; color to be selected.



## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Acceptance of Surfaces and Conditions: Examine substrates to which thermal insulation will be applied 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.

### **3.2 INSTALLATION, GENERAL**

- 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. General Requirements:
  - 1. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed at any time to ice, rain, or snow.
  - 2. Comply with insulation manufacturer's written instructions applicable to products and application indicated.
  - 3. Extend insulation in thickness indicated to envelop entire area to be insulated. Cut and fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.
  - 4. Apply a single layer of insulation to produce thickness indicated, unless multiple layers are otherwise shown or required to make up total thickness.

### **3.3 PREPARATION**

- A. General: Comply with manufacturer's instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.

### **3.4 INSTALLATION OF INSULATION SYSTEMS**

- A. Unfaced Glass Mineral Fiber (Fiberglass) Semi-Rigid and Batt Insulation: Install insulation in cavities formed by framing members according to following:
  - 1. Use insulation widths and lengths that fill the cavities formed by framing members. Where more than one length is required to fill cavity, provide lengths that will produce a snug fit between ends.
  - 2. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
  - 3. Where partition will be covered by gypsum board on only one side, apply adhesive to backside of gypsum board that is installed and press insulation in place to form bond to prevent insulation from sagging within cavity.

- B. Mineral Wool Semi-Rigid Insulation: Install in cavities formed by framing members according to the following requirements:
1. Cavity Wall Installations:
    - a. Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill cavity, provide lengths that will produce a snug fit between ends.
    - b. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
  2. Glazed Aluminum Framing System (Curtainwall) Installations:
    - a. Hold insulation in place by securing metal clips and straps or integral pockets within window frames, spaced at intervals recommended in writing by insulation manufacturer to hold insulation securely in place without touching spandrel glass. Maintain cavity width of dimension indicated on Drawings between insulation and glass.
    - b. Install insulation to fit snugly without bowing.
    - c. Install mullion covers, minimum 8 in (200 mm) width of insulation, centered over horizontal and vertical aluminum frames within spandrel area using the same impaling pins as used to attach the curtainwall insulation material. Secure covers with clinch shields over impaling pins.
- C. Sprayed Foam Insulating Gap Filler: As specified in Division 07 Section "Joint Sealants".
- D. Sprayed-Applied Thermal Insulation: Comply with manufacturer's written instructions for application procedures, and types of equipment used to mix, convey, and spray on insulation material.
1. Cover adjacent work subject to damage from fallout or overspray of insulation materials during application. Provide temporary enclosure as required to confine spraying operations and ensure adequate ambient conditions for temperature and ventilation.
  2. Coat substrates with adhesive before applying insulation material where recommended in writing by manufacturer for material and application indicated.
  3. Extend insulation material in full thickness over entire area of each substrate to be protected.
  4. Spray-apply insulation materials to maximum extent possible. Following the spraying operation in each area, complete the coverage by trowel application or other placement method recommended in writing by manufacturer.
  5. Apply insulation material in thicknesses and densities not less than those required to achieve minimum R-value indicated.
  6. Maintain profile of substrates except fill voids between members, including voids formed by fluted decks above beams and similar voids.
  7. Cure sprayed insulation materials according to manufacturer's recommendations to prevent premature drying.
  8. Protective Coating: Board-tamp sprayed insulation and over-spray with protective coating at installations that will be exposed to view in finished construction and for installations in crawl spaces.
    - a. Vapor Retarder Coating: Where indicated to have a vapor retarder, install this in lieu of protective coating. Board-tamp sprayed insulation and over-spray with vapor retarder coating.

### **3.5 PROTECTION**

- A. Protection: Protect installed insulation and vapor retarders from damage due to harmful weather exposures, physical abuse, and other causes. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation

**END OF SECTION**



## SECTION 07 2600

### UNDER-SLAB VAPOR RETARDER FOR CONCRETE SLABS-ON-GRADE

#### PART 1 – GENERAL

##### 1.1 SUMMARY

- A. Products Supplied Under This Section
  - 1. Vapor Retarder, seam tape, mastic, pipe boots for installation under concrete slabs.

##### 1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Cast-in-place Concrete - Section 03 3000
- B. Concrete Forming and Accessories - Section 03 2000
- C. Earthwork for Building Construction - Section 31 23 11

##### 1.3 REFERENCES

- A. American Society for Testing and Materials (ASTM), latest versions.
  - 1. ASTM E 96/ E96M Standard Test Methods for Water Vapor Transmission of Materials
  - 2. ASTM E 154 Standard Test Methods for Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs
  - 3. ASTM E 1643 Standard Practice for Selection, Design, Installation and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs
  - 4. ASTM E 1745 Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill Under Concrete Slabs
- B. American Concrete Institute (ACI), latest version.
  - 1. ACI 302.2R, Guide for Concrete Slabs that Receive Moisture-Sensitive Flooring Materials.

##### 1.4 SUBMITTALS

- A. Quality Control / Assurance
  - 1. Comply with Section 01 33 00 – Submittal Procedures.
  - 2. Independent laboratory test results showing compliance with ASTM & ACI Standards.

### UNDER-SLAB VAPOR RETARDER FOR CONC SOG

3. Manufacturer's samples, literature
  4. Manufacturer's installation instructions for placement, seaming and pipe boot installation
- B. Delivery, Storage, and Handling
1. Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name and manufacturer.
  2. Store materials in a clean dry area in accordance with manufacturer's instructions.
  3. Stack membrane on smooth ground or wood platform to eliminate warping.
  4. Protect materials during handling and application to prevent damage or contamination.
  5. Ensure membrane is stamped with manufacturer's name, product name and membrane thickness at intervals of no more than 85" (220 cm).
- C. Environmental requirements
1. Product not intended for uses subject to abuse or permanent exposure to the elements.
  2. Do not apply on frozen ground.

## **PART 2 – PRODUCTS**

### **2.1 MATERIALS**

- A. Vapor Retarder (Performance-Based Specifications)
1. Vapor Retarder must have the following qualities at minimum and meet floor finish manufacturer's warranty requirements.
    - a. Water Vapor Retarder ASTM E1745: Meets or exceeds Class A
    - b. Maximum Permeance ASTM E96: 0.01 perms or as required to meet Flooring Manufacturer's Warranties.
    - c. Tensile Strength ASTM E154, Section 9: not less than 45 LBS. Force/Inch
    - d. Puncture Resistance ASTM D1709, Method B.
    - e. Thickness of Retarder (plastic) ACI 302.1R-96: Not less than 15 mils
    - f. Material: Virgin Polyethylene or Polyolefin
  2. Vapor Retarder Products, may be by one of the following manufacturers or an approved equal, as long as the requirements above are met.

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- a. Epro, <http://eproserv.com>
- b. Fortifiber, <http://www.fortifiber.com>
- c. Stego Industries, <http://www.stegoindustries.com>
- d. W.R. Meadows, <http://www.wrmeadows.com>
- e. Raven Industries, <http://www.vaporblock.com>
- f. Reef Industries, <http://www.reefindustries.com>

## **2.2 ACCESSORIES**

- A. Seam Tape
  - 1. Tape must have the following qualities:
    - a. Water Vapor Transmission Rate ASTM E 96 0.3 perms or lower
- B. Vapor Proofing Mastic
  - 1. Mastic must have the following qualities:
    - a. Water Vapor Transmission Rate ASTM E 96 0.3 perms or lower
- C. Pipe Boots
  - 1. Construct pipe boots from vapor Retarder material, pressure sensitive tape and/or mastic per manufacturer's instructions.

## **PART 3 – EXECUTION**

### **3.1 EXAMINATION**

- A. Examine surfaces to receive membrane. Ensure compaction requirements have been completed and geotechnical firm has confirmed compaction requirements have been met. Notify Architect if surfaces are not acceptable. Do not begin surface preparation or application until unacceptable conditions have been corrected.

### **3.2 SURFACE PREPARATION**

- A. Prepare surfaces in accordance with manufacturers instructions.

### **3.3 INSTALLATION**

- A. Install Vapor Retarder:
  - 1. Installation shall be in accordance with manufacturer's instructions and ASTM E 1643.
    - a. Unroll Vapor Retarder with the longest dimension parallel with the direction of the pour.
    - b. Lap Vapor Retarder over footings and seal to foundation walls.

## **UNDER-SLAB VAPOR RETARDER FOR CONC SOG**

- c. Overlap joints 6 inches and seal with manufacturer's tape.
- d. Seal all penetrations (including pipes) per manufacturer's instructions.
- e. No penetration of the Vapor Retarder is allowed except for reinforcing steel and permanent utilities.
- f. Repair damaged areas by cutting patches of Vapor Retarder, overlapping damaged area 6 inches and taping all four sides with tape.

**END OF SECTION**

**UNDER-SLAB VAPOR RETARDER FOR CONC SOG**



## **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  $I_p$ : 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.~~

#### **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.
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 previous 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, Trafomatic.
- 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**

**17-13 OSU, College of Osteopathic Medicine at  
Cherokee Nation  
Childers Architect  
2019-04-19**

**ELECTRIC TRACTION ELEVATORS**

**14 2100 - 26**

## **SECTION 21 1100**

### **FACILITY FIRE-SUPPRESSION WATER-SERVICE PIPING**

#### **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 SUMMARY**

- A. Section includes fire-suppression water-service piping and related components outside the building and service entrance piping through floor into the building and the following:
  - 1. Pipes, fittings, and specialties.
  - 2. Fire-suppression specialty valves.
  - 3. Alarm devices.
- B. Utility-furnished products include water meters that are furnished to the site, ready for installation.
- C. Related Requirements:
  - 1. Section 21 1119 "Fire-Department Connections" for exposed-, flush-, and yard-type, fire-department connections.

##### **1.3 ACTION SUBMITTALS**

- A. Product Data: For each type of product.
- B. Shop Drawings:
  - 1. Detail precast concrete vault assemblies and indicate dimensions, method of field assembly, and components.
  - 2. Include diagrams for power, signal, and control wiring.

##### **1.4 INFORMATIONAL SUBMITTALS**

- A. Coordination Drawings: For piping and specialties including relation to other services in same area, drawn to scale. Show piping and specialty sizes and valves, meter and specialty locations, and elevations.
- B. Field quality-control reports.

## **1.5 QUALITY ASSURANCE**

- A. Regulatory Requirements:
  - 1. Comply with requirements of utility company supplying the water. Include tapping of water mains and backflow prevention.
  - 2. Comply with standards of authorities having jurisdiction for fire-suppression water-service piping, including materials, hose threads, installation, and testing.
- B. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- D. Comply with FM Global's "Approval Guide" or UL's "Fire Protection Equipment Directory" for fire-service-main products.
- E. NFPA Compliance: Comply with NFPA 24 for materials, installations, tests, flushing, and valve and hydrant supervision for fire-suppression water-service piping.

## **1.6 DELIVERY, STORAGE, AND HANDLING**

- A. Preparation for Transport: Prepare valves, including fire hydrants, according to the following:
  - 1. Ensure that valves are dry and internally protected against rust and corrosion.
  - 2. Protect valves against damage to threaded ends and flange faces.
  - 3. Set valves in best position for handling. Set valves closed to prevent rattling.
- B. During Storage: Use precautions for valves, including fire hydrants, according to the following:
  - 1. Do not remove end protectors unless necessary for inspection; then reinstall for storage.
  - 2. Protect from weather. Store indoors and maintain temperature higher than ambient dew point temperature. Support off the ground or pavement in watertight enclosures when outdoor storage is necessary.
- C. Handling: Use sling to handle valves and fire hydrants if size requires handling by crane or lift. Rig valves to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.
- D. Deliver piping with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe-end damage and to prevent entrance of dirt, debris, and moisture.
- E. Protect stored piping from moisture and dirt. Elevate above grade. Do not exceed structural capacity of floor when storing inside.
- F. Protect flanges, fittings, and specialties from moisture and dirt.
- G. Store plastic piping protected from direct sunlight. Support to prevent sagging and bending.

## **1.7 PROJECT CONDITIONS**

- A. Interruption of Existing Fire-Suppression Water-Service Piping: Do not interrupt service to

facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary water-distribution service according to requirements indicated:

1. Notify Construction Manager no fewer than two days in advance of proposed interruption of service.
2. Do not proceed with interruption of service without Construction Manager's written permission.

## **PART 2 - PRODUCTS**

### **2.1 DUCTILE-IRON PIPE AND FITTINGS**

- A. Grooved-Joint, Ductile-Iron Pipe: AWWA C151, with cut, rounded-grooved ends.
- B. Mechanical-Joint, Ductile-Iron Pipe: AWWA C151, with mechanical-joint bell and plain spigot end.
- C. Push-on-Joint, Ductile-Iron Pipe: AWWA C151, with push-on-joint bell and plain spigot end.
- D. Grooved-End, Ductile-Iron Pipe Appurtenances:
  1. Grooved-End, Ductile-Iron Fittings: ASTM A 47/A 47M, malleable-iron castings or ASTM A 536, ductile-iron castings with dimensions matching pipe.
  2. Grooved-End, Ductile-Iron-Piping Couplings: AWWA C606, for ductile-iron-pipe dimensions. Include ferrous housing sections, gasket suitable for water, and bolts and nuts.
- E. Mechanical-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.
  1. Glands, Gaskets, and Bolts: AWWA C111, ductile- or gray-iron glands, rubber gaskets, and steel bolts.
- F. Push-on-Joint, Ductile-Iron Fittings: AWWA C153, ductile-iron compact pattern.
  1. Gaskets: AWWA C111, rubber.
- G. Flanges: ASME B16.1, Class 125, cast iron.

### **2.2 PE PIPE AND FITTINGS**

- A. PE, Fire-Service Pipe: FM Global approved, with minimum thickness equivalent to Class 150 and Class 200.
- B. Molded PE Fittings: FM Global approved; PE butt-fusion type, made to match PE pipe dimensions and class.

### **2.3 PVC PIPE AND FITTINGS**

- A. PVC Pipe: AWWA C900 or UL 1285, Class 150 and Class 200, with bell end with gasket, and

with spigot end.

- B. PVC Fittings: AWWA C900 or UL 1285, Class 150 and Class 200, with bell-and-spigot or double-bell ends. Include elastomeric gasket in each bell.

## **2.4 SPECIAL PIPE FITTINGS**

- A. Ductile-Iron Flexible Expansion Joints:
  - 1. Manufacturers
    - a. Zurn Industries
    - b. Star Pipe Industries
    - c. Romac Industries
  - 2. Description: Compound, ductile-iron fitting with combination of flanged and mechanical-joint ends complying with AWWA C110 or AWWA C153. Include two gasketed ball-joint sections and one or more gasketed sleeve sections. Assemble components for offset and expansion indicated. Include AWWA C111, ductile-iron glands, rubber gaskets, and steel bolts.
  - 3. Pressure Rating: 250 psig (1725 kPa) minimum.
- B. Ductile-Iron Deflection Fittings:
  - 1. Manufacturers
    - a. EBAA Iron
  - 2. Description: Compound, ductile-iron coupling fitting with sleeve and one or two flexing sections for up to 15-degree deflection, gaskets, and restrained-joint ends complying with AWWA C110 or AWWA C153. Include AWWA C111, ductile-iron glands, rubber gaskets, and steel bolts.
  - 3. Pressure Rating: 250 psig (1725 kPa) minimum.

## **2.5 ENCASEMENT FOR PIPING**

- A. Standard: ASTM A 674 or AWWA C105.
- B. Material: Linear low-density PE film of 0.008-inch (0.20-mm) minimum thickness or high-density, cross-laminated PE film of 0.004-inch (0.10-mm) minimum thickness.
- C. Form: Sheet or tube.
- D. Color: Black.

## **2.6 JOINING MATERIALS**

- A. Gaskets for Ferrous Piping and Copper-Alloy Tubing: ASME B16.21, asbestos free.
- B. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series.
- C. Bonding Adhesive for Fiberglass Piping: As recommended by fiberglass piping manufacturer.



## **2.7 PIPING SPECIALTIES**

- A. Transition Fittings: Manufactured fitting or coupling same size as, with pressure rating at least equal to and ends compatible with, piping to be joined.
- B. Tubular-Sleeve Pipe Couplings:
  - 1. Manufacturers
    - a. Viking Johnson
    - b. Romac Industries
    - c. JCM Industries
  - 2. Description: Metal, bolted, sleeve-type, reducing or transition coupling, with center sleeve, gaskets, end rings, and bolt fasteners, and with ends of same sizes as piping to be joined.
  - 3. Standard: AWWA C219.
  - 4. Center-Sleeve Material: Manufacturer's standard.
  - 5. Gasket Material: Natural or synthetic rubber.
  - 6. Pressure Rating: 200 psig (1380 kPa) minimum.
  - 7. Metal Component Finish: Corrosion-resistant coating or material.

## **2.8 CORPORATION VALVES**

- A. Manufacturers
  - 1. Mueller Co.
  - 2. Master Meter, Inc.
- B. Corporation Valves: Comply with AWWA C800. Include saddle and valve compatible with tapping machine and manifold.
  - 1. Service Saddle: Copper alloy with seal and AWWA C800, threaded outlet for corporation valve.
  - 2. Corporation Valve: Bronze body and ground-key plug, with AWWA C800, threaded inlet and outlet matching service piping material.
  - 3. Manifold: Copper fitting with two to four inlets as required, with ends matching corporation valves and outlet matching service piping material.
- C. Meter Valves: Comply with AWWA C800 for high-pressure, service-line valves. Include angle- or straight-through-pattern bronze body, ground-key plug or ball, and wide tee head, with inlet and outlet matching service piping material.

## **2.9 CURB VALVES**

- A. Manufacturers
  - 1. Mueller Co.
  - 2. Master Meter, Inc.
- B. Curb Valves: Comply with AWWA C800 for high-pressure, service-line valves. Valve has bronze body, ground-key plug or ball, wide tee head, and inlet and outlet matching service piping material.
- C. Service Boxes for Curb Valves: Similar to AWWA M44 requirements for cast-iron valve boxes. Include cast-iron telescoping top section of length required for depth of burial of valve, plug with lettering "WATER," and bottom section with base that fits over curb valve and with a barrel approximately 3 inches (75 mm) in diameter.

1. Shutoff Rods: Steel; with tee-handle with one pointed end, stem of length to operate deepest buried valve, and slotted end matching curb valve.
- D. Meter Valves: Comply with AWWA C800 for high-pressure, service-line valves. Include angle- or straight-through-pattern bronze body, ground-key plug or ball, and wide tee head, with inlet and outlet matching service piping material.

## **2.10 DETECTOR CHECK VALVES**

- A. Manufacturers
  1. Ames Fire & Waterworks
  2. WATTS
  3. Globe Fire Sprinkler
  4. Kennedy Valve Company
- B. Description: Galvanized cast-iron body, bolted cover with air-bleed device for access to internal parts, and flanged ends. Include one-piece bronze disc with bronze bushings, pivot, and replaceable seat. Include threaded bypass taps in inlet and outlet for bypass meter connection. Set valve to allow minimal water flow through bypass meter when major water flow is required.
- C. Standards: UL 312 and FM Global's "Approval Guide."
- D. Pressure Rating: 175 psig (1200 kPa).
- E. Water Meter: AWWA C700, disc type, at least one-fourth size of detector check valve. Include meter, bypass piping, gate valves, check valve, and connections to detector check valve.

## **2.11 BACKFLOW PREVENTERS**

- A. Double-Check, Detector-Assembly Backflow Preventers:
  1. Ames Fire & Waterworks or equivalent
  2. Standards: ASSE 1048 and UL's "Fire Protection Equipment Directory" listing or FM Global's "Approval Guide."
  3. Operation: Continuous-pressure applications.
  4. Pressure Loss: 5 psig (35 kPa) maximum, through middle one-third of flow range.
  5. Body Material: Steel with interior lining complying with AWWA C550 or that is FDA approved.
  6. End Connections: Flanged.
  7. Configuration: Designed for horizontal, straight through flow.
  8. Accessories:
    - a. Valves: UL 262 and FM Global's "Approval Guide" listing; OS&Y gate type with flanged ends on inlet and outlet.
    - b. Bypass: With displacement-type water meter, shutoff valves, and reduced-pressure backflow preventer.
- B. Backflow Preventer Test Kits:
  1. Apollo Flow Controls
  2. Description: Factory calibrated, with gages, fittings, hoses, and carrying case with test-procedure instructions.

## **2.12 WATER METER BOXES**

- A. Description: Cast-iron body and cover for disc-type water meter, with lettering "WATER METER" on cover; and with slotted, open-bottom base section of length to fit over service piping.
  - 1. Option: Base section may be cast-iron, PVC, clay, or other pipe.
- B. Description: Cast-iron body and double cover for disc-type water meter, with lettering "WATER METER" on top cover; and with separate inner cover; air space between covers; and slotted, open-bottom base section of length to fit over service piping.
- C. Description: Polymer-concrete body and cover for disc-type water meter, with lettering "WATER" on cover; and with slotted, open-bottom base section of length to fit over service piping. Include vertical and lateral design loadings of 15,000 lb minimum over 10 by 10 inches (6 800 kg minimum over 254 by 254 mm) square.

## **2.13 ALARM DEVICES**

- A. General: UL 753 and FM Global's "Approval Guide" listing, of types and sizes to mate and match piping and equipment.
- B. Water-Flow Indicators: Vane-type water-flow detector, rated for 250-psig (1725-kPa) working pressure; designed for horizontal or vertical installation; with two single-pole, double-throw circuit switches to provide isolated alarm and auxiliary contacts, 7 A, 125-V ac and 0.25 A, 24-V dc; complete with factory-set, field-adjustable retard element to prevent false signals and tamperproof cover that sends signal when cover is removed.
- C. Supervisory Switches: Single pole, double throw; designed to signal valve in other than fully open position.
- D. Pressure Switches: Single pole, double throw; designed to signal increase in pressure.

## **PART 3 - EXECUTION**

### **3.1 EARTHWORK**

- A. Comply with excavating, trenching, and backfilling requirements in Section 31 2000 "Earth Moving."

### **3.2 PIPING INSTALLATION**

- A. Water-Main Connection: Arrange with water utility company for tap of size and in location indicated in water main.
- B. Water-Main Connection: Tap water main according to requirements of water utility company and of size and in location indicated.
- C. Make connections larger than NPS 2 (DN 50) with tapping machine according to the following:

1. Install tapping sleeve and tapping valve according to MSS SP-60.
  2. Install tapping sleeve on pipe to be tapped. Position flanged outlet for gate valve.
  3. Use tapping machine compatible with valve and tapping sleeve; cut hole in main. Remove tapping machine and connect water-service piping.
  4. Install gate valve onto tapping sleeve. Comply with MSS SP-60. Install valve with stem pointing up and with valve box.
- D. Comply with NFPA 24 for fire-service-main piping materials and installation.
- E. Install copper tube and fittings according to CDA's "Copper Tube Handbook."
1. Install encasement for tubing according to ASTM A 674 or AWWA C105.
- F. Install ductile-iron, water-service piping according to AWWA C600 and AWWA M41.
1. Install encasement for piping according to ASTM A 674 or AWWA C105.
- G. Install PE pipe according to ASTM D 2774 and ASTM F 645.
- H. Install PVC, AWWA pipe according to ASTM F 645 and AWWA M23.
- I. Bury piping with depth of cover over top at least 30 inches (750 mm), with top at least 12 inches (300 mm) below level of maximum frost penetration, and according to the following:
1. Under Driveways: With at least 36 inches (910 mm) of cover over top.
  2. Under Railroad Tracks: With at least 48 inches (1220 mm) of cover over top.
  3. In Loose Gravelly Soil and Rock: With at least 12 inches (300 mm) of additional cover.
- J. Install piping by tunneling or jacking, or combination of both, under streets and other obstructions that cannot be disturbed.
- K. Extend fire-suppression water-service piping and connect to water-supply source and building fire-suppression water-service piping systems at locations and pipe sizes indicated.
1. Terminate fire-suppression water-service piping within the building at the floor slab until building-water-piping systems are installed. Terminate piping with caps, plugs, or flanges as required for piping material. Make connections to building's fire-suppression water-service piping systems when those systems are installed.
- L. Install underground piping with restrained joints at horizontal and vertical changes in direction. Use restrained-joint piping, thrust blocks, anchors, tie-rods and clamps, and other supports.
- M. Comply with requirements in Section 21 1313 "Wet-Pipe Sprinkler Systems," for fire-suppression-water piping inside the building.
- N. Comply with requirements in Section 22 1116 "Domestic Water Piping" for potable-water piping inside the building.
- O. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 21 0517 "Sleeves and Sleeve Seals for Fire-Suppression Piping."
- P. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 21 0517 "Sleeves and Sleeve Seals for Fire-Suppression Piping."

### **3.3 JOINT CONSTRUCTION**

- A. Install couplings, flanges, flanged fittings, unions, nipples, and transition and special fittings that have finish and pressure rating same as or higher than systems pressure rating for aboveground applications unless otherwise indicated.
- B. Install unions adjacent to each valve in tubing NPS 2 (DN 50) and smaller.
- C. Install flanges, flange adaptors, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 (DN 65) and larger end connections.
- D. Ream ends of tubes and remove burrs.
- E. Remove scale, slag, dirt, and debris from outside and inside of pipes, tubes, and fittings before assembly.
- F. Ductile-Iron Piping, Gasketed Joints for Fire-Service-Main Piping: UL 194.
- G. Ductile-Iron Piping, Grooved Joints: Cut-groove pipe. Assemble joints with grooved-end, ductile-iron-piping couplings, gaskets, lubricant, and bolts.
- H. Flanged Joints: Select appropriate gasket material in size, type, and thickness suitable for water service. Join flanges with bolts according to ASME B31.9.
- I. PE Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D 2657.
- J. PVC Piping Gasketed Joints: Use joining materials according to AWWA C900. Construct joints with elastomeric seals and lubricant according to ASTM D 2774 or ASTM D 3139.
- K. Dissimilar Materials Piping Joints: Use adapters compatible with both piping materials, with OD, and with system working pressure.
- L. Do not use flanges or unions for underground piping.

### **3.4 ANCHORAGE INSTALLATION**

- A. Anchorage, General: Install water-distribution piping with restrained joints. Anchorages and restrained-joint types that may be used include the following:
  - 1. Concrete thrust blocks.
  - 2. Locking mechanical joints.
  - 3. Set-screw mechanical retainer glands.
  - 4. Bolted flanged joints.
  - 5. Heat-fused joints.
  - 6. Pipe clamps and tie rods.
- B. Install anchorages for tees, plugs and caps, bends, crosses, valves, and hydrant branches in fire-suppression water-service piping according to NFPA 24 and the following:
  - 1. Gasketed-Joint, Ductile-Iron, Water-Service Piping: According to AWWA C600.
  - 2. Gasketed-Joint, PVC Water-Service Piping: According to AWWA M23.
  - 3. Bonded-Joint Fiberglass, Water-Service Piping: According to AWWA M45.

- C. Apply full coat of asphalt or other acceptable corrosion-resistant material to surfaces of installed ferrous anchorage devices.

### **3.5 VALVE INSTALLATION**

- A. AWWA Gate Valves: Comply with AWWA C600 and AWWA M44. Install each underground valve with stem pointing up and with valve box.
- B. AWWA Valves Other Than Gate Valves: Comply with AWWA C600 and AWWA M44.
- C. UL-Listed or FM Global-Approved Gate Valves: Comply with NFPA 24. Install each underground valve and valves in vaults with stem pointing up and with vertical cast-iron indicator post.
- D. UL-Listed or FM Global-Approved Valves Other Than Gate Valves: Comply with NFPA 24.
- E. MSS Valves: Install as component of connected piping system.
- F. Corporation Valves and Curb Valves: Install each underground curb valve with head pointed up and with service box.
- G. Pressure-Reducing Valves: Install in vault or aboveground between shutoff valves.
- H. Support valves and piping, not direct buried, on concrete piers. Comply with requirements for concrete piers in Section 03 3000 "Cast-in-Place Concrete."

### **3.6 DETECTOR CHECK VALVE INSTALLATION**

- A. Install in vault or aboveground.
- B. Install for proper direction of flow. Install bypass with water meter, gate valves on each side of meter, and check valve downstream from meter.
- C. Support detector check valves and piping on concrete piers. Comply with requirements for concrete piers in Section 03 3000 "Cast-in-Place Concrete."

### **3.7 BACKFLOW PREVENTER INSTALLATION**

- A. Install backflow preventers of type, size, and capacity indicated. Include valves and test cocks. Install according to requirements of plumbing and health department and authorities having jurisdiction.
- B. Do not install backflow preventers that have relief drain in vault or in other spaces subject to flooding.
- C. Do not install bypass piping around backflow preventers.
- D. Support NPS 2-1/2 (DN 65) and larger backflow preventers and piping on concrete piers. Comply with requirements for concrete piers in Section 03 3000 "Cast-in-Place Concrete."

### **3.8 ALARM DEVICE INSTALLATION**

- A. General: Comply with NFPA 24 for devices and methods of valve supervision. Underground valves with valve box do not require supervision.
- B. Supervisory Switches: Supervise valves in open position.
  - 1. Valves: Grind away portion of exposed valve stem. Bolt switch, with plunger in stem depression, to OS&Y gate-valve yoke.
  - 2. Indicator Posts: Drill and thread hole in upper-barrel section at target plate. Install switch, with toggle against target plate, on barrel of indicator post.
- C. Locking and Sealing: Secure unsupervised valves as follows:
  - 1. Valves: Install chain and padlock on open OS&Y gate valve.
  - 2. Post Indicators: Install padlock on wrench on indicator post.
- D. Pressure Switches: Drill and thread hole in exposed barrel of fire hydrant. Install switch.
- E. Water-Flow Indicators: Install in water-service piping in vault. Select indicator with saddle and vane matching pipe size. Drill hole in pipe, insert vane, and bolt saddle to pipe.
- F. Connect alarm devices to building's fire-alarm system. Wiring and fire-alarm devices are specified in Section 28 3111 "Digital, Addressable Fire-Alarm System."

### **3.9 CONNECTIONS**

- A. Connect fire-suppression water-service piping to existing water main. Use tapping sleeve and tapping valve.
- B. Connect fire-suppression water-service piping to interior fire-suppression piping.

### **3.10 FIELD QUALITY CONTROL**

- A. Use test procedure prescribed by authorities having jurisdiction or, if method is not prescribed by authorities having jurisdiction, use procedure described below.
- B. Piping Tests: Conduct piping tests before joints are covered and after concrete thrust blocks have hardened sufficiently. Fill pipeline 24 hours before testing and apply test pressure to stabilize system. Use only potable water.
- C. Hydrostatic Tests: Test at not less than one-and-one-half times the working pressure for two hours.
  - 1. Increase pressure in 50-psig (350-kPa) increments and inspect each joint between increments. Hold at test pressure for one hour; decrease to zero psig (zero kPa). Slowly increase again to test pressure and hold for one more hour. Maximum allowable leakage is 2 quarts (1.89 L) per hour per 100 joints. Remake leaking joints with new materials and repeat test until leakage is within allowed limits.
- D. Prepare test and inspection reports.

### **3.11 IDENTIFICATION**

- A. Install continuous underground detectable warning tape during backfilling of trench for underground fire-suppression water-service piping. Locate below finished grade, directly over piping. Underground warning tapes are specified in Section 31 2000 "Earth Moving."
- B. Permanently attach equipment nameplate or marker indicating plastic fire-suppression water-service piping or fire-suppression water-service piping with electrically insulated fittings, on main electrical meter panel. Comply with requirements for identifying devices in Section 22 0553 "Identification for Plumbing Piping and Equipment."

### **3.12 CLEANING**

- A. Clean and disinfect fire-suppression water-service piping as follows:
  - 1. Purge new piping systems and parts of existing systems that have been altered, extended, or repaired before use.
  - 2. Use purging and disinfecting procedure prescribed by authorities having jurisdiction or, if method is not prescribed by authorities having jurisdiction, use procedure described in NFPA 24 for flushing of piping. Flush piping system with clean, potable water until dirty water does not appear at points of outlet.
  - 3. Use purging and disinfecting procedure prescribed by authorities having jurisdiction or, if method is not prescribed by authorities having jurisdiction, use procedure described in AWWA C651 or do as follows:
    - a. Fill system or part of system with water/chlorine solution containing at least 50 ppm of chlorine; isolate and allow it to stand for 24 hours.
    - b. Drain system or part of system of previous solution and refill with water/chlorine solution containing at least 200 ppm of chlorine; isolate and allow it to stand for three hours.
    - c. After standing time, flush system with clean, potable water until no chlorine remains in water coming from system.
    - d. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedure if biological examination shows evidence of contamination.
- B. Prepare reports of purging and disinfecting activities.

### **3.13 PIPING SCHEDULE**

- A. Underground fire-suppression water-service piping NPS 6 to NPS 12 (DN 150 to DN 300) shall be one of the following:
  - 1. Grooved-end, ductile-iron pipe; grooved-end, ductile-iron pipe appurtenances; and grooved joints.
  - 2. Mechanical-joint, ductile-iron pipe; mechanical-joint, ductile- or gray-iron, standard-pattern or ductile-iron, compact-pattern fittings; glands, gaskets, and bolts; and gasketed joints.
  - 3. Push-on-joint, ductile-iron pipe; push-on-joint, ductile-iron compact-pattern fittings; and gasketed joints.
  - 4. PVC, Class 200 pipe listed for fire-protection service; PVC fittings of same class as pipe; and gasketed joints.

- B. Underslab fire-suppression water-service piping NPS 6 to NPS 12 (DN 150 to DN 300) one of



the following:

1. Grooved-end, ductile-iron pipe; grooved-end, ductile-iron pipe appurtenances; and grooved joints.
2. Mechanical-joint, ductile-iron pipe; mechanical-joint, ductile- or gray-iron, standard-pattern or ductile-iron, compact-pattern fittings; glands, gaskets, and bolts; and restrained, gasketed joints.

### **3.14 VALVE SCHEDULE**

- A. Underground fire-suppression water-service shutoff valves NPS 3 (DN 80) and larger shall be one of the following:
  1. 200-psig (1380-kPa), AWWA, iron, nonrising-stem, resilient-seated gate valves.
  2. 250-psig (1725-kPa), AWWA, iron, nonrising-stem, resilient-seated gate valves.
  3. 250-psig (1725-kPa), UL-listed or FM Global-approved, iron, nonrising-stem gate valves.
- B. Standard-pressure, aboveground fire-suppression water-service shutoff valves NPS 3 (DN 80) and larger shall be one of the following:
  1. 200-psig (1380-kPa), AWWA, iron, OS&Y, resilient-seated gate valves.
  2. 250-psig (1725-kPa), AWWA, iron, OS&Y, resilient-seated gate valves.
  3. 250-psig (1725-kPa), UL-listed or FM Global-approved, iron, OS&Y gate valves.
  4. AWWA or UL-listed or FM Global-approved butterfly valves.
- C. Fire-suppression water-service check valves NPS 3 (DN 80) and larger shall be one of the following:
  1. AWWA or UL-listed or FM Global-approved check valves.
  2. UL-listed or FM Global-approved detector check valves.

**END OF SECTION**



## **SECTION 22 0517**

### **SLEEVES AND SLEEVE SEALS FOR PLUMBING PIPING**

#### **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 SUMMARY**

- A. Section Includes:
  - 1. Sleeves.
  - 2. Sleeve-seal systems.
  - 3. Grout.

##### **1.3 ACTION SUBMITTALS**

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

#### **PART 2 - PRODUCTS**

##### **2.1 SLEEVES**

- A. Cast-Iron Wall Pipes: Cast or fabricated of cast or ductile iron and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.
- B. Galvanized-Steel Wall Pipes: ASTM A 53/A 53M, Schedule 40, with plain ends and welded steel collar; zinc coated.
- C. Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, with plain ends.
- D. PVC-Pipe Sleeves: ASTM D 1785, Schedule 40.
- E. Galvanized-Steel-Sheet Sleeves: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.

##### **2.2 SLEEVE-SEAL SYSTEMS**

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Advance Products & Systems, Inc.
2. CALPICO, Inc.
3. Metraflex Company (The).
4. Pipeline Seal and Insulator, Inc.
5. Proco Products, Inc.

- B. Description: Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.
1. Sealing Elements: NBR interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
  2. Pressure Plates: Carbon steel.
  3. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating, of length required to secure pressure plates to sealing elements.

## **2.3 GROUT**

- A. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
- B. Characteristics: Nonshrink; recommended for interior and exterior applications.
- C. Design Mix: 5000-psi, 28-day compressive strength.
- D. Packaging: Premixed and factory packaged.

## **PART 3 - EXECUTION**

### **3.1 SLEEVE INSTALLATION**

- A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.
- B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 1-inch annular clear space between piping and concrete slabs and walls.
1. Sleeves are not required for core-drilled holes.
- C. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.
1. Cut sleeves to length for mounting flush with both surfaces.
    - a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level.
  2. Using grout, seal the space outside of sleeves in slabs and walls without sleeve-seal system.
- D. Install sleeves for pipes passing through interior partitions.
1. Cut sleeves to length for mounting flush with both surfaces.

2. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.
  3. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint. Comply with requirements for sealants specified in Section 07 9200 "Joint Sealants."
- E. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for firestopping specified in Section 07 8413 "Penetration Firestopping."

### **3.2 SLEEVE-SEAL-SYSTEM INSTALLATION**

- A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building.
- B. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Position piping in center of sleeve. Center piping in penetration, assemble sleeve-seal system components, and install in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

### **3.3 SLEEVE AND SLEEVE-SEAL SCHEDULE**

- A. Use sleeves and sleeve seals for the following piping-penetration applications:
1. Exterior Concrete Walls above Grade:
    - a. Piping Smaller Than NPS 6: Galvanized-steel wall sleeves.
    - b. Piping NPS 6 and Larger: Galvanized-steel wall sleeves.
  2. Exterior Concrete Walls below Grade:
    - a. Piping Smaller Than NPS 6: Cast-iron wall sleeves with sleeve-seal system.
      - 1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.
    - b. Piping NPS 6 and Larger: Cast-iron wall sleeves with sleeve-seal system.
      - 1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.
  3. Concrete Slabs above Grade:
    - a. Piping Smaller Than NPS 6: Galvanized-steel-pipe sleeves.
    - b. Piping NPS 6 and Larger: Galvanized-steel-pipe sleeves.
  4. Interior Partitions:
    - a. Piping Smaller Than NPS 6: Galvanized-steel-pipe sleeves.
    - b. Piping NPS 6 and Larger: Galvanized-steel-sheet sleeves.

**END OF SECTION**

## **SECTION 22 0553**

### **IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT**

#### **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 SUMMARY**

- A. Section Includes:
  - 1. Equipment labels.
  - 2. Warning signs and labels.
  - 3. Pipe labels.
  - 4. Stencils.
  - 5. Valve tags.
  - 6. Warning tags.

##### **1.3 ACTION SUBMITTALS**

- A. Product Data: For each type of product indicated.
- B. Samples: For color, letter style, and graphic representation required for each identification material and device.
- C. Equipment Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.
- D. Valve numbering scheme.
- E. Valve Schedules: For each piping system to include in maintenance manuals.

##### **1.4 COORDINATION**

- A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
- B. Coordinate installation of identifying devices with locations of access panels and doors.
- C. Install identifying devices before installing acoustical ceilings and similar concealment.

## **PART 2 - PRODUCTS**

### **2.1 EQUIPMENT LABELS**

#### **A. Metal Labels for Equipment:**

1. Material and Thickness: Aluminum, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
2. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
3. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
4. Fasteners: Stainless-steel rivets or self-tapping screws.
5. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

#### **B. Plastic Labels for Equipment:**

1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, and having predrilled holes for attachment hardware.
2. Letter Color: White.
3. Background Color: Black.
4. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
6. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
7. Fasteners: Stainless-steel rivets or self-tapping screws.
8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

#### **C. Label Content:** Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified.

#### **D. Equipment Label Schedule:** For each item of equipment to be labeled, on 8-1/2-by-11-inch bond paper. Tabulate equipment identification number and identify Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

### **2.2 WARNING SIGNS AND LABELS**

#### **A. Material and Thickness:** Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, and having predrilled holes for attachment hardware.

#### **B. Letter Color:** Black.

#### **C. Background Color:** Yellow.

#### **D. Maximum Temperature:** Able to withstand temperatures up to 160 deg F.



- E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
- F. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
- G. Fasteners: Stainless-steel rivets or self-tapping screws.
- H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- I. Label Content: Include caution and warning information, plus emergency notification instructions.

## **2.3 PIPE LABELS**

- A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.
- B. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.
- C. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.
- D. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, pipe size, and an arrow indicating flow direction.
  - 1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions, or as separate unit on each pipe label to indicate flow direction.
  - 2. Lettering Size: At least 1-1/2 inches high.

## **2.4 STENCILS**

- A. Stencils: Prepared with letter sizes according to ASME A13.1 for piping; and minimum letter height of 3/4 inch for access panel and door labels, equipment labels, and similar operational instructions.
  - 1. Stencil Material: Aluminum.
  - 2. Stencil Paint: Exterior, gloss, alkyd enamel black unless otherwise indicated. Paint may be in pressurized spray-can form.
  - 3. Identification Paint: Exterior, alkyd enamel in colors according to ASME A13.1 unless otherwise indicated.

## **2.5 VALVE TAGS**

- A. Valve Tags: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch numbers.
  - 1. Tag Material: Brass, 0.032-inch, Stainless steel, 0.025-inch, Aluminum, 0.032-inch, or anodized aluminum, 0.032-inch minimum thickness, and having predrilled or stamped

- holes for attachment hardware.
- 2. Fasteners: Brass wire-link or beaded chain; or S-hook.
- B. Valve Schedules: For each piping system, on 8-1/2-by-11-inch bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.
  - 1. Valve-tag schedule shall be included in operation and maintenance data.

## **2.6 WARNING TAGS**

- A. Warning Tags: Preprinted or partially preprinted, accident-prevention tags, of plasticized card stock with matte finish suitable for writing.
  - 1. Size: 3 by 5-1/4 inches minimum.
  - 2. Fasteners: Brass grommet and wire.
  - 3. Nomenclature: Large-size primary caption such as "DANGER," "CAUTION," or "DO NOT OPERATE."
  - 4. Color: Yellow background with black lettering.

## **PART 3 - EXECUTION**

### **3.1 PREPARATION**

- A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

### **3.2 EQUIPMENT LABEL INSTALLATION**

- A. Install or permanently fasten labels on each major item of mechanical equipment.
- B. Locate equipment labels where accessible and visible.

### **3.3 PIPE LABEL INSTALLATION**

- A. Piping Color-Coding: Painting of piping is specified in Section 09 9123 "Interior Painting."
- B. Stenciled Pipe Label Option: Stenciled labels may be provided instead of manufactured pipe labels, at Installer's option. Install stenciled pipe labels with painted, color-coded bands or rectangles, complying with ASME A13.1, on each piping system.
  - 1. Identification Paint: Use for contrasting background.
  - 2. Stencil Paint: Use for pipe marking.
- C. Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:

1. Near each valve and control device.
2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
4. At access doors, manholes, and similar access points that permit view of concealed piping.
5. Near major equipment items and other points of origination and termination.
6. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.
7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.

D. Pipe Label Color Schedule:

1. Domestic Water Piping:
  - a. Background Color: Complying with ANSI 13.1.
  - b. Letter Color: Complying with ANSI 13.1.
2. Sanitary Waste and Storm Drainage Piping:
  - a. Background Color: Complying with ANSI 13.1.
  - b. Letter Color: Complying with ANSI 13.1.

### 3.4 VALVE-TAG INSTALLATION

- A. Install tags on valves and control devices in piping systems, except check valves; valves within factory-fabricated equipment units; shutoff valves; faucets; convenience and lawn-watering hose connections; and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule.
- B. Valve-Tag Application Schedule: Tag valves according to size, shape, and color scheme and with captions similar to those indicated in the following subparagraphs:
  1. Valve-Tag Size and Shape:
    - a. Cold Water: 1-1/2 inches.
    - b. Hot Water: 1-1/2 inches.
  2. Valve-Tag Color:
    - a. Cold Water: Natural.
    - b. Hot Water: Natural.
  3. Letter Color:
    - a. Cold Water: Black.
    - b. Hot Water: Black.

### 3.5 WARNING-TAG INSTALLATION

- A. Write required message on, and attach warning tags to, equipment and other items where required.

**END OF SECTION**

**SECTION 22 1116**  
**DOMESTIC WATER PIPING**

**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 SUMMARY**

- A. Section Includes:
  - 1. Under-building-slab and aboveground domestic water pipes, tubes, and fittings inside buildings.
- B. Related Requirements:
  - 1. Section 22 1113 "Facility Water Distribution Piping" for water-service piping outside the building from source to the point where water-service piping enters the building.

**1.3 ACTION SUBMITTALS**

- A. Product Data: For transition fittings and dielectric fittings.

**1.4 INFORMATIONAL SUBMITTALS**

- A. System purging and disinfecting activities report.
- B. Field quality-control reports.

**1.5 FIELD CONDITIONS**

- A. Interruption of Existing Water Service: Do not interrupt water service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary water service according to requirements indicated:
  - 1. Notify Construction Manager and Owner no fewer than two days in advance of proposed interruption of water service.
  - 2. Do not interrupt water service without Construction Manager's and Owner's written permission.

## **PART 2 - PRODUCTS**

### **2.1 PIPING MATERIALS**

- A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.
- B. Potable-water piping and components shall comply with NSF 14 and NSF 61. Plastic piping components shall be marked with "NSF-pw."

### **2.2 COPPER TUBE AND FITTINGS**

- A. Hard Copper Tube: ASTM B 88, Type L water tube, drawn temper.
- B. Soft Copper Tube: ASTM B 88, Type K water tube, annealed temper.
- C. Cast-Copper, Solder-Joint Fittings: ASME B16.18, pressure fittings.
- D. Wrought-Copper, Solder-Joint Fittings: ASME B16.22, wrought-copper pressure fittings.
- E. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends.
- F. Copper Unions:
  - 1. MSS SP-123.
  - 2. Cast-copper-alloy, hexagonal-stock body.
  - 3. Ball-and-socket, metal-to-metal seating surfaces.
  - 4. Solder-joint or threaded ends.

### **2.3 PIPING JOINING MATERIALS**

- A. Pipe-Flange Gasket Materials:
  - 1. AWWA C110/A21.10, rubber, flat face, 1/8 inch thick or ASME B16.21, nonmetallic and asbestos free unless otherwise indicated.
  - 2. Full-face or ring type unless otherwise indicated.
- B. Metal, Pipe-Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.
- C. Solder Filler Metals: ASTM B 32, lead-free alloys.
- D. Flux: ASTM B 813, water flushable.
- E. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series, copper-phosphorus alloys for general-duty brazing unless otherwise indicated.
- F. Plastic, Pipe-Flange Gaskets, Bolts, and Nuts: Type and material recommended by piping system manufacturer unless otherwise indicated.

## 2.4 TRANSITION FITTINGS

- A. General Requirements:
  - 1. Same size as pipes to be joined.
  - 2. Pressure rating at least equal to pipes to be joined.
  - 3. End connections compatible with pipes to be joined.
- B. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.

## 2.5 DIELECTRIC FITTINGS

- A. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.
- B. Dielectric Unions:
  - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Capitol Manufacturing Company; member of the Phoenix Forge Group.
    - b. Central Plastics Company.
    - c. Hart Industries International, Inc.
    - d. Jomar International.
    - e. Matco-Norca.
    - f. McDonald, A. Y. Mfg. Co.
    - g. Watts; a division of Watts Water Technologies, Inc.
    - h. Wilkins; a Zurn company.
  - 2. Standard: ASSE 1079.
  - 3. Pressure Rating: 125 psig minimum at 180 deg F.
  - 4. End Connections: Solder-joint copper alloy and threaded ferrous.
- C. Dielectric Flanges:
  - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Capitol Manufacturing Company; member of the Phoenix Forge Group.
    - b. Central Plastics Company.
    - c. Matco-Norca.
    - d. Watts; a division of Watts Water Technologies, Inc.
    - e. Wilkins; a Zurn company.
  - 2. Standard: ASSE 1079.
  - 3. Factory-fabricated, bolted, companion-flange assembly.
  - 4. Pressure Rating: 125 psig minimum at 180 deg F.
  - 5. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.
- D. Dielectric-Flange Insulating Kits:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - a. Advance Products & Systems, Inc.
  - b. Calpico, Inc.
  - c. Central Plastics Company.
  - d. Pipeline Seal and Insulator, Inc.
2. Nonconducting materials for field assembly of companion flanges.
3. Pressure Rating: 150 psig.
4. Gasket: Neoprene or phenolic.
5. Bolt Sleeves: Phenolic or polyethylene.
6. Washers: Phenolic with steel backing washers.

### **PART 3 - EXECUTION**

#### **3.1 EARTHWORK**

- A. Comply with requirements in Section 31 2000 "Earth Moving" for excavating, trenching, and backfilling.

#### **3.2 PIPING INSTALLATION**

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of domestic water piping. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.
- B. Install copper tubing under building slab according to CDA's "Copper Tube Handbook."
- C. Install shutoff valve, hose-end drain valve, strainer, pressure gage, and test tee with valve inside the building at each domestic water-service entrance. Comply with requirements for pressure gages in Section 22 0519 "Meters and Gages for Plumbing Piping" and with requirements for drain valves and strainers in Section 22 1119 "Domestic Water Piping Specialties."
- D. Install shutoff valve immediately upstream of each dielectric fitting.
- E. Install water-pressure-reducing valves downstream from shutoff valves. Comply with requirements for pressure-reducing valves in Section 22 1119 "Domestic Water Piping Specialties."
- F. Install domestic water piping level and plumb.
- G. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.
- H. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.



- I. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.
- J. Install piping to permit valve servicing.
- K. Install nipples, unions, special fittings, and valves with pressure ratings the same as or higher than the system pressure rating used in applications below unless otherwise indicated.
- L. Install piping free of sags and bends.
- M. Install fittings for changes in direction and branch connections.
- N. Install unions in copper tubing at final connection to each piece of equipment, machine, and specialty.
- O. Install pressure gages on suction and discharge piping for each plumbing pump and packaged booster pump. Comply with requirements for pressure gages in Section 22 0519 "Meters and Gages for Plumbing Piping."
- P. Install thermostats in hot-water circulation piping. Comply with requirements for thermostats in Section 22 1123 "Domestic Water Pumps."
- Q. Install thermometers on inlet and outlet piping from each water heater. Comply with requirements for thermometers in Section 22 0519 "Meters and Gages for Plumbing Piping."
- R. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 22 0517 "Sleeves and Sleeve Seals for Plumbing Piping."
- S. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 22 0517 "Sleeves and Sleeve Seals for Plumbing Piping."
- T. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 22 0518 "Escutcheons for Plumbing Piping."

### **3.3 JOINT CONSTRUCTION**

- A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- B. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.
- C. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
  - 1. Apply appropriate tape or thread compound to external pipe threads.
  - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.
- D. Brazed Joints for Copper Tubing: Comply with CDA's "Copper Tube Handbook," "Brazed Joints" chapter.

- E. Soldered Joints for Copper Tubing: Apply ASTM B 813, water-flushable flux to end of tube. Join copper tube and fittings according to ASTM B 828 or CDA's "Copper Tube Handbook."
- F. Flanged Joints: Select appropriate asbestos-free, nonmetallic gasket material in size, type, and thickness suitable for domestic water service. Join flanges with gasket and bolts according to ASME B31.9.
- G. Joints for Dissimilar-Material Piping: Make joints using adapters compatible with materials of both piping systems.

### **3.4 TRANSITION FITTING INSTALLATION**

- A. Install transition couplings at joints of dissimilar piping.
- B. Transition Fittings in Underground Domestic Water Piping:
  - 1. Fittings for NPS 1-1/2 and Smaller: Fitting-type coupling.
  - 2. Fittings for NPS 2 and Larger: Sleeve-type coupling.
- C. Transition Fittings in Aboveground Domestic Water Piping NPS 2 and Smaller: Plastic-to-metal transition [fittings] or unions.

### **3.5 DIELECTRIC FITTING INSTALLATION**

- A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.
- B. Dielectric Fittings for NPS 2 and Smaller: Use dielectric unions.
- C. Dielectric Fittings for NPS 2-1/2 to NPS 4: Use dielectric flange kits.
- D. Dielectric Fittings for [NPS 5] and Larger: Use dielectric flange kits.

### **3.6 HANGER AND SUPPORT INSTALLATION**

- A. Comply with requirements for pipe hanger, support products, and installation in Section 22 0529 "Hangers and Supports for Plumbing Piping and Equipment."
  - 1. Vertical Piping: MSS Type 8 or 42, clamps.
  - 2. Individual, Straight, Horizontal Piping Runs:
    - a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
    - b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
    - c. Longer Than 100 Feet if Indicated: MSS Type 49, spring cushion rolls.
  - 3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
  - 4. Base of Vertical Piping: MSS Type 52, spring hangers.
- B. Support vertical piping and tubing at base and at each floor.
- C. Rod diameter may be reduced one size for double-rod hangers, to a minimum of 3/8 inch.

- D. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:
  - 1. NPS 3/4 and Smaller: 60 inches with 3/8-inch rod.
  - 2. NPS 1 and NPS 1-1/4: 72 inches with 3/8-inch rod.
  - 3. NPS 1-1/2 and NPS 2: 96 inches with 3/8-inch rod.
  - 4. NPS 2-1/2: 108 inches with 1/2-inch rod.
  - 5. NPS 3 to NPS 5: 10 feet with 1/2-inch rod.
  - 6. NPS 6: 10 feet with 5/8-inch rod.
  - 7. NPS 8: 10 feet with 3/4-inch rod.
- E. Install supports for vertical copper tubing every 10 feet.
- F. Support piping and tubing not listed in this article according to MSS SP-69 and manufacturer's written instructions.

### **3.7 CONNECTIONS**

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. When installing piping adjacent to equipment and machines, allow space for service and maintenance.
- C. Connect domestic water piping to exterior water-service piping. Use transition fitting to join dissimilar piping materials.
- D. Connect domestic water piping to water-service piping with shutoff valve; extend and connect to the following:
  - 1. Domestic Water Booster Pumps: Cold-water suction and discharge piping.
  - 2. Water Heaters: Cold-water inlet and hot-water outlet piping in sizes indicated, but not smaller than sizes of water heater connections.
  - 3. Plumbing Fixtures: Cold- and hot-water-supply piping in sizes indicated, but not smaller than that required by plumbing code.
  - 4. Equipment: Cold- and hot-water-supply piping as indicated, but not smaller than equipment connections. Provide shutoff valve and union for each connection. Use flanges instead of unions for NPS 2-1/2 and larger.

### **3.8 IDENTIFICATION**

- A. Identify system components. Comply with requirements for identification materials and installation in Section 22 0553 "Identification for Plumbing Piping and Equipment."
- B. Label pressure piping with system operating pressure.

### **3.9 FIELD QUALITY CONTROL**

- A. Perform the following tests and inspections:
  - 1. Piping Inspections:

- a. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.
  - b. During installation, notify authorities having jurisdiction at least one day before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:
    - 1) Roughing-in Inspection: Arrange for inspection of piping before concealing or closing in after roughing in and before setting fixtures.
    - 2) Final Inspection: Arrange for authorities having jurisdiction to observe tests specified in "Piping Tests" Subparagraph below and to ensure compliance with requirements.
  - c. Reinspection: If authorities having jurisdiction find that piping will not pass tests or inspections, make required corrections and arrange for reinspection.
  - d. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
2. Piping Tests:

- a. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.
- b. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit a separate report for each test, complete with diagram of portion of piping tested.
- c. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.
- d. Cap and subject piping to static water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow it to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
- e. Repair leaks and defects with new materials, and retest piping or portion thereof until satisfactory results are obtained.
- f. Prepare reports for tests and for corrective action required.

- B. Domestic water piping will be considered defective if it does not pass tests and inspections.
- C. Prepare test and inspection reports.

### **3.10 ADJUSTING**

- A. Perform the following adjustments before operation:
  - 1. Close drain valves, hydrants, and hose bibbs.
  - 2. Open shutoff valves to fully open position.
  - 3. Open throttling valves to proper setting.
  - 4. Adjust balancing valves in hot-water-circulation return piping to provide adequate flow.
    - a. Manually adjust ball-type balancing valves in hot-water-circulation return piping to provide hot-water flow in each branch.
    - b. Adjust calibrated balancing valves to flows indicated.
  - 5. Remove plugs used during testing of piping and for temporary sealing of piping during installation.

6. Remove and clean strainer screens. Close drain valves and replace drain plugs.
7. Remove filter cartridges from housings and verify that cartridges are as specified for application where used and are clean and ready for use.
8. Check plumbing specialties and verify proper settings, adjustments, and operation.

### **3.11 CLEANING**

- A. Clean and disinfect potable domestic water piping as follows:
  1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
  2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction; if methods are not prescribed, use procedures described in either AWWA C651 or AWWA C652 or follow procedures described below:
    - a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
    - b. Fill and isolate system according to either of the following:
      - 1) Fill system or part thereof with water/chlorine solution with at least 50 ppm of chlorine. Isolate with valves and allow to stand for 24 hours.
      - 2) Fill system or part thereof with water/chlorine solution with at least 200 ppm of chlorine. Isolate and allow to stand for three hours.
    - c. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.
    - d. Repeat procedures if biological examination shows contamination.
    - e. Submit water samples in sterile bottles to authorities having jurisdiction.
- B. Clean non-potable domestic water piping as follows:
  1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
  2. Use purging procedures prescribed by authorities having jurisdiction or; if methods are not prescribed, follow procedures described below:
    - a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
    - b. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedures if biological examination shows contamination.
- C. Prepare and submit reports of purging and disinfecting activities. Include copies of water-sample approvals from authorities having jurisdiction.
- D. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

### **3.12 PIPING SCHEDULE**

- A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.
- B. Flanges and unions may be used for aboveground piping joints unless otherwise indicated.

- C. Fitting Option: Extruded-tee connections and brazed joints may be used on aboveground copper tubing.
- D. Under-building-slab, domestic water, building-service piping, NPS 3 and smaller, shall be the following:
  - 1. Soft copper tube, ASTM B 88, Type K ASTM B 88, Type L; no joints below slab.
- E. Under-building-slab, domestic water piping, NPS 2 and smaller, shall be the following:
  - 1. Soft copper tube, ASTM B 88, Type K; no joints below slab.
- F. Aboveground domestic water piping, NPS 2 and smaller, shall be one of the following:
  - 1. Hard copper tube, ASTM B 88, Type L; wrought-copper, solder-joint fittings; and soldered joints.
- G. Aboveground domestic water piping, NPS 2-1/2 to NPS 4, shall be the following:
  - 1. Hard copper tube, ASTM B 88, Type L; wrought-copper, solder-joint fittings; and soldered joints.
- H. Aboveground domestic water piping, NPS 5 to NPS 8, shall be the following:
  - 1. Hard copper tube, ASTM B 88, Type L; cast- or wrought-copper, solder-joint fittings; and soldered joints.

### **3.13 VALVE SCHEDULE**

- A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:
  - 1. Shutoff Duty: Use ball or gate valves for piping NPS 2 and smaller. Use butterfly, ball, or gate valves with flanged ends for piping NPS 2-1/2 and larger.
  - 2. Throttling Duty: Use ball or globe valves for piping NPS 2 and smaller. Use butterfly or ball valves with flanged ends for piping NPS 2-1/2 and larger.
  - 3. Hot-Water Circulation Piping, Balancing Duty: Memory-stop balancing valves.
  - 4. Drain Duty: Hose-end drain valves.
- B. Use check valves to maintain correct direction of domestic water flow to and from equipment.
- C. Iron grooved-end valves may be used with grooved-end piping.

**END OF SECTION**

**SECTION 22 1316**  
**SANITARY WASTE AND VENT PIPING**

**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 SUMMARY**

- A. Section Includes:
  - 1. Pipe, tube, and fittings.
  - 2. Specialty pipe fittings.
- B. Related Sections:
  - 1. Section 22 1313 "Facility Sanitary Sewers" for sanitary sewerage piping and structures outside the building.

**1.3 PERFORMANCE REQUIREMENTS**

- A. Components and installation shall be capable of withstanding the following minimum working pressure unless otherwise indicated:
  - 1. Soil, Waste, and Vent Piping: 10-foot head of water.

**1.4 ACTION SUBMITTALS**

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

**1.5 INFORMATIONAL SUBMITTALS**

- A. Field quality-control reports.

**1.6 QUALITY ASSURANCE**

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- B. Comply with NSF/ANSI 14, "Plastics Piping Systems Components and Related Materials," for plastic piping components. Include marking with "NSF-dwv" for plastic drain, waste, and vent piping and "NSF-sewer" for plastic sewer piping.

## **PART 2 - PRODUCTS**

### **2.1 PIPING MATERIALS**

- A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

### **2.2 HUB-AND-SPIGOT, CAST-IRON SOIL PIPE AND FITTINGS**

- A. Pipe and Fittings: ASTM A 74, Service and Extra Heavy class(es).
- B. Gaskets: ASTM C 564, rubber.

### **2.3 HUBLESS, CAST-IRON SOIL PIPE AND FITTINGS**

- A. Pipe and Fittings: ASTM A 888 or CISPI 301.
- B. CISPI, Hubless-Piping Couplings:
  - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. ANACO-Husky.
    - b. Dallas Specialty & Mfg. Co.
    - c. Fernco Inc.
    - d. Matco-Norca, Inc.
    - e. MIFAB, Inc.
    - f. Mission Rubber Company; a division of MCP Industries, Inc.
    - g. Stant.
    - h. Tyler Pipe.
  - 2. Standards: ASTM C 1277 and CISPI 310.
  - 3. Description: Stainless-steel corrugated shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.
- C. Heavy-Duty, Hubless-Piping Couplings:
  - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. ANACO-Husky.
    - b. Clamp-All Corp.
    - c. Dallas Specialty & Mfg. Co.
    - d. MIFAB, Inc.
    - e. Mission Rubber Company; a division of MCP Industries, Inc.
    - f. Stant.
    - g. Tyler Pipe.
  - 2. Standards: ASTM C 1277 and ASTM C 1540.



3. Description: Stainless-steel shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.

## 2.4 PVC PIPE AND FITTINGS

- A. Solid-Wall PVC Pipe: ASTM D 2665, drain, waste, and vent.
- B. PVC Socket Fittings: ASTM D 2665, made to ASTM D 3311, drain, waste, and vent patterns and to fit Schedule 40 pipe.
- C. Adhesive Primer: ASTM F 656.
  1. Adhesive primer shall have a VOC content of 550 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
  2. Adhesive primer shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- D. Solvent Cement: ASTM D 2564.
  1. PVC solvent cement shall have a VOC content of 510 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
  2. Solvent cement shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

## 2.5 SPECIALTY PIPE FITTINGS

- A. Transition Couplings:
  1. General Requirements: Fitting or device for joining piping with small differences in OD's or of different materials. Include end connections same size as and compatible with pipes to be joined.
  2. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.
  3. Unshielded, Nonpressure Transition Couplings:
    - a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      - 1) Dallas Specialty & Mfg. Co.
      - 2) Fernco Inc.
      - 3) Mission Rubber Company; a division of MCP Industries, Inc.
      - 4) Plastic Oddities; a division of Diverse Corporate Technologies, Inc.
    - b. Standard: ASTM C 1173.
    - c. Description: Elastomeric, sleeve-type, reducing or transition pattern. Include shear ring and corrosion-resistant-metal tension band and tightening mechanism on each end.
    - d. Sleeve Materials:
      - 1) For Cast-Iron Soil Pipes: ASTM C 564, rubber.

- 2) For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
- 3) For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.

4. Shielded, Nonpressure Transition Couplings:

- a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - 1) Cascade Waterworks Mfg. Co.
  - 2) Mission Rubber Company; a division of MCP Industries, Inc.
- b. Standard: ASTM C 1460.
- c. Description: Elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.

## **PART 3 - EXECUTION**

### **3.1 EARTH MOVING**

- A. Comply with requirements for excavating, trenching, and backfilling specified in Section 31 2000 "Earth Moving."

### **3.2 PIPING INSTALLATION**

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.
- B. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
- C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- E. Install piping to permit valve servicing.
- F. Install piping at indicated slopes.
- G. Install piping free of sags and bends.
- H. Install fittings for changes in direction and branch connections.
- I. Install piping to allow application of insulation.

- J. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical. Use long-turn, double Y-branch and 1/8-bend fittings if two fixtures are installed back to back or side by side with common drain pipe. Straight tees, elbows, and crosses may be used on vent lines. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.
- K. Lay buried building drainage piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.
- L. Install soil and waste drainage and vent piping at the following minimum slopes unless otherwise indicated:
  - 1. Building Sanitary Drain: 2 percent downward in direction of flow for piping NPS 3 and smaller; 1 percent downward in direction of flow for piping NPS 4 and larger.
  - 2. Horizontal Sanitary Drainage Piping: 2 percent downward in direction of flow.
  - 3. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.
- M. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."
- N. Install aboveground PVC piping according to ASTM D 2665.
- O. Install engineered soil and waste drainage and vent piping systems as follows:
  - 1. Combination Waste and Vent: Comply with standards of authorities having jurisdiction.
- P. Plumbing Specialties:
  - 1. Install backwater valves in sanitary waster gravity-flow piping. Comply with requirements for backwater valves specified in Section 22 1319 "Sanitary Waste Piping Specialties."
  - 2. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers in sanitary drainage gravity-flow piping. Install cleanout fitting with closure plug inside the building in sanitary drainage force-main piping. Comply with requirements for cleanouts specified in Section 22 1319 "Sanitary Waste Piping Specialties."
  - 3. Install drains in sanitary drainage gravity-flow piping. Comply with requirements for drains specified in Section 22 1319 "Sanitary Waste Piping Specialties."
- Q. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.
- R. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 22 0517 "Sleeves and Sleeve Seals for Plumbing Piping."
- S. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 22 0517 "Sleeves and Sleeve Seals for Plumbing Piping."

- T. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 22 0518 "Escutcheons for Plumbing Piping."

### **3.3 JOINT CONSTRUCTION**

- A. Join hub-and-spigot, cast-iron soil piping with gasket joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.
- B. Join hubless, cast-iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-piping coupling joints.
- C. Plastic, Nonpressure-Piping, Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
  - 1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
  - 2. PVC Piping: Join according to ASTM D 2855 and ASTM D 2665 Appendixes.

### **3.4 SPECIALTY PIPE FITTING INSTALLATION**

- A. Transition Couplings:
  - 1. Install transition couplings at joints of piping with small differences in OD's.
  - 2. In Drainage Piping: Shielded, nonpressure transition couplings.

### **3.5 HANGER AND SUPPORT INSTALLATION**

- A. Comply with requirements for seismic-restraint devices specified in Section 22 0548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."
- B. Comply with requirements for pipe hanger and support devices and installation specified in Section 22 0529 "Hangers and Supports for Plumbing Piping and Equipment."
  - 1. Install carbon-steel pipe hangers for horizontal piping in noncorrosive environments.
  - 2. Install carbon-steel pipe support clamps for vertical piping in noncorrosive environments.
  - 3. Vertical Piping: MSS Type 8 or Type 42, clamps.
  - 4. Install individual, straight, horizontal piping runs:
    - a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
    - b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
    - c. Longer Than 100 Feet if Indicated: MSS Type 49, spring cushion rolls.
  - 5. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
  - 6. Base of Vertical Piping: MSS Type 52, spring hangers.
- C. Support horizontal piping and tubing within 12 inches of each fitting and coupling.
- D. Support vertical piping and tubing at base and at each floor.
- E. Rod diameter may be reduced one size for double-rod hangers, with 3/8-inch minimum rods.

- F. Install hangers for cast-iron soil piping with the following maximum horizontal spacing and minimum rod diameters:
  - 1. NPS 1-1/2 and NPS 2: 60 inches with 3/8-inch rod.
  - 2. NPS 3: 60 inches with 1/2-inch rod.
  - 3. NPS 4 and NPS 5: 60 inches with 5/8-inch rod.
  - 4. NPS 6 and NPS 8: 60 inches with 3/4-inch rod.
  - 5. NPS 10 and NPS 12: 60 inches with 7/8-inch rod.
  - 6. Spacing for 10-foot lengths may be increased to 10 feet. Spacing for fittings is limited to 60 inches.
- G. Install supports for vertical cast-iron soil piping every 15 feet.
- H. Install hangers for PVC piping with the following maximum horizontal spacing and minimum rod diameters:
  - 1. NPS 1-1/2 and NPS 2: 48 inches with 3/8-inch rod.
  - 2. NPS 3: 48 inches with 1/2-inch rod.
  - 3. NPS 4 and NPS 5: 48 inches with 5/8-inch rod.
  - 4. NPS 6 and NPS 8: 48 inches with 3/4-inch rod.
  - 5. NPS 10 and NPS 12: 48 inches with 7/8-inch rod.
- I. Install supports for vertical PVC piping every 48 inches.
- J. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

### **3.6 CONNECTIONS**

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.
- C. Connect drainage and vent piping to the following:
  - 1. Plumbing Fixtures: Connect drainage piping in sizes indicated, but not smaller than required by plumbing code.
  - 2. Plumbing Fixtures and Equipment: Connect atmospheric vent piping in sizes indicated, but not smaller than required by authorities having jurisdiction.
  - 3. Plumbing Specialties: Connect drainage and vent piping in sizes indicated, but not smaller than required by plumbing code.
  - 4. Install test tees (wall cleanouts) in conductors near floor and floor cleanouts with cover flush with floor.
  - 5. Install horizontal backwater valves in pit with pit cover flush with floor.
  - 6. Comply with requirements for backwater valves, cleanouts, and drains specified in Section 22 1319 "Sanitary Waste Piping Specialties."
  - 7. Equipment: Connect drainage piping as indicated. Provide shutoff valve if indicated and union for each connection. Use flanges instead of unions for connections NPS 2-1/2 and larger.
- D. Where installing piping adjacent to equipment, allow space for service and maintenance of equipment.

- E. Make connections according to the following unless otherwise indicated:
  - 1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.
  - 2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.

### **3.7 IDENTIFICATION**

- A. Identify exposed sanitary waste and vent piping. Comply with requirements for identification specified in Section 22 0553 "Identification for Plumbing Piping and Equipment."

### **3.8 FIELD QUALITY CONTROL**

- A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.
  - 1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
  - 2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
- B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.
- C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
- D. Test sanitary drainage and vent piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:
  - 1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
  - 2. Leave uncovered and unconcealed new, altered, extended, or replaced drainage and vent piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
  - 3. Roughing-in Plumbing Test Procedure: Test drainage and vent piping except outside leaders on completion of roughing-in. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water. From 15 minutes before inspection starts to completion of inspection, water level must not drop. Inspect joints for leaks.
  - 4. Finished Plumbing Test Procedure: After plumbing fixtures have been set and traps filled with water, test connections and prove they are gastight and watertight. Plug vent-stack openings on roof and building drains where they leave building. Introduce air into piping system equal to pressure of 1-inch wg. Use U-tube or manometer inserted in trap of water closet to measure this pressure. Air pressure must remain constant without introducing additional air throughout period of inspection. Inspect plumbing fixture connections for gas and water leaks.
  - 5. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
  - 6. Prepare reports for tests and required corrective action.

### **3.9 CLEANING AND PROTECTION**

- A. Clean interior of piping. Remove dirt and debris as work progresses.
- B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.
- C. Place plugs in ends of uncompleted piping at end of day and when work stops.
- D. Exposed PVC Piping: Protect plumbing vents exposed to sunlight with two coats of water-based latex paint.

### **3.10 PIPING SCHEDULE**

- A. Flanges and unions may be used on aboveground pressure piping unless otherwise indicated.
- B. Aboveground, soil and waste piping NPS 4 and smaller shall be the following:
  - 1. Hubless, cast-iron soil pipe and fittings; hubless-piping couplings; and coupled joints.
  - 2. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
  - 3. Dissimilar Pipe-Material Couplings: Shielded, nonpressure transition couplings.
- C. Aboveground, soil and waste piping NPS 5 and larger shall be the following:
  - 1. Hubless, cast-iron soil pipe and fittings; hubless-piping couplings; and coupled joints.
  - 2. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
  - 3. Dissimilar Pipe-Material Couplings: Shielded, nonpressure transition couplings.
- D. Aboveground, vent piping NPS 4 and smaller shall be the following:
  - 1. Hubless, cast-iron soil pipe and fittings; hubless-piping couplings; and coupled joints.
  - 2. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
  - 3. Dissimilar Pipe-Material Couplings: Shielded, nonpressure transition couplings.
- E. Aboveground, vent piping NPS 5 and larger shall be the following:
  - 1. Hubless, cast-iron soil pipe and fittings; hubless-piping couplings; and coupled joints.
  - 2. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
  - 3. Dissimilar Pipe-Material Couplings: Shielded, nonpressure transition couplings.
- F. Underground, soil, waste, and vent piping NPS 4 and smaller shall be the following:
  - 1. Service class, cast-iron soil piping; gaskets; and gasketed joints.
  - 2. Solid wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
  - 3. Dissimilar Pipe-Material Couplings: Shielded, nonpressure transition couplings.
- G. Underground, soil and waste piping NPS 5 and larger shall be the following:
  - 1. Service class, cast-iron soil piping; gaskets; and gasketed joints.
  - 2. Hubless, cast-iron soil pipe and fittings; hubless-piping couplings; coupled joints.
  - 3. Solid-wall PVC pipe; PVC socket fittings; and solvent-cemented joints.
  - 4. Dissimilar Pipe-Material Couplings: Shielded, nonpressure transition couplings.

**END OF SECTION**





## **SECTION 22 1319**

### **SANITARY WASTE PIPING SPECIALTIES**

#### **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 SUMMARY**

- A. Section Includes:
  - 1. Cleanouts.
  - 2. Floor drains.
  - 3. Air-admittance valves.
  - 4. Miscellaneous sanitary drainage piping specialties.

##### **1.3 DEFINITIONS**

- A. ABS: Acrylonitrile-butadiene-styrene plastic.
- B. FRP: Fiberglass-reinforced plastic.
- C. HDPE: High-density polyethylene plastic.
- D. PE: Polyethylene plastic.
- E. PP: Polypropylene plastic.
- F. PVC: Polyvinyl chloride plastic.

##### **1.4 ACTION SUBMITTALS**

- A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and accessories.

##### **1.5 INFORMATIONAL SUBMITTALS**

- A. Field quality-control reports.

##### **1.6 CLOSEOUT SUBMITTALS**

- A. Operation and Maintenance Data: For drainage piping specialties to include in emergency, operation, and maintenance manuals.

## 1.7 QUALITY ASSURANCE

- A. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.
- B. Comply with NSF 14, "Plastics Piping Components and Related Materials," for plastic sanitary piping specialty components.

## 1.8 COORDINATION

- A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Section 03 3000 "Cast-in-Place Concrete."
- B. Coordinate size and location of roof penetrations.

## PART 2 - PRODUCTS

### 2.1 CLEANOUTS

- A. Exposed Metal Cleanouts:
  - 1. ASME A112.36.2M, Cast-Iron Cleanouts:
    - a. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
      - 1) Josam Company.
      - 2) MIFAB, Inc.
      - 3) Smith, Jay R. Mfg. Co.
      - 4) Tyler Pipe.
      - 5) Watts Drainage Products.
      - 6) Zurn Plumbing Products Group.
  - 2. Standard: ASME A112.36.2M for cast iron for cleanout test tee.
  - 3. Size: Same as connected drainage piping
  - 4. Body Material: Hub-and-spigot, cast-iron soil pipe T-branch or hubless, cast-iron soil pipe test tee as required to match connected piping.
  - 5. Closure: Countersunk or raised-head, brass or cast-iron plug.
  - 6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.
- B. Metal Floor Cleanouts:
  - 1. ASME A112.36.2M, Cast-Iron Cleanouts:
    - a. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
      - 1) Josam Company.
      - 2) Smith, Jay R. Mfg. Co.
      - 3) Tyler Pipe.
      - 4) Watts Drainage Products.
      - 5) Zurn Plumbing Products Group.

2. Standard: ASME A112.36.2M for adjustable housing cleanout.
3. Size: Same as connected branch.
4. Type: Adjustable housing.
5. Body or Ferrule: Cast iron.
6. Closure: Brass plug with straight threads and gasket.
7. Adjustable Housing Material: Cast iron.
8. Frame and Cover Material and Finish: Nickel-bronze, copper alloy.
9. Frame and Cover Shape: Round.
10. Top Loading Classification: Heavy Duty.
11. Riser: ASTM A 74, Service class, cast-iron drainage pipe fitting and riser to cleanout.
12. Standard: ASME A112.3.1.
13. Size: Same as connected branch.
14. Housing: Stainless steel.
15. Closure: Stainless steel with seal.
16. Riser: Stainless-steel drainage pipe fitting to cleanout.

C. Cast-Iron Wall Cleanouts:

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
  - a. Josam Company; Josam Div.
  - b. MIFAB, Inc.
  - c. Smith, Jay R. Mfg. Co.
  - d. Tyler Pipe; Wade Div.
  - e. Watts Drainage Products.
  - f. Zurn Plumbing Products Group; Specification Drainage Operation.
2. Standard: ASME A112.36.2M. Include wall access.
3. Size: Same as connected drainage piping.
4. Body: Hub-and-spigot, cast-iron soil pipe T-branch or hubless, cast-iron soil pipe test tee as required to match connected piping.
5. Closure: Countersunk, brass or cast-iron plug.
6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.
7. Wall Access Coverplate: Round, flat, stainless-steel cover plate with screw.
8. Wall Access: Square, nickel-bronze, copper-alloy, or stainless-steel wall-installation frame and cover.

## 2.2 FLOOR DRAINS

A. Cast-Iron Floor Drains:

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
  - a. Josam Company; Josam Div.
  - b. MIFAB, Inc.
  - c. Smith, Jay R. Mfg. Co.
  - d. Tyler Pipe; Wade Div.
  - e. Watts Drainage Products.
  - f. Zurn Plumbing Products Group; Specification Drainage Operation.
2. Standard: ASME A112.6.3.
3. Pattern: Floor drain.
4. Body Material: Gray iron.
5. Top of Body and Strainer Finish: Polished bronze.
6. Funnel: Refer to Drawings.
7. Trap Material: Cast iron.

8. Trap Pattern: Deep-seal P-trap.
9. Trap Features: Trap-seal primer valve drain connection.

## 2.3 AIR-ADMITTANCE VALVES

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - a. Ayrlett, LLC.
  - b. Durgo, Inc.
  - c. Oatey.
  - d. ProSet Systems Inc.
  - e. RectorSeal.
  - f. Studor, Inc.
2. Standard: ASSE 1051, Type A for single fixture or Type B for branch piping.
3. Housing: Plastic.
4. Operation: Mechanical sealing diaphragm.
5. Size: Same as connected fixture or branch vent piping.

### B. Stack Air-Admittance Valves:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - a. Durgo, Inc.
  - b. Oatey.
  - c. Studor, Inc.
2. Standard: ASSE 1050 for vent stacks.
3. Housing: Plastic.
4. Operation: Mechanical sealing diaphragm.
5. Size: Same as connected stack vent or vent stack.

## 2.4 MISCELLANEOUS SANITARY DRAINAGE PIPING SPECIALTIES

### A. Open Drains:

1. Description: Shop or field fabricate from ASTM A 74, Service class, hub-and-spigot, cast-iron, soil-pipe fittings. Include P-trap, hub-and-spigot riser section; and where required, increaser fitting joined with ASTM C 564, rubber gaskets.
2. Size: Same as connected waste piping.

### B. Deep-Seal Traps:

1. Description: Cast-iron or bronze casting, with inlet and outlet matching connected piping and cleanout trap-seal primer valve connection.
2. Size: Same as connected waste piping.
  - a. NPS 2: 4-inch- minimum water seal.
  - b. NPS 2-1/2 and Larger: 5-inch- minimum water seal.

C. Floor-Drain, Trap-Seal Primer Fittings:

1. Description: Cast iron, with threaded inlet and threaded or spigot outlet, and trap-seal primer valve connection.
2. Size: Same as floor drain outlet with NPS 1/2 side inlet.

D. Air-Gap Fittings:

1. Standard: ASME A112.1.2, for fitting designed to ensure fixed, positive air gap between installed inlet and outlet piping.
2. Body: Bronze or cast iron.
3. Inlet: Opening in top of body.
4. Outlet: Larger than inlet.
5. Size: Same as connected waste piping and with inlet large enough for associated indirect waste piping.

E. Expansion Joints:

1. Standard: ASME A112.21.2M.
2. Body: Cast iron with bronze sleeve, packing, and gland.
3. End Connections: Matching connected piping.
4. Size: Same as connected soil, waste, or vent piping.

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION**

- A. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:
1. Size same as drainage piping up to NPS 4. Use NPS 4 for larger drainage piping unless larger cleanout is indicated.
  2. Locate at each change in direction of piping greater than 45 degrees.
  3. Locate at minimum intervals of 50 feet for piping NPS 4 and smaller and 100 feet for larger piping.
  4. Locate at base of each vertical soil and waste stack.
- B. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.
- C. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.
- D. Install floor drains at low points of surface areas to be drained. Set grates of drains flush with finished floor, unless otherwise indicated.
1. Position floor drains for easy access and maintenance.
  2. Set floor drains below elevation of surrounding finished floor to allow floor drainage. Set with grates depressed according to the following drainage area radii:
    - a. Radius, 30 Inches or Less: Equivalent to 1 percent slope, but not less than 1/4-inch total depression.
    - b. Radius, 30 to 60 Inches: Equivalent to 1 percent slope.

- c. Radius, 60 Inches or Larger: Equivalent to 1 percent slope, but not greater than 1-inch total depression.
- 3. Install floor-drain flashing collar or flange so no leakage occurs between drain and adjoining flooring. Maintain integrity of waterproof membranes where penetrated.
- 4. Install individual traps for floor drains connected to sanitary building drain, unless otherwise indicated.
- E. Install fixture air-admittance valves on fixture drain piping.
- F. Install stack air-admittance valves at top of stack vent and vent stack piping.
- G. Install flashing fittings on sanitary stack vents and vent stacks that extend through roof.
- H. Assemble open drain fittings and install with top of hub 2 inches above floor.
- I. Install deep-seal traps on floor drains and other waste outlets, if indicated.
- J. Install floor-drain, trap-seal primer fittings on inlet to floor drains that require trap-seal primer connection.
  - 1. Exception: Fitting may be omitted if trap has trap-seal primer connection.
  - 2. Size: Same as floor drain inlet.
- K. Install air-gap fittings on draining-type backflow preventers and on indirect-waste piping discharge into sanitary drainage system.
- L. Install sleeve flashing device with each riser and stack passing through floors with waterproof membrane.
- M. Install vent caps on each vent pipe passing through roof.
- N. Install expansion joints on vertical stacks and conductors. Position expansion joints for easy access and maintenance.
- O. Install wood-blocking reinforcement for wall-mounting-type specialties.
- P. Install traps on plumbing specialty drain outlets. Omit traps on indirect wastes unless trap is indicated.

### **3.2 CONNECTIONS**

- A. Comply with requirements in Section 22 1316 "Sanitary Waste and Vent Piping" for piping installation requirements. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to equipment to allow service and maintenance.

### **3.3 PROTECTION**

- A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.

- B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

**END OF SECTION**





**SECTION 22 1413**  
**FACILITY STORM DRAINAGE PIPING**

**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 SUMMARY**

- A. Section Includes:
  - 1. Pipe, tube, and fittings.
  - 2. Specialty pipe fittings.

**1.3 PERFORMANCE REQUIREMENTS**

- A. Components and installation shall be capable of withstanding the following minimum working pressure unless otherwise indicated:
  - 1. Storm Drainage Piping: 10-foot head of water.

**1.4 ACTION SUBMITTALS**

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

**1.5 INFORMATIONAL SUBMITTALS**

- A. Field quality-control reports.

**1.6 QUALITY ASSURANCE**

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- B. Comply with NSF/ANSI 14, "Plastics Piping System Components and Related Materials," for plastic piping components. Include marking with "NSF-drain" for plastic drain piping and "NSF-sewer" for plastic sewer piping.

## **PART 2 - PRODUCTS**

### **2.1 PIPING MATERIALS**

- A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

### **2.2 HUB-AND-SPIGOT, CAST-IRON SOIL PIPE AND FITTINGS**

- A. Pipe and Fittings: ASTM A 74, Service classes.
- B. Gaskets: ASTM C 564, rubber.

### **2.3 HUBLESS, CAST-IRON SOIL PIPE AND FITTINGS**

- A. Pipe and Fittings: ASTM A 888 or CISPI 301.
- B. CISPI, Hubless-Piping Couplings:
  - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. ANACO-Husky.
    - b. Dallas Specialty & Mfg. Co.
    - c. Fernco Inc.
    - d. Matco-Norca, Inc.
    - e. MIFAB, Inc.
    - f. Mission Rubber Company; a division of MCP Industries, Inc.
    - g. Stant.
    - h. Tyler Pipe.
  - 2. Standards: ASTM C 1277 and CISPI 310.
  - 3. Description: Stainless-steel corrugated shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.
- C. Heavy-Duty, Hubless-Piping Couplings:
  - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. ANACO-Husky.
    - b. Clamp-All Corp.
    - c. Dallas Specialty & Mfg. Co.
    - d. MIFAB, Inc.
    - e. Mission Rubber Company; a division of MCP Industries, Inc.
    - f. Stant.
    - g. Tyler Pipe.
  - 2. Standards: ASTM C 1277 and ASTM C 1540.

3. Description: Stainless-steel shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.

## 2.4 PVC PIPE AND FITTINGS

- A. Solid-Wall PVC Pipe: ASTM D 2665, drain, waste, and vent.
- B. PVC Socket Fittings: ASTM D 2665, made to ASTM D 3311, drain, waste, and vent patterns and to fit Schedule 40 pipe.
- C. Adhesive Primer: ASTM F 656.
  1. Adhesive primer shall have a VOC content of 550 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- D. Solvent Cement: ASTM D 2564.
  1. PVC solvent cement shall have a VOC content of 510 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

## 2.5 SPECIALTY PIPE FITTINGS

- A. Transition Couplings:
  1. General Requirements: Fitting or device for joining piping with small differences in OD's or of different materials. Include end connections same size as and compatible with pipes to be joined.
  2. Fitting-Type Transition Couplings: Manufactured piping coupling or specified-piping-system fitting.
  3. Unshielded, Nonpressure Transition Couplings:
    - a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      - 1) Dallas Specialty & Mfg. Co.
      - 2) Fernco Inc.
      - 3) Mission Rubber Company; a division of MCP Industries, Inc.
      - 4) Plastic Oddities; a division of Diverse Corporate Technologies, Inc.
    - b. Standard: ASTM C 1173.
    - c. Description: Elastomeric, sleeve-type, reducing or transition pattern. Include shear ring and corrosion-resistant-metal tension band and tightening mechanism on each end.
    - d. Sleeve Materials:
      - 1) For Cast-Iron Soil Pipes: ASTM C 564, rubber.
      - 2) For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
      - 3) For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.
  4. Shielded, Nonpressure Transition Couplings:

- a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - 1) Cascade Waterworks Mfg. Co.
  - 2) Mission Rubber Company; a division of MCP Industries, Inc.
- b. Standard: ASTM C 1460.
- c. Description: Elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.

## **PART 3 - EXECUTION**

### **3.1 EARTH MOVING**

- A. Comply with requirements for excavating, trenching, and backfilling specified in Section 31 2000 "Earth Moving."

### **3.2 PIPING INSTALLATION**

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations from layout are approved on coordination drawings.
- B. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
- C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- E. Install piping to permit valve servicing.
- F. Install piping at indicated slopes.
- G. Install piping free of sags and bends.
- H. Install fittings for changes in direction and branch connections.
- I. Install piping to allow application of insulation.
- J. Make changes in direction for storm drainage piping using appropriate branches, bends, and long-sweep bends. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.
- K. Lay buried building storm drainage piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping

upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.

- L. Install storm drainage piping at the following minimum slopes unless otherwise indicated:
  - 1. Building Storm Drain: 2 percent downward in direction of flow for piping NPS 3 and smaller; 1 percent downward in direction of flow for piping NPS 4 and larger.
  - 2. Horizontal Storm-Drainage Piping: 2 percent downward in direction of flow.
- M. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."
- N. Install aboveground PVC piping according to ASTM D 2665.
- O. Install underground PVC piping according to ASTM D 2321.
- P. Install underground, ductile-iron, force-main piping according to AWWA C600. Install buried piping inside building between wall and floor penetrations and connection to storm sewer piping outside building with restrained joints. Anchor pipe to wall or floor. Install thrust-block supports at vertical and horizontal offsets.
- Q. Plumbing Specialties:
  - 1. Install backwater valves in storm drainage gravity-flow piping. Comply with requirements for backwater valves specified in Section 22 1423 "Storm Drainage Piping Specialties."
  - 2. Install cleanouts at grade and extend to where building storm drains connect to building storm sewers in storm drainage gravity-flow piping. Install cleanout fitting with closure plug inside the building in storm drainage force-main piping. Comply with requirements for cleanouts specified in Section 22 1423 "Storm Drainage Piping Specialties."
  - 3. Install drains in storm drainage gravity-flow piping. Comply with requirements for drains specified in Section 22 1423 "Storm Drainage Piping Specialties."
- R. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.
- S. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 22 0517 "Sleeves and Sleeve Seals for Plumbing Piping."
- T. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 22 0517 "Sleeves and Sleeve Seals for Plumbing Piping."
- U. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 22 0518 "Escutcheons for Plumbing Piping."

### **3.3 JOINT CONSTRUCTION**

- A. Hub-and-Spigot, Cast-Iron Soil Piping Gasketed Joints: Join according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.
- B. Hubless, Cast-Iron Soil Piping Coupled Joints: Join according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-piping coupling joints.

- C. Plastic, Nonpressure-Piping, Solvent-Cemented Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:

1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
2. PVC Piping: Join according to ASTM D 2855 and ASTM D 2665 Appendixes.

### **3.4 SPECIALTY PIPE FITTING INSTALLATION**

- A. Transition Couplings:

1. Install transition couplings at joints of piping with small differences in OD's.
2. In Drainage Piping: Shielded, nonpressure transition couplings.

### **3.5 VALVE INSTALLATION**

- A. General valve installation requirements are specified in Section 22 0523 "General-Duty Valves for Plumbing Piping."

- B. Backwater Valves: Install backwater valves in piping subject to backflow.

1. Horizontal Piping: Horizontal backwater valves. Use normally closed type unless otherwise indicated.
2. Install backwater valves in accessible locations.
3. Comply with requirements for backwater valves specified in Section 22 1423 "Storm Drainage Piping Specialties."

### **3.6 HANGER AND SUPPORT INSTALLATION**

- A. Comply with requirements for pipe hanger and support devices and installation specified in Section 22 0529 "Hangers and Supports for Plumbing Piping and Equipment."

1. Install carbon-steel pipe hangers for horizontal piping in noncorrosive environments.
2. Install stainless-steel pipe hangers for horizontal piping in corrosive environments.
3. Install carbon-steel pipe support clamps for vertical piping in noncorrosive environments.
4. Install stainless-steel pipe support clamps for vertical piping in corrosive environments.
5. Vertical Piping: MSS Type 8 or Type 42, clamps.
6. Individual, Straight, Horizontal Piping Runs:
  - a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
  - b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
  - c. Longer Than 100 Feet if Indicated: MSS Type 49, spring cushion rolls.
7. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
8. Base of Vertical Piping: MSS Type 52, spring hangers.

- B. Support horizontal piping and tubing within 12 inches of each fitting and coupling.

- C. Support vertical piping and tubing at base and at each floor.

- D. Rod diameter may be reduced one size for double-rod hangers, with 3/8-inch minimum rods.

- E. Install hangers for cast-iron soil piping with the following maximum horizontal spacing and minimum rod diameters:
  - 1. NPS 1-1/2 and NPS 2: 60 inches with 3/8-inch rod.
  - 2. NPS 3: 60 inches with 1/2-inch rod.
  - 3. NPS 4 and NPS 5: 60 inches with 5/8-inch rod.
  - 4. NPS 6 and NPS 8: 60 inches with 3/4-inch rod.
  - 5. NPS 10 and NPS 12: 60 inches with 7/8-inch rod.
  - 6. Spacing for 10-foot pipe lengths may be increased to 10 feet. Spacing for fittings is limited to 60 inches.
- F. Install supports for vertical cast-iron soil piping every 15 feet.
- G. Install hangers for PVC piping with the following maximum horizontal spacing and minimum rod diameters:
  - 1. NPS 1-1/2 and NPS 2: 48 inches with 3/8-inch rod.
  - 2. NPS 3: 48 inches with 1/2-inch rod.
  - 3. NPS 4 and NPS 5: 48 inches with 5/8-inch rod.
  - 4. NPS 6 and NPS 8: 48 inches with 3/4-inch rod.
  - 5. NPS 10 and NPS 12: 48 inches with 7/8-inch rod.
- H. Install supports for vertical PVC piping every 48 inches.
- I. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

### **3.7 CONNECTIONS**

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect interior storm drainage piping to exterior storm drainage piping. Use transition fitting to join dissimilar piping materials.
- C. Connect storm drainage piping to roof drains and storm drainage specialties.
  - 1. Install test tees (wall cleanouts) in conductors near floor, and floor cleanouts with cover flush with floor.
  - 2. Install horizontal backwater valves in pit with pit cover flush with floor.
  - 3. Comply with requirements for backwater valves cleanouts and drains specified in Section 22 1423 "Storm Drainage Piping Specialties."
- D. Where installing piping adjacent to equipment, allow space for service and maintenance of equipment.
- E. Make connections according to the following unless otherwise indicated:
  - 1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.
  - 2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.

### **3.8 IDENTIFICATION**

- A. Identify exposed storm drainage piping. Comply with requirements for identification specified in Section 22 0553 "Identification for Plumbing Piping and Equipment."

### **3.9 FIELD QUALITY CONTROL**

- A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.
  - 1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in.
  - 2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
- B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.
- C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
- D. Test storm drainage piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:
  - 1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
  - 2. Leave uncovered and unconcealed new, altered, extended, or replaced storm drainage piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
  - 3. Test Procedure: Test storm drainage piping on completion of roughing-in. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water. From 15 minutes before inspection starts until completion of inspection, water level must not drop. Inspect joints for leaks.
  - 4. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
  - 5. Prepare reports for tests and required corrective action.

### **3.10 CLEANING**

- A. Clean interior of piping. Remove dirt and debris as work progresses.
- B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.
- C. Place plugs in ends of uncompleted piping at end of day and when work stops.

### **3.11 PIPING SCHEDULE**

- A. Flanges and unions may be used on aboveground pressure piping unless otherwise indicated.
- B. Aboveground storm drainage piping NPS 6 and smaller shall be the following:



1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
  2. Hubless, cast-iron soil pipe and fittings; hubless-piping couplings; and coupled joints.
  3. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
  4. Dissimilar Pipe-Material Couplings: Shielded, nonpressure transition couplings.
- C. Aboveground, storm drainage piping NPS 8 and larger shall be the following:
1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
  2. Hubless, cast-iron soil pipe and fittings; hubless-piping couplings; and coupled joints.
  3. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
  4. Dissimilar Pipe-Material Couplings: Shielded, nonpressure transition couplings.
- D. Underground storm drainage piping NPS 6 and smaller shall be the following:
1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
  2. Hubless, cast-iron soil pipe and fittings; hubless-piping couplings; and coupled joints.
  3. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
  4. Dissimilar Pipe-Material Couplings: Shielded, nonpressure transition couplings.
- E. Underground, storm drainage piping NPS 8 and larger shall be the following:
1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
  2. Hubless, cast-iron soil pipe and fittings; hubless-piping couplings; and coupled joints.
  3. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
  4. Dissimilar Pipe-Material Couplings: Shielded, nonpressure transition couplings.

#### **END OF SECTION**



## SECTION 22 1423

### STORM DRAINAGE PIPING SPECIALTIES

#### 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 SUMMARY

- A. Section Includes:
  - 1. Roof drains.
  - 2. Miscellaneous storm drainage piping specialties.
  - 3. Through-penetration firestop assemblies.

##### 1.3 ACTION SUBMITTALS

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

##### 1.4 QUALITY ASSURANCE

- A. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.

#### PART 2 - PRODUCTS

##### 2.1 METAL ROOF DRAINS

- A. Cast-Iron, Large-Sump, General-Purpose Roof Drains:
  - 1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
    - a. Josam Company.
    - b. Marathon Roofing Products.
    - c. MIFAB, Inc.
    - d. Smith, Jay R. Mfg. Co.
    - e. Tyler Pipe.
    - f. Watts Water Technologies, Inc.
    - g. Zurn Plumbing Products Group; Specification Drainage Operation.
  - 2. Standard: ASME A112.6.4, for general-purpose roof drains.
  - 3. Body Material: Cast iron.
  - 4. Dimension of Body: Nominal 14-inch diameter.

5. Combination Flashing Ring and Gravel Stop: Required.
6. Outlet: Bottom.
7. Extension Collars: Required.
8. Underdeck Clamp: Required.
9. Sump Receiver Plate: Required.
10. Dome Material: Cast iron.
11. Water Dam: 2 inches high.

## **2.2 MISCELLANEOUS STORM DRAINAGE PIPING SPECIALTIES**

### **A. Downspout Adaptors:**

1. Description: Manufactured, gray-iron casting, for attaching to horizontal-outlet, parapet roof drain and to exterior, sheet metal downspout.
2. Size: Inlet size to match parapet drain outlet.

### **B. Downspout Boots:**

1. Description: Manufactured, ASTM A 48/A 48M, gray-iron casting, with strap or ears for attaching to building; NPS 4 outlet; and shop-applied bituminous coating.
2. Size: Inlet size to match downspout and NPS 4 outlet.

### **C. Conductor Nozzles:**

1. Description: Bronze body with threaded inlet and bronze wall flange with mounting holes.
2. Size: Same as connected conductor.

## **2.3 THROUGH-PENETRATION FIRESTOP ASSEMBLIES**

### **A. Through-Penetration Firestop Assemblies:**

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - a. ProSet Systems Inc.
2. Standard: ASTM E 814, for through-penetration firestop assemblies.
3. Certification and Listing: Intertek Testing Service NA for through-penetration firestop assemblies.
4. Size: Same as connected pipe.
5. Sleeve: Molded PVC plastic, of length to match slab thickness and with integral nailing flange on one end for installation in cast-in-place concrete slabs.
6. Stack Fitting: ASTM A 48/A 48M, gray-iron, hubless-pattern, wye branch with neoprene O-ring at base and gray-iron plug in thermal-release harness. Include PVC protective cap for plug.
7. Special Coating: Corrosion resistant on interior of fittings.

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION**

- A. Install roof drains at low points of roof areas according to roof membrane manufacturer's written installation instructions.
  - 1. Install flashing collar or flange of roof drain to prevent leakage between drain and adjoining roofing. Maintain integrity of waterproof membranes where penetrated.
  - 2. Install expansion joints, if indicated, in roof drain outlets.
  - 3. Position roof drains for easy access and maintenance.
- B. Install downspout adapters on outlet of back-outlet parapet roof drains and connect to sheet metal downspouts.
- C. Install downspout boots at grade with top 12 inches above grade. Secure to building wall.
- D. Install conductor nozzles at exposed bottom of conductors where they spill onto grade.
- E. Install cleanouts in aboveground piping and building drain piping according to the following instructions unless otherwise indicated:
  - 1. Use cleanouts the same size as drainage piping up to NPS 4. Use NPS 4 for larger drainage piping unless larger cleanout is indicated.
  - 2. Locate cleanouts at each change in direction of piping greater than 45 degrees.
  - 3. Locate cleanouts at minimum intervals of 50 feet for piping NPS 4 and smaller and 100 feet for larger piping.
  - 4. Locate cleanouts at base of each vertical soil and waste stack.
- F. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.
- G. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.
- H. Install test tees in vertical conductors and near floor.
- I. Install wall cleanouts in vertical conductors. Install access door in wall if indicated.
- J. Install trench drains at low points of surface areas to be drained. Set grates of drains flush with finished surface unless otherwise indicated.
- K. Assemble channel drainage system components according to manufacturer's written instructions. Install on support devices so that top will be flush with adjacent surface.
- L. Install through-penetration firestop assemblies in plastic conductors at concrete floor penetrations.
- M. Install sleeve flashing device with each conductor passing through floors with waterproof membrane.

### **3.2 CONNECTIONS**

- A. Comply with requirements for piping specified in Section 22 1413 "Facility Storm Drainage Piping." Drawings indicate general arrangement of piping, fittings, and specialties.

### **3.3 PROTECTION**

- A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.
- B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

**END OF SECTION**

## **SECTION 22 1429**

### **SUMP PUMPS**

#### **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 SUMMARY**

- A. Section Includes:
  - 1. Submersible sump pumps.
  - 2. Sump-pump basins and basin covers.
  - 3. Packaged drainage-pump units.

##### **1.3 ACTION SUBMITTALS**

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
- B. Wiring Diagrams: For power, signal, and control wiring.

##### **1.4 CLOSEOUT SUBMITTALS**

- A. Operation and Maintenance Data: For pumps and controls, to include in operation and maintenance manuals.

##### **1.5 QUALITY ASSURANCE**

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. UL Compliance: Comply with UL 778 for motor-operated water pumps.

##### **1.6 DELIVERY, STORAGE, AND HANDLING**

- A. Retain shipping flange protective covers and protective coatings during storage.
- B. Protect bearings and couplings against damage.
- C. Comply with pump manufacturer's written rigging instructions for handling.

## PART 2 - PRODUCTS

### 2.1 SUBMERSIBLE SUMP PUMPS

- A. Submersible, Fixed-Position, Single-Seal Sump Pumps:
1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
    - a. ABS Pumps Inc.
    - b. Barnes; Crane Pumps & Systems.
    - c. Bell & Gossett Domestic Pump; ITT Corporation.
    - d. Goulds Pumps; ITT Corporation.
    - e. Grundfos Pumps Corp.
    - f. Little Giant Pump Co.
    - g. Pentair Pump Group; Hydromatic Pumps.
    - h. Pentair Pump Group; Myers.
    - i. Weil Pump Company, Inc.
    - j. Zoeller Company.
  2. Description: Factory-assembled and -tested sump-pump unit.
  3. Pump Type: Submersible, end-suction, single-stage, close-coupled, overhung-impeller, centrifugal sump pump as defined in HI 1.1-1.2 and HI 1.3.
  4. Pump Casing: Cast iron, with strainer inlet, legs that elevate pump to permit flow into impeller, and vertical discharge for piping connection.
  5. Impeller: Statically and dynamically balanced, ASTM A 48/A 48M, Class No. 25 A cast iron and ASTM B 584, cast bronze, semiopen design for clear wastewater handling, and keyed and secured to shaft.
  6. Pump and Motor Shaft: Stainless steel or steel, with factory-sealed, grease-lubricated ball bearings.
  7. Seal: Mechanical.
  8. Motor: Hermetically sealed, capacitor-start type; with built-in overload protection; lifting eye or lug; and three-conductor, waterproof power cable of length required and with grounding plug and cable-sealing assembly for connection at pump.
  9. Controls:
    - a. Enclosure: NEMA 250, Type 4X.
    - b. Switch Type: Pedestal-mounted float switch with float rods and rod buttons.
    - c. Automatic Alternator: Start pumps on successive cycles and start multiple pumps if one cannot handle load.
    - d. Float Guides: Pipe or other restraint for floats and rods in basins of depth greater than 60 inches.
    - e. High-Water Alarm: Cover-mounted, compression-probe alarm, with electric bell; 120-V ac, with transformer and contacts for remote alarm bell.
  10. Control-Interface Features:
    - a. Remote Alarm Contacts: For remote alarm interface.
    - b. Building Automation System Interface: Auxiliary contacts in pump controls for interface to building automation system and capable of providing the following:
      - 1) On-off status of pump.
      - 2) Alarm status.



## 2.2 SUMP-PUMP BASINS AND BASIN COVERS

- A. Basins: Factory-fabricated, watertight, cylindrical, basin sump with top flange and sidewall openings for pipe connections.
  - 1. Material: Fiberglass or polyethylene.
  - 2. Reinforcement: Mounting plates for pumps, fittings, and accessories.
  - 3. Anchor Flange: Same material as or compatible with basin sump, cast in or attached to sump, in location and of size required to anchor basin in concrete slab.
- B. Basin Covers: Fabricate metal cover with openings having gaskets, seals, and bushings; for access to pumps, pump shafts, control rods, discharge piping, vent connections, and power cables.
  - 1. Reinforcement: Steel or cast iron, capable of supporting foot traffic for basins installed in foot-traffic areas.

## 2.3 PACKAGED DRAINAGE-PUMP UNITS

- A. Packaged Submersible Drainage-Pump Units:
  - 1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
    - a. ABS Pumps Inc.
    - b. Bell & Gossett Domestic Pump; ITT Corporation.
    - c. Goulds Pumps; ITT Corporation.
    - d. Grundfos Pumps Corp.
    - e. Little Giant Pump Co.
    - f. Pentair Pump Group; Hydromatic Pumps.
    - g. Pentair Pump Group; Myers.
    - h. Weil Pump Company, Inc.
    - i. Zoeller Company.
  - 2. Description: Factory-assembled and -tested, automatic-operation, basin-mounted, sump-pump unit.
  - 3. Pump Type: Submersible, end-suction, single-stage, close-coupled, overhung-impeller centrifugal pump as defined in HI 1.1-1.2 and HI 1.3.
  - 4. Casing: Metal.
  - 5. Impeller: Brass or thermoplastic.
  - 6. Pump Seal: Mechanical.
  - 7. Motor: Hermetically sealed, capacitor-start type, with built-in overload protection.
  - 8. Power Cord: Three-conductor, waterproof cable of length required but not less than 72 inches, with grounding plug and cable-sealing assembly for connection at pump.
  - 9. Pump Discharge Piping: Factory or field fabricated, galvanized, ASTM A 53/A 53M, Schedule 40, steel pipe with ASME B16.4, Class 125, gray iron threaded fittings.
  - 10. Control: Motor-mounted float switch.
  - 11. Basin: Plastic.

## 2.4 MOTORS

- A. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Section 22 0513 "Common Motor Requirements for Plumbing Equipment."

1. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
- B. Motors for submersible pumps shall be hermetically sealed.

### **PART 3 - EXECUTION**

#### **3.1 EARTHWORK**

- A. Excavation and filling are specified in Section 31 2000 "Earth Moving."

#### **3.2 EXAMINATION**

- A. Examine roughing-in for plumbing piping to verify actual locations of storm drainage piping connections before sump pump installation.

#### **3.3 INSTALLATION**

- A. Pump Installation Standards: Comply with HI 1.4 for installation of sump pumps.

#### **3.4 CONNECTIONS**

- A. Comply with requirements for piping specified in Section 22 1413 "Facility Storm Drainage Piping." Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to equipment to allow service and maintenance.

#### **3.5 FIELD QUALITY CONTROL**

- A. Perform tests and inspections.
- B. Tests and Inspections:
  1. Perform each visual and mechanical inspection.
  2. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
  3. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
  4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- C. Pumps and controls will be considered defective if they do not pass tests and inspections.
- D. Prepare test and inspection reports.

#### **3.6 STARTUP SERVICE**

- A. Perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.

### **3.7 ADJUSTING**

- A. Adjust pumps to function smoothly, and lubricate as recommended by manufacturer.
- B. Adjust control set points.

### **3.8 DEMONSTRATION**

- A. Train Owner's maintenance personnel to adjust, operate, and maintain controls and pumps.

**END OF SECTION**



## **SECTION 23 0517**

### **SLEEVES AND SLEEVE SEALS FOR HVAC PIPING**

#### **PART 1 - GENERAL**

##### **1.1 SUMMARY**

- A. Section Includes:
  - 1. Sleeves.
  - 2. Sleeve-seal systems.
  - 3. Grout.

##### **1.2 ACTION SUBMITTALS**

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

#### **PART 2 - PRODUCTS**

##### **2.1 SLEEVES**

- A. Cast-Iron Wall Pipes: Cast or fabricated of cast or ductile iron and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.
- B. Galvanized-Steel Wall Pipes: ASTM A 53/A 53M, Schedule 40, with plain ends and welded steel collar; zinc coated.
- C. Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, with plain ends.
- D. PVC-Pipe Sleeves: ASTM D 1785, Schedule 40.
- E. Galvanized-Steel-Sheet Sleeves: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.

##### **2.2 SLEEVE-SEAL SYSTEMS**

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - 1. Advance Products & Systems, Inc.
  - 2. CALPICO, Inc.
  - 3. Metraflex Company (The).
  - 4. Pipeline Seal and Insulator, Inc.
  - 5. Proco Products, Inc.

- B. Description: Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.
  - 1. Sealing Elements: NBR interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
  - 2. Pressure Plates: Carbon steel.
  - 3. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating, of length required to secure pressure plates to sealing elements.

## **2.3 GROUT**

- A. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
- B. Characteristics: Nonshrink; recommended for interior and exterior applications.
- C. Design Mix: 5000-psi, 28-day compressive strength.
- D. Packaging: Premixed and factory packaged.

## **PART 3 - EXECUTION**

### **3.1 SLEEVE INSTALLATION**

- A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.
- B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 1-inch annular clear space between piping and concrete slabs and walls.
  - 1. Sleeves are not required for core-drilled holes.
- C. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.
  - 1. Cut sleeves to length for mounting flush with both surfaces.
    - a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level.
  - 2. Using grout, seal the space outside of sleeves in slabs and walls without sleeve-seal system.
- D. Install sleeves for pipes passing through interior partitions.
  - 1. Cut sleeves to length for mounting flush with both surfaces.
  - 2. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.
  - 3. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint. Comply with requirements for sealants specified in Section 07 9200 "Joint Sealants."

- E. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for firestopping specified in Section 07 8413 "Penetration Firestopping."

### **3.2 SLEEVE-SEAL-SYSTEM INSTALLATION**

- A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building.
- B. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Position piping in center of sleeve. Center piping in penetration, assemble sleeve-seal system components, and install in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

### **3.3 SLEEVE AND SLEEVE-SEAL SCHEDULE**

- A. Use sleeves and sleeve seals for the following piping-penetration applications:
  - 1. Exterior Concrete Walls above Grade:
    - a. Piping Smaller Than NPS 6: Galvanized-steel wall sleeves.
    - b. Piping NPS 6 and Larger: Galvanized-steel wall sleeves.
  - 2. Exterior Concrete Walls below Grade:
    - a. Piping Smaller Than NPS 6: Cast-iron wall sleeves with sleeve-seal system.
      - 1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.
    - b. Piping NPS 6 and Larger: Cast-iron wall sleeves with sleeve-seal system.
      - 1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.
  - 3. Concrete Slabs above Grade:
    - a. Piping Smaller Than NPS 6: Galvanized-steel-pipe sleeves.
    - b. Piping NPS 6 and Larger: Galvanized-steel-pipe sleeves.
  - 4. Interior Partitions:
    - a. Piping Smaller Than NPS 6: Galvanized-steel-pipe sleeves.
    - b. Piping NPS 6 and Larger: Galvanized-steel-sheet sleeves.

**END OF SECTION**





## **SECTION 23 1123**

### **FACILITY NATURAL-GAS PIPING**

#### **PART 1 - GENERAL**

##### **1.1 SUMMARY**

- A. Section Includes:
  - 1. Pipes, tubes, and fittings.
  - 2. Piping specialties.
  - 3. Piping and tubing joining materials.
  - 4. Valves.
  - 5. Pressure regulators.

##### **1.2 PERFORMANCE REQUIREMENTS**

- A. Minimum Operating-Pressure Ratings:
  - 1. Piping and Valves: 100 psig minimum unless otherwise indicated.
  - 2. Service Regulators: 65 psig minimum unless otherwise indicated.
- B. Natural-Gas System Pressures within Buildings: Two pressure ranges. Primary pressure is more than 0.5 psig but not more than 2 psig, and is reduced to secondary pressure of 0.5 psig or less.
- C. Delegated Design: Design restraints and anchors for natural-gas piping and equipment, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

##### **1.3 ACTION SUBMITTALS**

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: For facility natural-gas piping layout. Include plans, piping layout and elevations, sections, and details for fabrication of pipe anchors, hangers, supports for multiple pipes, alignment guides, expansion joints and loops, and attachments of the same to building structure. Detail location of anchors, alignment guides, and expansion joints and loops.

##### **1.4 INFORMATIONAL SUBMITTALS**

- A. Welding certificates.
- B. Field quality-control reports.

##### **1.5 CLOSEOUT SUBMITTALS**

- A. Operation and maintenance data.

## **1.6 QUALITY ASSURANCE**

- A. Steel Support Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

## **PART 2 - PRODUCTS**

### **2.1 PIPES, TUBES, AND FITTINGS**

- A. Steel Pipe: ASTM A 53/A 53M, black steel, Schedule 40, Type E or S, Grade B.
  - 1. Malleable-Iron Threaded Fittings: ASME B16.3, Class 150, standard pattern.
  - 2. Wrought-Steel Welding Fittings: ASTM A 234/A 234M for butt welding and socket welding.
  - 3. Unions: ASME B16.39, Class 150, malleable iron with brass-to-iron seat, ground joint, and threaded ends.
  - 4. Protective Coating for Underground Piping: Factory-applied, three-layer coating of epoxy, adhesive, and PE.
    - a. Joint Cover Kits: Epoxy paint, adhesive, and heat-shrink PE sleeves.
- B. PE Pipe: ASTM D 2513, SDR 11.
  - 1. PE Fittings: ASTM D 2683, socket-fusion type or ASTM D 3261, butt-fusion type with dimensions matching PE pipe.
  - 2. PE Transition Fittings: Factory-fabricated fittings with PE pipe complying with ASTM D 2513, SDR 11; and steel pipe complying with ASTM A 53/A 53M, black steel, Schedule 40, Type E or S, Grade B.
  - 3. Anodeless Service-Line Risers: Factory fabricated and leak tested.
    - a. Underground Portion: PE pipe complying with ASTM D 2513, SDR 11 inlet.
    - b. Casing: Steel pipe complying with ASTM A 53/A 53M, Schedule 40, black steel, Type E or S, Grade B, with corrosion-protective coating covering. Vent casing aboveground.
    - c. Aboveground Portion: PE transition fitting.
    - d. Outlet shall be threaded or suitable for welded connection.
    - e. Tracer wire connection.
    - f. Ultraviolet shield.
    - g. Stake supports with factory finish to match steel pipe casing or carrier pipe.
  - 4. Transition Service-Line Risers: Factory fabricated and leak tested.
    - a. Underground Portion: PE pipe complying with ASTM D 2513, SDR 11 inlet connected to steel pipe complying with ASTM A 53/A 53M, Schedule 40, Type E or S, Grade B, with corrosion-protective coating for aboveground outlet.
    - b. Outlet shall be threaded or suitable for welded connection.
    - c. Bridging sleeve over mechanical coupling.
    - d. Factory-connected anode.

- e. Tracer wire connection.
- f. Ultraviolet shield.
- g. Stake supports with factory finish to match steel pipe casing or carrier pipe.

## **2.2 PIPING SPECIALTIES**

### **A. Appliance Flexible Connectors:**

- 1. Indoor, Fixed-Appliance Flexible Connectors: Comply with ANSI Z21.24.
- 2. Indoor, Movable-Appliance Flexible Connectors: Comply with ANSI Z21.69.
- 3. Outdoor, Appliance Flexible Connectors: Comply with ANSI Z21.75.
- 4. Corrugated stainless-steel tubing with polymer coating.
- 5. Operating-Pressure Rating: 0.5 psig.
- 6. End Fittings: Zinc-coated steel.
- 7. Threaded Ends: Comply with ASME B1.20.1.
- 8. Maximum Length: 72 inches

### **B. Quick-Disconnect Devices: Comply with ANSI Z21.41.**

- 1. Copper-alloy convenience outlet and matching plug connector.
- 2. Nitrile seals.
- 3. Hand operated with automatic shutoff when disconnected.
- 4. For indoor or outdoor applications.
- 5. Adjustable, retractable restraining cable.

### **C. Y-Pattern Strainers:**

- 1. Body: ASTM A 126, Class B, cast iron with bolted cover and bottom drain connection.
- 2. End Connections: Threaded ends for NPS 2 and smaller.
- 3. Strainer Screen: 40-mesh startup strainer, and perforated stainless-steel basket with 50 percent free area.
- 4. CWP Rating: 125 psig.

### **D. Weatherproof Vent Cap: Cast- or malleable-iron increaser fitting with corrosion-resistant wire screen, with free area at least equal to cross-sectional area of connecting pipe and threaded-end connection.**

## **2.3 JOINING MATERIALS**

### **A. Joint Compound and Tape: Suitable for natural gas.**

### **B. Welding Filler Metals: Comply with AWS D10.12/D10.12M for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.**

### **C. Brazing Filler Metals: Alloy with melting point greater than 1000 deg F complying with AWS A5.8/A5.8M. Brazing alloys containing more than 0.05 percent phosphorus are prohibited.**

## **2.4 MANUAL GAS SHUTOFF VALVES**

### **A. See "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles for where each valve type is applied in various services.**

### **B. General Requirements for Metallic Valves, NPS 2 and Smaller: Comply with ASME B16.33.**

- 1. CWP Rating: 125 psig.
- 2. Threaded Ends: Comply with ASME B1.20.1.

3. Dryseal Threads on Flare Ends: Comply with ASME B1.20.3.
4. Tamperproof Feature: Locking feature for valves indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
5. Listing: Listed and labeled by an NRTL acceptable to authorities having jurisdiction for valves 1 inch and smaller.
6. Service Mark: Valves 1-1/4 inches to NPS 2 shall have initials "WOG" permanently marked on valve body.

C. One-Piece, Bronze Ball Valve with Bronze Trim: MSS SP-110.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - a. BrassCraft Manufacturing Company; a Masco company.
  - b. Conbraco Industries, Inc.; Apollo Div.
  - c. Lyall, R. W. & Company, Inc.
  - d. McDonald, A. Y. Mfg. Co.
  - e. Perfection Corporation; a subsidiary of American Meter Company.
2. Body: Bronze, complying with ASTM B 584.
3. Ball: Chrome-plated brass.
4. Stem: Bronze; blowout proof.
5. Seats: Reinforced TFE; blowout proof.
6. Packing: Separate packnut with adjustable-stem packing threaded ends.
7. Ends: Threaded, flared, or socket as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
8. CWP Rating: 600 psig.
9. Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
10. Service: Suitable for natural-gas service with "WOG" indicated on valve body.

D. Two-Piece, Full-Port, Bronze Ball Valves with Bronze Trim: MSS SP-110.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - a. BrassCraft Manufacturing Company; a Masco company.
  - b. Conbraco Industries, Inc.; Apollo Div.
  - c. Lyall, R. W. & Company, Inc.
  - d. McDonald, A. Y. Mfg. Co.
  - e. Perfection Corporation; a subsidiary of American Meter Company.
2. Body: Bronze, complying with ASTM B 584.
3. Ball: Chrome-plated bronze.
4. Stem: Bronze; blowout proof.
5. Seats: Reinforced TFE; blowout proof.
6. Packing: Threaded-body packnut design with adjustable-stem packing.
7. Ends: Threaded, flared, or socket as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
8. CWP Rating: 600 psig.
9. Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
10. Service: Suitable for natural-gas service with "WOG" indicated on valve body.

E. Bronze Plug Valves: MSS SP-78.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - a. Lee Brass Company.
  - b. McDonald, A. Y. Mfg. Co.
2. Body: Bronze, complying with ASTM B 584.
3. Plug: Bronze.
4. Ends: Threaded, socket, as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
5. Operator: Square head or lug type with tamperproof feature where indicated.
6. Pressure Class: 125 psig.
7. Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
8. Service: Suitable for natural-gas service with "WOG" indicated on valve body.

F. PE Ball Valves: Comply with ASME B16.40.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - a. Kerotest Manufacturing Corp.
  - b. Lyall, R. W. & Company, Inc.
  - c. Perfection Corporation; a subsidiary of American Meter Company.
2. Body: PE.
3. Ball: PE.
4. Stem: Acetal.
5. Seats and Seals: Nitrile.
6. Ends: Plain or fusible to match piping.
7. CWP Rating: 80 psig.
8. Operating Temperature: Minus 20 to plus 140 deg F.
9. Operator: Nut or flat head for key operation.
10. Include plastic valve extension.
11. Include tamperproof locking feature for valves where indicated on Drawings.

G. Valve Boxes:

1. Cast-iron, two-section box.
2. Top section with cover with "GAS" lettering.
3. Bottom section with base to fit over valve and barrel a minimum of 5 inches in diameter.
4. Adjustable cast-iron extensions of length required for depth of bury.
5. Include tee-handle, steel operating wrench with socket end fitting valve nut or flat head, and with stem of length required to operate valve.

## 2.5 PRESSURE REGULATORS

A. General Requirements:

1. Single stage and suitable for natural gas.
2. Steel jacket and corrosion-resistant components.
3. Elevation compensator.

4. End Connections: Threaded for regulators NPS 2 and smaller.

B. Line Pressure Regulators: Comply with ANSI Z21.80.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - a. Actaris.
  - b. American Meter Company.
  - c. Eclipse Combustion, Inc.
  - d. Fisher Control Valves and Regulators; Division of Emerson Process Management.
  - e. Invensys.
  - f. Maxitrol Company.
  - g. Richards Industries; Jordan Valve Div.
2. Body and Diaphragm Case: Cast iron or die-cast aluminum.
3. Springs: Zinc-plated steel; interchangeable.
4. Diaphragm Plate: Zinc-plated steel.
5. Seat Disc: Nitrile rubber resistant to gas impurities, abrasion, and deformation at the valve port.
6. Orifice: Aluminum; interchangeable.
7. Seal Plug: Ultraviolet-stabilized, mineral-filled nylon.
8. Single-port, self-contained regulator with orifice no larger than required at maximum pressure inlet, and no pressure sensing piping external to the regulator.
9. Pressure regulator shall maintain discharge pressure setting downstream, and not exceed 150 percent of design discharge pressure at shutoff.
10. Overpressure Protection Device: Factory mounted on pressure regulator.
11. Atmospheric Vent: Factory- or field-installed, stainless-steel screen in opening if not connected to vent piping.

C. Appliance Pressure Regulators: Comply with ANSI Z21.18.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - a. Canadian Meter Company Inc.
  - b. Eaton Corporation; Controls Div.
  - c. Harper Wyman Co.
  - d. Maxitrol Company.
  - e. SCP, Inc.
2. Body and Diaphragm Case: Die-cast aluminum.
3. Springs: Zinc-plated steel; interchangeable.
4. Diaphragm Plate: Zinc-plated steel.
5. Seat Disc: Nitrile rubber.
6. Seal Plug: Ultraviolet-stabilized, mineral-filled nylon.
7. Factory-Applied Finish: Minimum three-layer polyester and polyurethane paint finish.
8. Regulator may include vent limiting device, instead of vent connection, if approved by authorities having jurisdiction.

## 2.6 DIELECTRIC UNIONS

A. Dielectric Unions:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - a. Capitol Manufacturing Company.
  - b. Central Plastics Company.
  - c. Hart Industries International, Inc.
  - d. Jomar International Ltd.
  - e. Matco-Norca, Inc.
  - f. McDonald, A. Y. Mfg. Co.
  - g. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
  - h. Wilkins; a Zurn company.
2. Description:
  - a. Standard: ASSE 1079.
  - b. Pressure Rating: 125 psig minimum at 180 deg F.
  - c. End Connections: Solder-joint copper alloy and threaded ferrous.

## **2.7 LABELING AND IDENTIFYING**

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

## **PART 3 - EXECUTION**

### **3.1 OUTDOOR PIPING INSTALLATION**

- A. Comply with the International Fuel Gas Code for installation and purging of natural-gas piping.
- B. Install underground, natural-gas piping buried at least 36 inches below finished grade. Comply with requirements in Section 31 2000 "Earth Moving" for excavating, trenching, and backfilling.
  1. If natural-gas piping is installed less than 36 inches below finished grade, install it in containment conduit.
- C. Install underground, PE, natural-gas piping according to ASTM D 2774.
- D. Steel Piping with Protective Coating:
  1. Apply joint cover kits to pipe after joining to cover, seal, and protect joints.
  2. Repair damage to PE coating on pipe as recommended in writing by protective coating manufacturer.
  3. Replace pipe having damaged PE coating with new pipe.
- E. Install fittings for changes in direction and branch connections.
- F. Install pressure gage downstream from each service regulator. Pressure gages are specified in Section 23 0519 "Meters and Gages for HVAC Piping."

### **3.2 INDOOR PIPING INSTALLATION**

- A. Comply with the International Fuel Gas Code for installation and purging of natural-gas piping.
- B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
- C. Arrange for pipe spaces, chases, slots, sleeves, and openings in building structure during progress of construction, to allow for mechanical installations.
- D. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
- E. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- F. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- G. Locate valves for easy access.
- H. Install natural-gas piping at uniform grade of 2 percent down toward drip and sediment traps.
- I. Install piping free of sags and bends.
- J. Install fittings for changes in direction and branch connections.
- K. Verify final equipment locations for roughing-in.
- L. Comply with requirements in Sections specifying gas-fired appliances and equipment for roughing-in requirements.
- M. Drips and Sediment Traps: Install drips at points where condensate may collect, including service-meter outlets. Locate where accessible to permit cleaning and emptying. Do not install where condensate is subject to freezing.
  - 1. Construct drips and sediment traps using tee fitting with bottom outlet plugged or capped. Use nipple a minimum length of 3 pipe diameters, but not less than 3 inches long and same size as connected pipe. Install with space below bottom of drip to remove plug or cap.
- N. Extend relief vent connections for service regulators, line regulators, and overpressure protection devices to outdoors and terminate with weatherproof vent cap.
- O. Conceal pipe installations in walls, pipe spaces, utility spaces, above ceilings, below grade or floors, and in floor channels unless indicated to be exposed to view.
- P. Use eccentric reducer fittings to make reductions in pipe sizes. Install fittings with level side down.
- Q. Connect branch piping from top or side of horizontal piping.



- R. Install unions in pipes NPS 2 and smaller, adjacent to each valve, at final connection to each piece of equipment.
- S. Do not use natural-gas piping as grounding electrode.
- T. Install strainer on inlet of each line-pressure regulator and automatic or electrically operated valve.
- U. Install pressure gage downstream from each line regulator. Pressure gages are specified in Section 22 0519 "Meters and Gages for Plumbing Piping."
- V. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 22 0517 "Sleeves and Sleeve Seals for Plumbing Piping."
- W. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 22 0517 "Sleeves and Sleeve Seals for Plumbing Piping."
- X. Install escutcheons for piping penetrations of walls, ceilings, and floors.

### **3.3 VALVE INSTALLATION**

- A. Install manual gas shutoff valve for each gas appliance ahead of corrugated stainless-steel tubing or copper connector.
- B. Install underground valves with valve boxes.
- C. Install regulators and overpressure protection devices with maintenance access space adequate for servicing and testing.
- D. Install earthquake valves aboveground outside buildings according to listing.
- E. Install anode for metallic valves in underground PE piping.

### **3.4 PIPING JOINT CONSTRUCTION**

- A. Ream ends of pipes and tubes and remove burrs.
- B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- C. Threaded Joints:
  - 1. Thread pipe with tapered pipe threads complying with ASME B1.20.1.
  - 2. Cut threads full and clean using sharp dies.
  - 3. Ream threaded pipe ends to remove burrs and restore full inside diameter of pipe.
  - 4. Apply appropriate tape or thread compound to external pipe threads unless dryseal threading is specified.
  - 5. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
- D. Welded Joints:
  - 1. Construct joints according to AWS D10.12/D10.12M, using qualified processes and welding operators.

2. Bevel plain ends of steel pipe.
  3. Patch factory-applied protective coating as recommended by manufacturer at field welds and where damage to coating occurs during construction.
- E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter.
- F. Flared Joints: Cut tubing with roll cutting tool. Flare tube end with tool to result in flare dimensions complying with SAE J513. Tighten finger tight, then use wrench. Do not overtighten.
- G. PE Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D 2657.
1. Plain-End Pipe and Fittings: Use butt fusion.
  2. Plain-End Pipe and Socket Fittings: Use socket fusion.

### **3.5 HANGER AND SUPPORT INSTALLATION**

- A. Comply with requirements for pipe hangers and supports specified in Section 22 0529 "Hangers and Supports for Plumbing Piping and Equipment."
- B. Install hangers for horizontal steel piping with the following maximum spacing and minimum rod sizes:
1. NPS 1 and Smaller: Maximum span, 96 inches; minimum rod size, 3/8 inch.
  2. NPS 1-1/4: Maximum span, 108 inches; minimum rod size, 3/8 inch.
  3. NPS 1-1/2 and NPS 2: Maximum span, 108 inches; minimum rod size, 3/8 inch.
- C. Install hangers for horizontal, corrugated stainless-steel tubing with the following maximum spacing and minimum rod sizes:
1. NPS 3/8: Maximum span, 48 inches; minimum rod size, 3/8 inch.
  2. NPS 1/2: Maximum span, 72 inches; minimum rod size, 3/8 inch.
  3. NPS 3/4 and Larger: Maximum span, 96 inches; minimum rod size, 3/8 inch.

### **3.6 CONNECTIONS**

- A. Connect to utility's gas main according to utility's procedures and requirements.
- B. Install natural-gas piping electrically continuous and bonded to gas appliance equipment grounding conductor of the circuit powering the appliance according to NFPA 70.
- C. Install piping adjacent to appliances to allow service and maintenance of appliances.
- D. Connect piping to appliances using manual gas shutoff valves and unions. Install valve within 72 inches of each gas-fired appliance and equipment. Install union between valve and appliances or equipment.
- E. Sediment Traps: Install tee fitting with capped nipple in bottom to form drip, as close as practical to inlet of each appliance.

### **3.7 LABELING AND IDENTIFYING**

- A. Comply with requirements in Section 22 0553 "Identification for Plumbing Piping and Equipment" for piping and valve identification.

- B. Install detectable warning tape directly above gas piping, 12 inches below finished grade, except 6 inches below subgrade under pavements and slabs.

### **3.8 FIELD QUALITY CONTROL**

- A. Test, inspect, and purge natural gas according to the International Fuel Gas Code and authorities having jurisdiction.
- B. Natural-gas piping will be considered defective if it does not pass tests and inspections.
- C. Prepare test and inspection reports.

### **3.9 PAINTING**

- A. Comply with requirements in Section 09 9113 "Exterior Painting" and Section 09 9123 "Interior Painting" for painting interior and exterior natural-gas piping.
- B. Paint exposed, exterior metal piping, valves, service regulators, service meters and meter bars, earthquake valves, and piping specialties, except components, with factory-applied paint or protective coating.
  - 1. Alkyd System: MPI EXT 5.1D.
    - a. Prime Coat: Alkyd anticorrosive metal primer.
    - b. Intermediate Coat: Exterior alkyd enamel matching topcoat.
    - c. Topcoat: Exterior alkyd enamel (flat).
    - d. Color: Gray.
- C. Damage and Touchup: Repair marred and damaged factory-applied finishes with materials and by procedures to match original factory finish.

### **3.10 OUTDOOR PIPING SCHEDULE**

- A. Underground natural-gas piping shall be one of the following:
  - 1. See piping schedule on drawings.
  - 2. PE pipe and fittings joined by heat fusion; service-line risers with tracer wire terminated in an accessible location.
  - 3. Coat pipe and fittings with protective coating for steel piping.
- B. Aboveground natural-gas piping shall be one of the following:
  - 1. Steel pipe with malleable-iron fittings and threaded joints.
  - 2. Steel pipe with wrought-steel fittings and welded joints.
- C. Containment Conduit: Steel pipe with wrought-steel fittings and welded joints. Coat pipe and fittings with protective coating for steel piping.

### **3.11 INDOOR PIPING SCHEDULE**

- A. See piping schedule on drawings.

### **3.12 UNDERGROUND MANUAL GAS SHUTOFF VALVE SCHEDULE**

- A. Connections to Existing Gas Piping: Use valve and fitting assemblies made for tapping utility's gas mains and listed by an NRTL.
- B. Underground: PE valves.

### **3.13 ABOVEGROUND MANUAL GAS SHUTOFF VALVE SCHEDULE**

- A. Valves for pipe sizes NPS 2 and smaller at service meter shall be one of the following:
  - 1. One-piece, bronze ball valve with bronze trim.
  - 2. Two-piece, full-port, bronze ball valves with bronze trim.
  - 3. Bronze plug valve.
- B. Distribution piping valves for pipe sizes NPS 2 and smaller shall be one of the following:
  - 1. One-piece, bronze ball valve with bronze trim.
  - 2. Two-piece, full-port, bronze ball valves with bronze trim.
  - 3. Bronze plug valve.
- C. Valves in branch piping for single appliance shall be one of the following:
  - 1. One-piece, bronze ball valve with bronze trim.
  - 2. Two-piece, full-port, bronze ball valves with bronze trim.
  - 3. Bronze plug valve.

**END OF SECTION**

## **SECTION 23 2300**

### **REFRIGERANT PIPING**

#### **PART 1 - GENERAL**

##### **1.1 SUMMARY**

- A. This Section includes refrigerant piping used for air-conditioning applications.

##### **1.2 PERFORMANCE REQUIREMENTS**

- A. Line Test Pressure for Refrigerant R-134a:
  - 1. Suction Lines for Air-Conditioning Applications: 115 psig.
  - 2. Suction Lines for Heat-Pump Applications: 225 psig.
  - 3. Hot-Gas and Liquid Lines: 225 psig.
- B. Line Test Pressure for Refrigerant R-407C:
  - 1. Suction Lines for Air-Conditioning Applications: 230 psig.
  - 2. Suction Lines for Heat-Pump Applications: 380 psig.
  - 3. Hot-Gas and Liquid Lines: 380 psig.
- C. Line Test Pressure for Refrigerant R-410A:
  - 1. Suction Lines for Air-Conditioning Applications: 300 psig.
  - 2. Suction Lines for Heat-Pump Applications: 535 psig.
  - 3. Hot-Gas and Liquid Lines: 535 psig.

##### **1.3 ACTION SUBMITTALS**

- A. Product Data: For each type of valve and refrigerant piping specialty indicated. Include pressure drop based on manufacturer's test data.
- B. Shop Drawings: Show layout of refrigerant piping and specialties, including pipe, tube, and fitting sizes, flow capacities, valve arrangements and locations, slopes of horizontal runs, oil traps, double risers, wall and floor penetrations, and equipment connection details. Show interface and spatial relationships between piping and equipment.
  - 1. Refrigerant piping indicated on Drawings is schematic only. Size piping and design actual piping layout, including oil traps, double risers, specialties, and pipe and tube sizes to accommodate, as a minimum, equipment provided, elevation difference between compressor and evaporator, and length of piping to ensure proper operation and compliance with warranties of connected equipment.

##### **1.4 INFORMATIONAL SUBMITTALS**

- A. Field quality-control test reports.

## **1.5 CLOSEOUT SUBMITTALS**

- A. Operation and maintenance data.

## **1.6 QUALITY ASSURANCE**

- A. Comply with ASHRAE 15, "Safety Code for Refrigeration Systems."
- B. Comply with ASME B31.5, "Refrigeration Piping and Heat Transfer Components."

## **1.7 PRODUCT STORAGE AND HANDLING**

- A. Store piping in a clean and protected area with end caps in place to ensure that piping interior and exterior are clean when installed.

# **PART 2 - PRODUCTS**

## **2.1 COPPER TUBE AND FITTINGS**

- A. Copper Tube: ASTM B 280, Type ACR.
- B. Wrought-Copper Fittings: ASME B16.22.
- C. Wrought-Copper Unions: ASME B16.22.
- D. Solder Filler Metals: ASTM B 32. Use 95-5 tin antimony or alloy HB solder to join copper socket fittings on copper pipe.
- E. Brazing Filler Metals: AWS A5.8.
- F. Flexible Connectors:
  - 1. Body: Tin-bronze bellows with woven, flexible, tinned-bronze-wire-reinforced protective jacket.
  - 2. End Connections: Socket ends.
  - 3. Offset Performance: Capable of minimum 3/4-inch misalignment in minimum 7-inch-long assembly.
  - 4. Pressure Rating: Factory test at minimum 500 psig.
  - 5. Maximum Operating Temperature: 250 deg F.

# **PART 3 - EXECUTION**

## **3.1 PIPING APPLICATIONS**

- A. Hot-Gas and Liquid Lines, and Suction Lines: Copper, Type ACR, drawn-temper tubing and wrought-copper fittings with soldered joints.

## **3.2 PIPING INSTALLATION**

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems; indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Shop Drawings.

- B. Install refrigerant piping according to ASHRAE 15.
- C. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
- D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- F. Install piping adjacent to machines to allow service and maintenance.
- G. Install piping free of sags and bends.
- H. Install fittings for changes in direction and branch connections.
- I. Select system components with pressure rating equal to or greater than system operating pressure.
- J. Install piping as short and direct as possible, with a minimum number of joints, elbows, and fittings.
- K. Arrange piping to allow inspection and service of refrigeration equipment. Install valves and specialties in accessible locations to allow for service and inspection. Install access doors or panels as specified in Section 08 3113 "Access Doors and Frames" if valves or equipment requiring maintenance is concealed behind finished surfaces.
- L. Install refrigerant piping in protective conduit where installed belowground.
- M. Install refrigerant piping in rigid or flexible conduit in locations where exposed to mechanical injury.
- N. Slope refrigerant piping as follows:
  - 1. Install horizontal hot-gas discharge piping with a uniform slope downward away from compressor.
  - 2. Install horizontal suction lines with a uniform slope downward to compressor.
  - 3. Install traps and double risers to entrain oil in vertical runs.
  - 4. Liquid lines may be installed level.
- O. When brazing or soldering, remove solenoid-valve coils and sight glasses; also remove valve stems, seats, and packing, and accessible internal parts of refrigerant specialties. Do not apply heat near expansion-valve bulb.
- P. Install piping with adequate clearance between pipe and adjacent walls and hangers or between pipes for insulation installation.
- Q. Identify refrigerant piping and valves according to Section 23 0553 "Identification for HVAC Piping and Equipment."
- R. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 23 0517 "Sleeves and Sleeve Seals for HVAC Piping."

- S. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 23 0517 "Sleeves and Sleeve Seals for HVAC Piping."
- T. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 23 0518 "Escutcheons for HVAC Piping."

### **3.3 PIPE JOINT CONSTRUCTION**

- A. Soldered Joints: Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook."
- B. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," Chapter "Pipe and Tube."
  - 1. Use Type BcuP, copper-phosphorus alloy for joining copper socket fittings with copper pipe.
  - 2. Use Type BAg, cadmium-free silver alloy for joining copper with bronze or steel.

### **3.4 HANGERS AND SUPPORTS**

- A. Hanger, support, and anchor products are specified in Section 23 0529 "Hangers and Supports for HVAC Piping and Equipment."
- B. Install the following pipe attachments:
  - 1. Adjustable steel clevis hangers for individual horizontal runs less than 20 feet long.
  - 2. Roller hangers and spring hangers for individual horizontal runs 20 feet or longer.
  - 3. Pipe Roller: MSS SP-58, Type 44 for multiple horizontal piping 20 feet or longer, supported on a trapeze.
  - 4. Spring hangers to support vertical runs.
  - 5. Copper-clad hangers and supports for hangers and supports in direct contact with copper pipe.
- C. Install hangers for copper tubing with the following maximum spacing and minimum rod sizes:
  - 1. NPS 1/2: Maximum span, 60 inches; minimum rod size, 1/4 inch.
  - 2. NPS 5/8: Maximum span, 60 inches; minimum rod size, 1/4 inch.
  - 3. NPS 1: Maximum span, 72 inches; minimum rod size, 1/4 inch.
  - 4. NPS 1-1/4: Maximum span, 96 inches; minimum rod size, 3/8 inch.
  - 5. NPS 1-1/2: Maximum span, 96 inches; minimum rod size, 3/8 inch.
  - 6. NPS 2: Maximum span, 96 inches; minimum rod size, 3/8 inch.
  - 7. NPS 2-1/2: Maximum span, 108 inches; minimum rod size, 3/8 inch.
  - 8. NPS 3: Maximum span, 10 feet; minimum rod size, 3/8 inch.
  - 9. NPS 4: Maximum span, 12 feet; minimum rod size, 1/2 inch.
- D. Support multifloor vertical runs at least at each floor.



### **3.5 FIELD QUALITY CONTROL**

- A. Perform tests and inspections and prepare test reports.
- B. Tests and Inspections:
  - 1. Comply with ASME B31.5, Chapter VI.
  - 2. Test refrigerant piping and specialties. Isolate compressor, condenser, evaporator, and safety devices from test pressure if they are not rated above the test pressure.
  - 3. Test high- and low-pressure side piping of each system separately at not less than the pressures indicated in Part 1 "Performance Requirements" Article.
    - a. Fill system with nitrogen to the required test pressure.
    - b. System shall maintain test pressure at the manifold gage throughout duration of test.
    - c. Test joints and fittings with electronic leak detector or by brushing a small amount of soap and glycerin solution over joints.
    - d. Remake leaking joints using new materials, and retest until satisfactory results are achieved.

### **3.6 SYSTEM CHARGING**

- A. Charge system using the following procedures:
  - 1. Install core in filter dryers after leak test but before evacuation.
  - 2. Evacuate entire refrigerant system with a vacuum pump to 500 micrometers. If vacuum holds for 12 hours, system is ready for charging.
  - 3. Break vacuum with refrigerant gas, allowing pressure to build up to 2 psig.
  - 4. Charge system with a new filter-dryer core in charging line.

### **3.7 ADJUSTING**

- A. Adjust thermostatic expansion valve to obtain proper evaporator superheat.
- B. Adjust high- and low-pressure switch settings to avoid short cycling in response to fluctuating suction pressure.
- C. Adjust set-point temperature of air-conditioning or chilled-water controllers to the system design temperature.
- D. Perform the following adjustments before operating the refrigeration system, according to manufacturer's written instructions:
  - 1. Open shutoff valves in condenser water circuit.
  - 2. Verify that compressor oil level is correct.
  - 3. Open compressor suction and discharge valves.
  - 4. Open refrigerant valves except bypass valves that are used for other purposes.
  - 5. Check open compressor-motor alignment and verify lubrication for motors and bearings.
- E. Replace core of replaceable filter dryer after system has been adjusted and after design flow rates and pressures are established.

**END OF SECTION**



## **SECTION 26 0526**

### **GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS**

#### **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 SUMMARY**

- A. Section includes grounding and bonding systems and equipment.
- B. Section includes grounding and bonding systems and equipment, plus the following special applications:
  - 1. Underground distribution grounding.
  - 2. Ground bonding common with lightning protection system.
  - 3. Foundation steel electrodes.

##### **1.3 ACTION SUBMITTALS**

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

##### **1.4 INFORMATIONAL SUBMITTALS**

- A. Coordination Drawings: Plans showing dimensioned locations of grounding features specified in "Field Quality Control" Article, including the following:
  - 1. Test wells.
  - 2. Ground rods.
  - 3. Ground rings.
  - 4. Grounding arrangements and connections for separately derived systems.
- B. Qualification Data: For testing agency and testing agency's field supervisor.
- C. Field quality-control reports.

##### **1.5 CLOSEOUT SUBMITTALS**

- A. Operation and Maintenance Data: For grounding to include in emergency, operation, and maintenance manuals.
  - 1. In addition to items specified in Section 01 7823 "Operation and Maintenance Data," include the following:

- a. Plans showing as-built, dimensioned locations of grounding features specified in "Field Quality Control" Article, including the following:
  - 1) Test wells.
  - 2) Ground rods.
  - 3) Ground rings.
  - 4) Grounding arrangements and connections for separately derived systems.
- b. Instructions for periodic testing and inspection of grounding features at test wells, ground rings, and grounding connections for separately derived systems based on NETA MTS and NFPA 70B .
  - 1) Tests shall determine if ground-resistance or impedance values remain within specified maximums, and instructions shall recommend corrective action if values do not.
  - 2) Include recommended testing intervals.

## 1.6 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Certified by NETA.

## PART 2 - PRODUCTS

### 2.1 SYSTEM DESCRIPTION

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with UL 467 for grounding and bonding materials and equipment.

### 2.2 CONDUCTORS

- A. Insulated Conductors: Copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.
- B. Bare Copper Conductors:
  1. Solid Conductors: ASTM B 3.
  2. Stranded Conductors: ASTM B 8.
  3. Tinned Conductors: ASTM B 33.
  4. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch in diameter.
  5. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
  6. Bonding Jumper: Copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.
  7. Tinned Bonding Jumper: Tinned-copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.
- C. Grounding Bus: Predrilled rectangular bars of annealed copper, 1/4 by 4 inches (unless noted otherwise on drawings) in cross section, with 9/32-inch holes spaced 1-1/8 inches apart. Stand-off insulators for mounting shall comply with UL 891 for use in switchboards, 600 V and shall be

Lexan or PVC, impulse tested at 5000 V.

1. Grounding bus bar shall be installed in each dedicated data equipment room/closet.
2. Install No. 6 AWG conductor connecting each grounding bus bar to the main service grounding distribution system.

## **2.3 CONNECTORS**

- A. Listed and labeled by an NRTL acceptable to authorities having jurisdiction for applications in which used and for specific types, sizes, and combinations of conductors and other items connected.
- B. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.
- C. Bus-Bar Connectors: Mechanical type, cast silicon bronze, solderless exothermic-type wire terminals, and long-barrel, two-bolt connection to ground bus bar.
- D. Bus-Bar Connectors: Compression type, copper or copper alloy, with two wire terminals.
- E. Beam Clamps: Mechanical type, terminal, ground wire access from four directions, with dual, tin-plated or silicon bronze bolts.
- F. Cable-to-Cable Connectors: Compression type, copper or copper alloy.
- G. Conduit Hubs: Mechanical type, terminal with threaded hub.
- H. Ground Rod Clamps: Mechanical type, copper or copper alloy, terminal with hex head bolt.
- I. Ground Rod Clamps: Mechanical type, copper or copper alloy, terminal with hex head bolt.
- J. Lay-in Lug Connector: Mechanical type, copper rated for direct burial terminal with set screw.
- K. Service Post Connectors: Mechanical type, bronze alloy terminal, in short- and long-stud lengths, capable of single and double conductor connections.
- L. Signal Reference Grid Clamp: Mechanical type, stamped-steel terminal with hex head screw.
- M. Straps: Solid copper, copper lugs. Rated for 600 A.
- N. Tower Ground Clamps: Mechanical type, copper or copper alloy.
- O. U-Bolt Clamps: Mechanical type, copper or copper alloy, terminal listed for direct burial.
- P. Water Pipe Clamps:
  1. Mechanical type, two pieces with zinc-plated bolts.
    - a. Material: Die-cast zinc alloy.
    - b. Listed for direct burial.
  2. U-bolt type with malleable-iron clamp and copper ground connector rated for direct burial.

## **2.4 GROUNDING ELECTRODES**

- A. Ground Rods: Copper-clad steel; 3/4 inch diameter by 10 feet in length.
- B. Chemical-Enhanced Grounding Electrodes: Copper tube, straight or L-shaped, charged with nonhazardous electrolytic chemical salts.
  - 1. Termination: Factory-attached No. 4/0 AWG bare conductor at least 48 inches long.
  - 2. Backfill Material: Electrode manufacturer's recommended material.
- C. Ground Plates: 1/4 inch thick, hot-dip galvanized.

## **PART 3 - EXECUTION**

### **3.1 APPLICATIONS**

- A. Conductors: Install solid conductor for No. 8 AWG and smaller, and stranded conductors for No. 6 AWG and larger unless otherwise indicated.
- B. Underground Grounding Conductors: Install bare tinned-copper conductor, No. 2/0 AWG minimum.
  - 1. Bury at least 24 inches below grade.
  - 2. Duct-Bank Grounding Conductor: Bury 12 inches above duct bank when indicated as part of duct-bank installation.
- C. Isolated Grounding Conductors: Green-colored insulation with continuous yellow stripe. On feeders with isolated ground, identify grounding conductor where visible to normal inspection, with alternating bands of green and yellow tape, with at least three bands of green and two bands of yellow.
- D. Grounding Bus: Install in electrical equipment rooms, in rooms housing service and low voltage data equipment and elsewhere as indicated.
  - 1. Install bus horizontally, on insulated spacers 2 inches minimum from wall, 6 inches above finished floor unless otherwise indicated.
  - 2. Where indicated on both sides of doorways, route bus up to top of door frame, across top of doorway, and down; connect to horizontal bus.
- E. Conductor Terminations and Connections:
  - 1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
  - 2. Underground Connections: Welded connectors except at test wells and as otherwise indicated.
  - 3. Connections to Ground Rods at Test Wells: Bolted connectors.
  - 4. Connections to Structural Steel: Welded connectors.

### **3.2 GROUNDING AT THE SERVICE**

- A. Equipment grounding conductors and grounding electrode conductors shall be connected to the ground bus. Install a main bonding jumper between the neutral and ground buses.

### **3.3 GROUNDING SEPARATELY DERIVED SYSTEMS**

- A. Generator: Install grounding electrode(s) at the generator location. The electrode shall be connected to the equipment grounding conductor and to the frame of the generator.

### **3.4 GROUNDING UNDERGROUND DISTRIBUTION SYSTEM COMPONENTS**

- A. Comply with IEEE C2 grounding requirements.
- B. Grounding Manholes and Handholes: Install a driven ground rod through manhole or handhole floor, close to wall, and set rod depth so 4 inches will extend above finished floor. If necessary, install ground rod before manhole is placed and provide No. 1/0 AWG bare, tinned-copper conductor from ground rod into manhole through a waterproof sleeve in manhole wall. Protect ground rods passing through concrete floor with a double wrapping of pressure-sensitive insulating tape or heat-shrunk insulating sleeve from 2 inches above to 6 inches below concrete. Seal floor opening with waterproof, nonshrink grout.
- C. Grounding Connections to Manhole Components: Bond exposed-metal parts such as inserts, cable racks, pulling irons, ladders, and cable shields within each manhole or handhole, to ground rod or grounding conductor. Make connections with No. 4 AWG minimum, stranded, hard-drawn copper bonding conductor. Train conductors level or plumb around corners and fasten to manhole walls. Connect to cable armor and cable shields according to written instructions by manufacturer of splicing and termination kits.
- D. Pad-Mounted Transformers and Switches: Install two ground rods and ground ring around the pad. Ground pad-mounted equipment and noncurrent-carrying metal items associated with substations by connecting them to underground cable and grounding electrodes. Install tinned-copper conductor not less than No. 2 AWG for ground ring and for taps to equipment grounding terminals. Bury ground ring not less than 6 inches from the foundation.

### **3.5 EQUIPMENT GROUNDING**

- A. Install insulated equipment grounding conductors with all feeders and branch circuits.
- B. Install insulated equipment grounding conductors with the following items, in addition to those required by NFPA 70:
  - 1. Feeders and branch circuits.
  - 2. Lighting circuits.
  - 3. Receptacle circuits.
  - 4. Single-phase motor and appliance branch circuits.
  - 5. Three-phase motor and appliance branch circuits.
  - 6. Flexible raceway runs.
  - 7. Armored and metal-clad cable runs.
  - 8. Busway Supply Circuits: Install insulated equipment grounding conductor from grounding bus in the switchgear, switchboard, or distribution panel to equipment grounding bar terminal on busway.
- C. Air-Duct Equipment Circuits: Install insulated equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners, heaters, dampers, humidifiers, and other duct electrical equipment. Bond conductor to each unit and to air duct and connected metallic piping.

- D. Water Heater, Heat-Tracing, and Antifrost Heating Cables: Install a separate insulated equipment grounding conductor to each electric water heater and heat-tracing cable. Bond conductor to heater units, piping, connected equipment, and components.
- E. Isolated Grounding Receptacle Circuits: Install an insulated equipment grounding conductor connected to the receptacle grounding terminal. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service unless otherwise indicated.
- F. Isolated Equipment Enclosure Circuits: For designated equipment supplied by a branch circuit or feeder, isolate equipment enclosure from supply circuit raceway with a nonmetallic raceway fitting listed for the purpose. Install fitting where raceway enters enclosure, and install a separate insulated equipment grounding conductor. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service unless otherwise indicated.
- G. Poles Supporting Outdoor Lighting Fixtures: Install grounding electrode and a separate insulated equipment grounding conductor in addition to grounding conductor installed with branch-circuit conductors.
- H. Metallic Fences: Comply with requirements of IEEE C2.
  - 1. Grounding Conductor: Bare copper, not less than No. 8 AWG.
  - 2. Gates: Shall be bonded to the grounding conductor with a flexible bonding jumper.
  - 3. Barbed Wire: Strands shall be bonded to the grounding conductor.

### **3.6 FENCE GROUNDING**

- A. Fence Grounding: Install at maximum intervals of 1500 feet except as follows:
  - 1. Fences within 100 Feet of Buildings, Structures, Walkways, and Roadways: Ground at maximum intervals of 750 feet.
    - a. Gates and Other Fence Openings: Ground fence on each side of opening.
      - 1) Bond metal gates to gate posts.
      - 2) Bond across openings, with and without gates, except at openings indicated as intentional fence discontinuities. Use No. 2 AWG wire and bury it at least 18 inches below finished grade.
- B. Protection at Crossings of Overhead Electrical Power Lines: Ground fence at location of crossing and at a maximum distance of 150 feet on each side of crossing.
- C. Fences Enclosing Electrical Power Distribution Equipment: Ground as required by IEEE C2 unless otherwise indicated.
- D. Grounding Method: At each grounding location, drive a grounding rod vertically until the top is 6 inches below finished grade. Connect rod to fence with No. 6 AWG conductor. Connect conductor to each fence component at grounding location.
- E. Bonding Method for Gates: Connect bonding jumper between gate post and gate frame.
- F. Bonding to Lightning-Protection System: If fence terminates at lightning-protected building or



structure, ground the fence and bond the fence grounding conductor to lightning-protection down conductor or lightning-protection grounding conductor, complying with NFPA 780.

### **3.7 INSTALLATION**

- A. Grounding Conductors: Route along shortest and straightest paths possible unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.
- B. Ground Bonding Common with Lightning Protection System: Comply with NFPA 780 and UL 96 when interconnecting with lightning protection system. Bond electrical power system ground directly to lightning protection system grounding conductor at closest point to electrical service grounding electrode. Use bonding conductor sized same as system grounding electrode conductor, and install in conduit.
- C. Ground Rods: Drive rods until tops are 2 inches below finished floor or final grade unless otherwise indicated.
  - 1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating if any.
  - 2. Use exothermic welds for all below-grade connections.
  - 3. For grounding electrode system, install at least three rods spaced at least one-rod length from each other and located at least the same distance from other grounding electrodes, and connect to the service grounding electrode conductor.
- D. Test Wells: Ground rod driven through drilled hole in bottom of handhole. Handholes are specified in Section 26 0543 "Underground Ducts and Raceways for Electrical Systems," and shall be at least 12 inches deep, with cover.
  - 1. Install at least one test well for each service unless otherwise indicated. Install at the ground rod electrically closest to service entrance. Set top of test well flush with finished grade or floor.
- E. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance except where routed through short lengths of conduit.
  - 1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
  - 2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install bonding so vibration is not transmitted to rigidly mounted equipment.
  - 3. Use exothermic-welded connectors for outdoor locations; if a disconnect-type connection is required, use a bolted clamp.
- F. Grounding and Bonding for Piping:
  - 1. Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes; use a bolted clamp connector or bolt a lug-type connector to a pipe flange by using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
  - 2. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.

3. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.
- G. Bonding Interior Metal Ducts: Bond metal air ducts to equipment grounding conductors of associated fans, blowers, electric heaters, and air cleaners. Install bonding jumper to bond across flexible duct connections to achieve continuity.
- H. Grounding for Steel Building Structure: Install a driven ground rod at base of each corner column and at intermediate exterior columns at distances not more than 60 feet apart.
- I. Ground Ring: Install a grounding conductor, electrically connected to each building structure ground rod and to each steel column, extending around the perimeter of building.
  1. Install tinned-copper conductor not less than No. 2/0 AWG for ground ring and for taps to building steel.
  2. Bury ground ring not less than 24 inches from building's foundation.
- J. Concrete-Encased Grounding Electrode (Ufer Ground): Fabricate according to NFPA 70; use a minimum of 20 feet of bare copper conductor not smaller than No. 4 AWG.
  1. If concrete foundation is less than 20 feet long, coil excess conductor within base of foundation.
  2. Bond grounding conductor to reinforcing steel in at least four locations and to anchor bolts. Extend grounding conductor below grade and connect to building's grounding grid or to grounding electrode external to concrete.
- K. Connections: Make connections so possibility of galvanic action or electrolysis is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact are galvanically compatible.
  1. Use electroplated or hot-tin-coated materials to ensure high conductivity and to make contact points closer in order of galvanic series.
  2. Make connections with clean, bare metal at points of contact.
  3. Make aluminum-to-steel connections with stainless-steel separators and mechanical clamps.
  4. Make aluminum-to-galvanized-steel connections with tin-plated copper jumpers and mechanical clamps.
  5. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.

### **3.8 FIELD QUALITY CONTROL**

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Perform tests and inspections.
- C. Tests and Inspections:
  1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
  2. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.
  3. Test completed grounding system at each location where a maximum ground-resistance

level is specified, at service disconnect enclosure grounding terminal, at ground test wells, and at individual ground rods. Make tests at ground rods before any conductors are connected.

- a. Measure ground resistance no fewer than two full days after last trace of precipitation and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.
  - b. Perform tests by fall-of-potential method according to IEEE 81.
4. Prepare dimensioned Drawings locating each test well, ground rod and ground-rod assembly, and other grounding electrodes. Identify each by letter in alphabetical order, and key to the record of tests and observations. Include the number of rods driven and their depth at each location, and include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.
- D. Grounding system will be considered defective if it does not pass tests and inspections.
- E. Prepare test and inspection reports.
- F. Report measured ground resistances that exceed the following values:
1. Power and Lighting Equipment or System with Capacity of 500 kVA and Less: 10 ohms.
  2. Power and Lighting Equipment or System with Capacity of 500 to 1000 kVA: 5 ohms.
  3. Power and Lighting Equipment or System with Capacity More Than 1000 kVA: 3 ohms.
  4. Power Distribution Units or Panelboards Serving Electronic Equipment: 3 ohm(s).
  5. Substations and Pad-Mounted Equipment: 5 ohms.
  6. Manhole Grounds: 10 ohms.
- G. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

#### **END OF SECTION**



## **SECTION 26 0533**

### **RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS**

#### **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 SUMMARY**

- A. Section Includes:
  - 1. Metal conduits and fittings.
  - 2. Nonmetallic conduits and fittings.
  - 3. Metal wireways and auxiliary gutters.
  - 4. Nonmetal wireways and auxiliary gutters.
  - 5. Surface raceways.
  - 6. Boxes, enclosures, and cabinets.
  - 7. Handholes and boxes for exterior underground cabling.

##### **1.3 DEFINITIONS**

- A. ARC: Aluminum rigid conduit.
- B. GRC: Galvanized rigid steel conduit.
- C. IMC: Intermediate metal conduit.

##### **1.4 ACTION SUBMITTALS**

- A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.
- B. Shop Drawings: For custom enclosures and cabinets. Include plans, elevations, sections, and attachment details.

##### **1.5 INFORMATIONAL SUBMITTALS**

- A. Coordination Drawings: Conduit routing plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of items involved:
  - 1. Structural members in paths of conduit groups with common supports.
  - 2. HVAC and plumbing items and architectural features in paths of conduit groups with common supports.

- B. Qualification Data: For professional engineer.
- C. Seismic Qualification Data: Certificates, for enclosures, cabinets, and conduit racks and their mounting provisions, including those for internal 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.
  - 4. Detailed description of conduit support devices and interconnections on which the certification is based and their installation requirements.
- D. Source quality-control reports.

## **PART 2 - PRODUCTS**

### **2.1 METAL CONDUITS AND FITTINGS**

- A. Metal Conduit:
  - 1. Listing and Labeling: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
  - 2. GRC: Comply with ANSI C80.1 and UL 6.
  - 3. ARC: Comply with ANSI C80.5 and UL 6A.
  - 4. IMC: Comply with ANSI C80.6 and UL 1242.
  - 5. PVC-Coated Steel Conduit: PVC-coated rigid steel conduit.
    - a. Comply with NEMA RN 1.
    - b. Coating Thickness: 0.040 inch, minimum.
  - 6. EMT: Comply with ANSI C80.3 and UL 797.
  - 7. FMC: Comply with UL 1; zinc-coated steel or aluminum.
  - 8. LFMC: Flexible steel conduit with PVC jacket and complying with UL 360.
- B. Metal Fittings:
  - 1. Comply with NEMA FB 1 and UL 514B.
  - 2. Listing and Labeling: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
  - 3. Fittings, General: Listed and labeled for type of conduit, location, and use.
  - 4. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 1203 and NFPA 70.
  - 5. Fittings for EMT:
    - a. Material: Steel.
    - b. Type: compression.
  - 6. Expansion Fittings: PVC or steel to match conduit type, complying with UL 651, rated for environmental conditions where installed, and including flexible external bonding jumper.
  - 7. Coating for Fittings for PVC-Coated Conduit: Minimum thickness of 0.040 inch, with overlapping sleeves protecting threaded joints.
- C. Joint Compound for IMC, GRC, or ARC: Approved, as defined in NFPA 70, by authorities

having jurisdiction for use in conduit assemblies, and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.

## **2.2 NONMETALLIC CONDUITS AND FITTINGS**

- A. Nonmetallic Conduit:
  - 1. Listing and Labeling: Nonmetallic conduit shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
  - 2. Fiberglass:
    - a. Comply with NEMA TC 14.
    - b. Comply with UL 2515 for aboveground raceways.
    - c. Comply with UL 2420 for belowground raceways.
  - 3. ENT: Comply with NEMA TC 13 and UL 1653.
  - 4. RNC: Type EPC-40-PVC, complying with NEMA TC 2 and UL 651 unless otherwise indicated.
  - 5. LFNC: Comply with UL 1660.
  - 6. Rigid HDPE: Comply with UL 651A.
  - 7. Continuous HDPE: Comply with UL 651A.
  - 8. Coilable HDPE: Preassembled with conductors or cables, and complying with ASTM D 3485.
  - 9. RTRC: Comply with UL 2515A and NEMA TC 14.
- B. Nonmetallic Fittings:
  - 1. Fittings, General: Listed and labeled for type of conduit, location, and use.
  - 2. Fittings for ENT and RNC: Comply with NEMA TC 3; match to conduit or tubing type and material.
    - a. Fittings for LFNC: Comply with UL 514B.
  - 3. Solvents and Adhesives: As recommended by conduit manufacturer.

## **2.3 METAL WIREWAYS AND AUXILIARY GUTTERS**

- A. Description: Sheet metal, complying with UL 870 and NEMA 250, (enclosure suitable to environment) unless otherwise indicated, and sized according to NFPA 70.
  - 1. Metal wireways installed outdoors shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Fittings and Accessories: Include covers, couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.
- C. Wireway Covers: Hinged, Flanged-and-gasketed type unless otherwise indicated.
- D. Finish: Manufacturer's standard enamel finish.

## **2.4 NONMETALLIC WIREWAYS AND AUXILIARY GUTTERS**

- A. Listing and Labeling: Nonmetallic wireways and auxiliary gutters shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Description: Fiberglass polyester, extruded and fabricated to required size and shape, without holes or knockouts. Cover shall be gasketed with oil-resistant gasket material and fastened with captive screws treated for corrosion resistance. Connections shall be flanged and have stainless-steel screws and oil-resistant gaskets.
- C. Description: PVC, extruded and fabricated to required size and shape, and having snap-on cover, mechanically coupled connections, and plastic fasteners.
- D. Fittings and Accessories: Couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings shall match and mate with wireways as required for complete system.
- E. Solvents and Adhesives: As recommended by conduit manufacturer.

## **2.5 SURFACE RACEWAYS**

- A. Listing and Labeling: Surface raceways and tele-power poles shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Surface Metal Raceways: Galvanized steel with snap-on covers complying with UL 5. Manufacturer's standard enamel finish in color selected by Architect unless otherwise indicated.
- C. Surface Nonmetallic Raceways: not allowed unless noted otherwise.

## **2.6 BOXES, ENCLOSURES, AND CABINETS**

- A. General Requirements for Boxes, Enclosures, and Cabinets: Boxes, enclosures, and cabinets installed in wet locations shall be listed for use in wet locations.
- B. Sheet Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.
- C. Cast-Metal Outlet and Device Boxes: Comply with NEMA FB 1, aluminum, Type FD, with gasketed cover.
- D. Nonmetallic Outlet and Device Boxes: Comply with NEMA OS 2 and UL 514C.
- E. Metal Floor Boxes: refer to drawings.
- F. Nonmetallic Floor Boxes: refer to drawings
- G. Luminaire Outlet Boxes: Nonadjustable, designed for attachment of luminaire weighing 50 lb. Outlet boxes designed for attachment of luminaires weighing more than 50 lb shall be listed and marked for the maximum allowable weight.
- H. Paddle Fan Outlet Boxes: Nonadjustable, designed for attachment of paddle fan weighing 90 lb.



1. Listing and Labeling: Paddle fan outlet boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- I. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.
- J. Cast-Metal Access, Pull, and Junction Boxes: Comply with NEMA FB 1 and UL 1773, cast aluminum or galvanized, cast iron (suitable to environment) with gasketed cover.
- K. Box extensions used to accommodate new building finishes shall be of same material as recessed box.
- L. Device Box Dimensions: 4 inches square by 2-1/8 inches deep.
- M. Gangable boxes are allowed.
- N. Hinged-Cover Enclosures: Comply with UL 50 and NEMA 250, NEMA enclosure type suitable to environment with continuous-hinge cover with flush latch unless otherwise indicated.
  1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
  2. Nonmetallic Enclosures: Fiberglass.
  3. Interior Panels: Steel; all sides finished with manufacturer's standard enamel.
- O. Cabinets:
  1. NEMA 250, NEMA enclosure suitable to environment, galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
  2. Hinged door in front cover with flush latch and concealed hinge.
  3. Key latch to match panelboards.
  4. Metal barriers to separate wiring of different systems and voltage.
  5. Accessory feet where required for freestanding equipment.
  6. Nonmetallic cabinets shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

## 2.7 HANDHOLES AND BOXES FOR EXTERIOR UNDERGROUND WIRING

- A. General Requirements for Handholes and Boxes:
  1. Boxes and handholes for use in underground systems shall be designed and identified as defined in NFPA 70, for intended location and application.
  2. Boxes installed in wet areas shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Polymer-Concrete Handholes and Boxes with Polymer-Concrete Cover: Molded of sand and aggregate, bound together with polymer resin, and reinforced with steel, fiberglass, or a combination of the two.
  1. Standard: Comply with SCTE 77.
  2. Configuration: Designed for flush burial with open bottom unless otherwise indicated.
  3. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure and handhole location.
  4. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
  5. Cover Legend: Molded lettering, "ELECTRIC."
  6. Conduit Entrance Provisions: Conduit-terminating fittings shall mate with entering ducts

- for secure, fixed installation in enclosure wall.
- 7. Handholes 12 Inches Wide by 24 Inches Long and Larger: Have inserts for cable racks and pulling-in irons installed before concrete is poured.
- C. Fiberglass Handholes and Boxes: Molded of fiberglass-reinforced polyester resin, with frame and covers of reinforced concrete.
  - 1. Standard: Comply with SCTE 77.
  - 2. Color of Frame and Cover: Gray.
  - 3. Configuration: Designed for flush burial with open bottom unless otherwise indicated.
  - 4. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure and handhole location.
  - 5. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
  - 6. Cover Legend: Molded lettering, "ELECTRIC."
  - 7. Conduit Entrance Provisions: Conduit-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.
  - 8. Handholes 12 Inches Wide by 24 Inches Long and Larger: Have inserts for cable racks and pulling-in irons installed before concrete is poured.

## **2.8 SOURCE QUALITY CONTROL FOR UNDERGROUND ENCLOSURES**

- A. Handhole and Pull-Box Prototype Test: Test prototypes of handholes and boxes for compliance with SCTE 77. Strength tests shall be for specified tier ratings of products supplied.
  - 1. Tests of materials shall be performed by an independent testing agency.
  - 2. Strength tests of complete boxes and covers shall be by either an independent testing agency or manufacturer. A qualified registered professional engineer shall certify tests by manufacturer.
  - 3. Testing machine pressure gages shall have current calibration certification complying with ISO 9000 and ISO 10012 and traceable to NIST standards.

## **PART 3 - EXECUTION**

### **3.1 RACEWAY APPLICATION**

- A. Outdoors: Apply raceway products as specified below unless otherwise indicated:
  - 1. Exposed Conduit: GRC.
  - 2. Concealed Conduit, Aboveground: EMT.
  - 3. Underground Conduit: RNC, Type EPC-80-PVC, direct buried.
  - 4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
  - 5. Boxes and Enclosures, Aboveground: NEMA 250, Type 4.
  - 6. Feeders to Variable Speed Drive: Metallic (EMT or GRC)
- B. Indoors: Apply raceway products as specified below unless otherwise indicated:
  - 1. Exposed, Not Subject to Physical Damage: EMT.
  - 2. Exposed, Not Subject to Severe Physical Damage: EMT unless noted otherwise.
  - 3. Exposed and Subject to Severe Physical Damage: GRC. Raceway locations include the following:
    - a. Loading dock.

- b. Corridors used for traffic of mechanized carts, forklifts, and pallet-handling units.
  - c. Mechanical rooms.
  - d. Gymnasiums.
- 4. Concealed in Ceilings and Interior Walls and Partitions: EMT.
- 5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
- 6. Damp or Wet Locations: GRC.
- 7. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4 stainless steel in institutional and commercial kitchens and damp or wet locations.
- 8. Feeders to Variable Speed Drive: Metallic (EMT or GRC)
- C. Minimum Raceway Size: 1/2-inch trade size. 3/4-inch minimum for school and healthcare facilities.
- D. Raceway Fittings: Compatible with raceways and suitable for use and location.
  - 1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.
  - 2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with this type of conduit. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer and apply in thickness and number of coats recommended by manufacturer.
  - 3. EMT: Use compression, steel fittings. Comply with NEMA FB 2.10.
  - 4. Flexible Conduit: Use only fittings listed for use with flexible conduit. Comply with NEMA FB 2.20.
- E. Install nonferrous conduit or tubing for circuits operating above 60 Hz. Where aluminum raceways are installed for such circuits and pass through concrete, install in nonmetallic sleeve.
- F. Do not install aluminum conduits, boxes, or fittings in contact with concrete or earth.
- G. Install surface raceways only where indicated on Drawings.
- H. Do not install nonmetallic conduit where ambient temperature exceeds 120 deg F.

### **3.2 INSTALLATION**

- A. Comply with NECA 1 and NECA 101 for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NECA 102 for aluminum conduits. Comply with NFPA 70 limitations for types of raceways allowed in specific occupancies and number of floors.
- B. Keep raceways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.
- C. Complete raceway installation before starting conductor installation.
- D. Comply with requirements in Section 26 0529 "Hangers and Supports for Electrical Systems" for hangers and supports.
- E. Arrange stub-ups so curved portions of bends are not visible above finished slab.

- F. Install no more than the equivalent of three 90-degree bends in any conduit run except for control wiring conduits, for which fewer bends are allowed. Support within 12 inches of changes in direction.
- G. Conceal conduit and EMT within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.
- H. Support conduit within 12 inches of enclosures to which attached.
- I. Raceways Embedded in Slabs:
  - 1. Run conduit larger than 1-inch trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support. Secure raceways to reinforcement at maximum 10-foot intervals.
  - 2. Arrange raceways to cross building expansion joints at right angles with expansion fittings.
  - 3. Arrange raceways to keep a minimum of 1 inch of concrete cover in all directions.
  - 4. Do not embed threadless fittings in concrete unless specifically approved by Architect for each specific location.
  - 5. Change from ENT to GRC before rising above floor. Elbows shall be GRC. Continue GRC until conduit passes through the slab prior to transition back to ENT.
  - 6. Provide coated GRC for all bends greater than 30 degrees, including the 90-degree elbows below grade and the entire vertical risers for transitions from below to above grade or above-slab."
- J. Stub-ups to Above Recessed Ceilings:
  - 1. Use EMT, IMC, or RMC for raceways.
  - 2. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.
- K. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.
- L. Coat field-cut threads on PVC-coated raceway with a corrosion-preventing conductive compound prior to assembly.
- M. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors including conductors smaller than No. 4 AWG.
- N. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install bushings on conduits up to 1-1/4-inch trade size and insulated throat metal bushings on 1-1/2-inch trade size and larger conduits terminated with locknuts. Install insulated throat metal grounding bushings on service conduits.
- O. Install raceways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus 1/4 turn more.
- P. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure to assure a continuous ground path.
- Q. Cut conduit perpendicular to the length. For conduits 2-inch trade size and larger, use roll cutter or a guide to make cut straight and perpendicular to the length.

- R. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire. Cap underground raceways designated as spare above grade alongside raceways in use.
- S. Surface Raceways:
1. Install surface raceway with a minimum 2-inch radius control at bend points.
  2. Secure surface raceway with screws or other anchor-type devices at intervals not exceeding 48 inches and with no less than two supports per straight raceway section. Support surface raceway according to manufacturer's written instructions. Tape and glue are not acceptable support methods.
- T. Install raceway sealing fittings at accessible locations according to NFPA 70 and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings according to NFPA 70.
- U. Install devices to seal raceway interiors at accessible locations. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal the interior of all raceways at the following points:
1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
  2. Where an underground service raceway enters a building or structure.
  3. Where otherwise required by NFPA 70.
- V. Comply with manufacturer's written instructions for solvent welding RNC and fittings.
- W. Expansion-Joint Fittings:
1. Install in each run of aboveground RNC that is located where environmental temperature change may exceed 30 deg F and that has straight-run length that exceeds 25 feet. Install in each run of aboveground RMC and EMT conduit that is located where environmental temperature change may exceed 100 deg F and that has straight-run length that exceeds 100 feet.
  2. Install type and quantity of fittings that accommodate temperature change listed for each of the following locations:
    - a. Outdoor Locations Not Exposed to Direct Sunlight: 125 deg F temperature change.
    - b. Outdoor Locations Exposed to Direct Sunlight: 155 deg F temperature change.
    - c. Indoor Spaces Connected with Outdoors without Physical Separation: 125 deg F temperature change.
    - d. Attics: 135 deg F temperature change.
  3. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per deg F of temperature change for PVC conduits. Install fitting(s) that provide expansion and contraction for at least 0.000078 inch per foot of length of straight run per deg F of temperature change for metal conduits.
  4. Install expansion fittings at all locations where conduits cross building or structure expansion joints.
  5. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at time of installation. Install conduit supports to allow for expansion movement.

- X. Flexible Conduit Connections: Comply with NEMA RV 3. Use a maximum of 72 inches of flexible conduit for recessed and semirecessed luminaires, equipment subject to vibration, noise transmission, or movement; and for transformers and motors.
  - 1. Use LFMC in damp or wet locations subject to severe physical damage.
  - 2. Use LFMC or LFNC in damp or wet locations not subject to severe physical damage.
- Y. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to center of box unless otherwise indicated.
- Z. Surface mount boxes at window mullions at locations indicated on drawings. Use of MC cable is acceptable. Conceal raceways and conductors within mullion cavity. Splices within the mullions are not allowed.
- AA. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall. Prepare block surfaces to provide a flat surface for a raintight connection between box and cover plate or supported equipment and box.
- BB. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.
- CC. Locate boxes so that cover or plate will not span different building finishes.
- DD. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for the purpose.
- EE. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.
- FF. Set metal floor boxes level and flush with finished floor surface.
- GG. Set nonmetallic floor boxes level. Trim after installation to fit flush with finished floor surface.

### **3.3 INSTALLATION OF UNDERGROUND CONDUIT**

- A. Direct-Buried Conduit:
  - 1. Excavate trench bottom to provide firm and uniform support for conduit. Prepare trench bottom as specified in Section 31 2000 "Earth Moving" for pipe less than 6 inches in nominal diameter.
  - 2. Install backfill as specified in Section 31 2000 "Earth Moving."
  - 3. After installing conduit, backfill and compact. Start at tie-in point, and work toward end of conduit run, leaving conduit at end of run free to move with expansion and contraction as temperature changes during this process. Firmly hand tamp backfill around conduit to provide maximum supporting strength. After placing controlled backfill to within 12 inches of finished grade, make final conduit connection at end of run and complete backfilling with normal compaction as specified in Section 31 2000 "Earth Moving."
  - 4. Install manufactured duct elbows for stub-ups at poles and equipment and at building entrances through floor unless otherwise indicated. Encase elbows for stub-up ducts throughout length of elbow.
  - 5. Install manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through floor.

- a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches of concrete for a minimum of 12 inches on each side of the coupling.
  - b. For stub-ups at equipment mounted on outdoor concrete bases and where conduits penetrate building foundations, extend steel conduit horizontally a minimum of 60 inches from edge of foundation or equipment base. Install insulated grounding bushings on terminations at equipment.
- 6. Warning Planks: Bury warning planks approximately 12 inches above direct-buried conduits but a minimum of 6 inches below grade. Align planks along centerline of conduit.
- 7. Underground Warning Tape: Comply with requirements in Section 26 0553 "Identification for Electrical Systems."

### **3.4 INSTALLATION OF UNDERGROUND HANDHOLES AND BOXES**

- A. Install handholes and boxes level and plumb and with orientation and depth coordinated with connecting conduits to minimize bends and deflections required for proper entrances.
- B. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1/2-inch sieve to No. 4 sieve and compacted to same density as adjacent undisturbed earth.
- C. Elevation: In paved areas, set so cover surface will be flush with finished grade. Set covers of other enclosures 1 inch above finished grade.
- D. Install handholes with bottom below frost line, below grade.
- E. Install removable hardware, including pulling eyes, cable stanchions, cable arms, and insulators, as required for installation and support of cables and conductors and as indicated. Select arm lengths to be long enough to provide spare space for future cables but short enough to preserve adequate working clearances in enclosure.
- F. Field-cut openings for conduits according to enclosure manufacturer's written instructions. Cut wall of enclosure with a tool designed for material to be cut. Size holes for terminating fittings to be used, and seal around penetrations after fittings are installed.

### **3.5 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS**

- A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 26 0544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

### **3.6 FIRESTOPPING**

- A. Install firestopping at penetrations of fire-rated floor and wall assemblies. Comply with requirements in Section 07 8413 "Penetration Firestopping."

### **3.7 PROTECTION**

- A. Protect coatings, finishes, and cabinets from damage and deterioration.

1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
2. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.

**END OF SECTION**



## **SECTION 26 0539**

### **UNDERFLOOR RACEWAYS FOR ELECTRICAL SYSTEMS**

#### **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 SUMMARY**

- A. Section Includes:
  - 1. Flat-top, single- or multichannel, underfloor raceways.
  - 2. Flush, flat-top underfloor raceways.
  - 3. Cellular metal underfloor raceways.
  - 4. Trench-type underfloor raceways.
  - 5. Electrical connection components for precast cellular concrete floor decks.
  - 6. Electrical connection components for electrified cellular steel floor decks.
  - 7. Supports, raceway fittings, and hardware.
  - 8. Junction boxes.
  - 9. Service fittings.
- B. Related Requirements:
  - 1. Section 03 4100 "Precast Structural Concrete" for precast concrete units used as cellular concrete floor raceways.
  - 2. Section 05 3100 "Steel Decking" for rough-in of underfloor duct distribution system.

##### **1.3 DEFINITIONS**

- A. Activation: Nomenclature used by some manufacturers for a service fitting.

##### **1.4 ACTION SUBMITTALS**

- A. Product Data: For each type of product.
  - 1. Include finishes, construction details, material descriptions, dimensions, and profiles for underfloor raceway components, fittings, and accessories.
  - 2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
- B. Shop Drawings: For underfloor raceways.
  - 1. Include floor plans, elevations, sections, and details.
  - 2. Detail fabrication and assembly of underfloor raceways.

- a. Identify components and accessories, such as expansion-joint assemblies, straight raceway lengths, preset and afterset inserts, and service fittings.
- b. Detail preparation and installation methods and instructions.
- c. Provide dimensions locating raceway header and distribution elements. Include spacing between preset inserts and between preset inserts and ends of duct runs, walls, columns, junction boxes, and header duct connections.
- d. Provide raceway fill charts for each duct size provided for each conductor size the duct is identified to accept. Provide separate charts for power and communication conductors and cables.
- e. Show connections between raceway elements and relationships between components and adjacent structural and architectural elements, including slab reinforcement, floor finish work, permanent partitions, expansion joints, and pretensioning or post-tensioning components.
- f. Indicate height of preset inserts, junction boxes, and raceways coordinated with depth of concrete slab and floor fill.
- g. Indicate thickening of slabs where required for adequate encasement of raceway components.
- h. Document coordination of exposed components with floor-covering materials to ensure that fittings and trim are suitable for indicated floor-covering material.
- i. Revise locations from those indicated in the Contract Documents, as required to suit field conditions and to ensure a functioning layout. Identify proposed deviations from the Contract Documents.
- j. Show details of connections and terminations of underfloor raceways at panelboards and communication terminal equipment in equipment rooms, wire closets, and similar spaces.
- k. Identify those cells of cellular floor deck that are to be connected and fitted for the following underfloor distribution:
  - 1) Power.
  - 2) Voice.
  - 3) Data.
  - 4) Signal.
  - 5) Communications.

C. Samples: For each underfloor raceway product, in specified finish, including the following:

1. Service fittings and flush and recessed outlet and junction-box covers.
2. A section of each service raceway configuration, with specified preset insert and service fitting installed.
3. A junction box of each size and type for use with underfloor raceway.
4. A section of each header raceway configuration, complete with provisions for connection with service raceway.
5. A section of trench-type raceway, complete with cover and required trim.
6. A junction box of each size and type for use with trench-type raceway, complete with cover and trim.

## 1.5 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

## 1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For underfloor raceways, to include in emergency, operation,

and maintenance manuals.

1. In addition to items specified in Section 01 7823 "Operation and Maintenance Data," include the following:
  - a. Manufacturer's written instructions for locating preset inserts and for installing afterset inserts.
- B. Project Record Documents: Submit final as-built Drawings, indicating dimensioned locations for all ducts, junction boxes, and preset inserts. Typical spacing designation shall be accepted only for preset insert spacing along a continuous length of duct.

## **1.7 QUALITY ASSURANCE**

- A. Testing Agency Qualifications: Member company of NETA or an NRTL.
  1. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing.
- B. Comply with UL 884.
- C. Comply with NFPA 70.
- D. Mockup: Install a mockup for evaluation of surface preparation and duct installation techniques and workmanship.
  1. Mockup area shall be designated by Architect.
  2. Do not proceed with remaining work until workmanship, appearance, and performance are approved.
  3. Repair or reinstall mockup area as required to produce acceptable work.
  4. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
  5. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

## **PART 2 - PRODUCTS**

### **2.1 SYSTEM DESCRIPTION**

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Jacks, Receptacles, and Fittings:
  1. Comply with Section 26 2726 "Wiring Devices" for power outlets, faceplates, and connectors.

## **2.2 TRENCH-TYPE UNDERFLOOR RACEWAYS**

- A. Description: Trench-type raceways used as header or feeder raceways to serve service raceways.
- B. Source Limitations: Obtain underfloor raceway components for each system through single source from single manufacturer.
- C. Trench: Steel, shop or factory welded and fabricated to indicated sizes. Include the following features:
  - 1. Slab Depth Adjustment: Minimum of minus 1/8 inch to plus 5/8 inch before and during concrete placement.
  - 2. Cover Supports: Height adjustable, with leveling screws to rigidly support cover assembly.
  - 3. Screed Strip: Extruded aluminum along both edges at proper elevation without requiring shim material.
  - 4. Trim Strip: Select to accommodate floor finish material.
  - 5. Partitions: Arranged to separate channels and isolate wiring of different systems.
  - 6. Grommeted openings in active floor cells or service raceways.
  - 7. Manufacturer's standard corrosion-resistant finish, applied after fabrication.
- D. Cover Plates: Removable, steel plates, 1/4 inch thick, each weighing 60 lb or less with full gasket attached to side units. Fabricate intermediate supports to limit unsupported spans to 15 inches or less. Fabricate covers with appropriate depth recess to receive indicated floor finish.

## **2.3 SUPPORTS, RACEWAY FITTINGS, AND HARDWARE**

- A. Source Limitations: Obtain underfloor raceway supports, fittings, and hardware components for each system through single source from single manufacturer.
- B. Supports, fittings, and hardware shall be compatible with raceway and outlet system and shall be listed for use with raceway systems and components delivered.
- C. Supports: Adjustable for height and arranged to maintain alignment and spacing of raceways during concrete placement. Include hold-down straps.
- D. Raceway Fittings: Couplings, expansion-joint sleeves, cross-under offsets, vertical and horizontal elbows, grounding screws, adapters, end caps, and other fittings suitable for use with basic components to form a complete installation.

## **2.4 JUNCTION BOXES**

- A. Description: Raceway manufacturer's standard enclosure for indicated type, quantity, arrangement, and configuration of raceways at each raceway junction, intersection, and access location. Include the following accessories and features:
  - 1. Mounting brackets.
  - 2. Escutcheons and holders to accommodate surrounding floor covering.
  - 3. Means for leveling and height adjustment more than 3/8 inch before and after concrete is placed.
  - 4. Boxes shall withstand a minimum 300-lb concentrated load. Internal supports shall be

- provided as needed to meet this requirement.
- 5. All boxes shall provide 2-inch-minimum bend radius for data and communication cables.
- 6. Raceway Openings: For underfloor raceways and conduits arranged to accommodate raceway layout.
- 7. Covers shall have appropriate depth recess to receive specific floor finish material.
- 8. Partitions to separate wiring of different systems.

## 2.5 SERVICE FITTINGS/ACTIVATIONS

- A. Source Limitations: Obtain underfloor raceway service fittings and hardware for each system through single source from single manufacturer.
- B. Exposed Parts Finish: To be approved by Architect.
- C. Flush, Single-System Service Fitting for Rectangular Inserts: Include mounting, hinged cover, and trim to support and provide access to connector, jack, or receptacle devices mounted flush with floor within insert.
  - 1. Connector, Jack, and Receptacle Devices: Modular type.
  - 2. Power Receptacle Rating: 20 A, 120 V unless otherwise indicated.
  - 3. Recess-Mounted Service Fitting: Modular fittings compatible with preset inserts. Include device plates for indicated systems and provisions for receptacles, jacks, and connectors. Include hinged flush covers with recessed depth to match thickness of floor finish material. Provide for internally mounted receptacle- and communication-jack and connector assemblies.
    - a. Duplex receptacle.
    - b. Duplex data jacks.
    - c. Double duplex receptacles.
    - d. Duplex receptacle and duplex data jacks.
    - e. Fiber-optic cable connector.
- D. Surface-Mounted Service Fitting: Modular pedestal type, with locking attachment matched to insert floor opening.
  - 1. Power-outlet, double-faced, surface-mounted unit for duplex receptacle on both sides.
  - 2. Power-outlet, single-faced, surface-mounted unit for duplex receptacle on one side.
  - 3. Communication-outlet, double-faced, surface-mounted unit.
    - a. Include bushed openings on both sides; 1-inch minimum diameter; insulated with nonconducting material.
    - b. Include provisions for modular dual fiber-optic connector assembly on both sides.
    - c. Include provisions for modular dual jack-connector assembly, rated for Category 6 on both sides.
  - 4. Communication-outlet, single-faced, surface-mounted unit with bushed opening on one side; 1-inch minimum diameter; insulated with nonconducting material.
  - 5. Combination surface-mounted unit for duplex receptacle on one side and with communication cable connection provision on opposite side.
    - a. Communication Side: Include bushed opening; 1-inch minimum diameter; insulated with nonconducting material.
    - b. Communication Side: Include provisions for modular dual jack-connector assembly, rated for Category 6.

6. Flush-Mounted Service Fittings: Modular fittings compatible with preset inserts and shall include covers, provisions for receptacles jacks and connector assemblies and wiring extensions to wall-mounted outlets, and associated device plates for indicated systems. Include flush covers, recessed to suit floor finish material.
7. Indicate types and locations of devices on Drawings.
  - a. Duplex convenience receptacle.
  - b. Duplex data outlets.
  - c. Double duplex convenience receptacles.
  - d. Duplex convenience receptacle and duplex data outlets.
  - e. Double duplex data outlets.
  - f. Duplex fiber-optic communication connector.
  - g. Wiring-Extension Service Fittings: Arrangement of brackets and mountings to support and provide access to wiring or cabling of a cell, and to connect the cable or raceway that extends the system to an individual wall outlet. Provide for connection of RMC for power extensions, and ENT optical fiber/communication cable raceway for communication system extensions.

### **PART 3 - EXECUTION**

#### **3.1 EXAMINATION**

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

#### **3.2 INSTALLATION**

- A. Install raceways aligned and leveled and, unless otherwise indicated, parallel or perpendicular to floor supports.
- B. Maintain arrangement of conductor services throughout the raceway system.
- C. Install a concrete mud slab for support of cellular metal, flush duct, or trench duct raceway. Construct mud slab with wire mesh in the top 1 inch of concrete.
- D. Install a vapor barrier between the cellular metal raceway and a substrate in contact with earth.
- E. Arrange supports to attain proper elevation, alignment, and spacing of raceways. Fasten supports securely at ends and at intervals not to exceed 60 inches, to prevent movement during concrete pour.
- F. Level raceway components with finished slab and make adjustments in raceway component elevation to accommodate indicated floor finishes.
- G. Junction Boxes: Install tops level and flush with finished floor. Install blank closure plates or plugs to close unused junction-box openings. Grout boxes in place to prevent movement during construction. Place top covers in inverted position during construction to prevent damage to surface of cover. Reinstall covers in proper position prior to final acceptance of the Work.

- H. Install preset inserts per manufacturer's instructions.
- I. Adjust supports to maintain a 1/8- to 3/8-inch finished concrete cover over preset inserts.
- J. Remove burrs, sharp edges, dents, and mechanical defects.
- K. Cap or plug boxes, insert- and service-fitting openings, and open ends of raceways.
- L. Install expansion fittings with suitable bonding jumper where raceways cross building expansion joints.
- M. Bond underfloor raceway components to create a continuous bonding path.
- N. Seal raceways, cells, junction boxes, and inserts to prevent water, concrete, or foreign matter from entering raceways before and during pouring slab or placing fill. Tape joints or seal with compound, as recommended in writing by underfloor raceway manufacturer.
- O. Install a marker at the center of the last insert of each cell and channel of each straight run of metal underfloor service raceway to locate the insert and identify the system.
  - 1. Install markers at last inserts on both sides of permanent walls and at first inserts adjacent to each junction box.
  - 2. Install markers flush at screed line before pouring slab or placing fill. Extend marker with grommited screw when floor covering is placed. Do not extend through carpet.
  - 3. Use slotted-head screw to identify electrical power; use Phillips-head screw to identify conventional communications.
  - 4. Use another distinctive screw head to identify third system, such as special-purpose wiring.
- P. Protect underfloor raceway system from damage. Do not use the installed duct system as working platforms or walkways. Do not allow equipment or heavy traffic over duct during construction period, without first installing ramps over the duct. Ramps shall be designed so that imposed loads are not transferred to the duct. Components of the system that are damaged during construction shall be replaced.
- Q. Install concrete surrounding underfloor raceways according to Section 03 3000 "Cast-in-Place Concrete."
- R. Afterset Inserts: Cut, hole saw, and drill slab and raceways to allow for installation at locations indicated on plans.
- S. Wiring shall comply with Section 26 0519 "Low-Voltage Electrical Power Conductors and Cables" and NFPA 70 requirements for wet locations.
  - 1. Install wiring from outlet insert toward junction boxes, then to termination at panel.
  - 2. Splices: All splices and taps shall be made in junction boxes. No splices or taps shall be made in raceways or outlet inserts.

### **3.3 FIELD QUALITY CONTROL**

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

- B. Perform the following tests and inspections with the assistance of a factory-authorized service representative:
  - 1. Perform visual inspection of interior of each section of trench raceway to verify absence of dirt, dust, construction debris, and moisture. Replace damaged and malfunctioning components.
  - 2. Prior to and after concrete pour, perform point-to-point tests of ground continuity and resistance of ground path between the most remote accessible fitting on each branch of each underfloor raceway system and the main electrical distribution grounding system.
    - a. Determine cause and perform correction of any point-to-point resistance value that exceeds 0.05 ohms.
    - b. Comply with NETA Acceptance Testing Specification about safety, suitability of test equipment, test instrument calibration, and test report and records.
- C. Prepare test and inspection reports.

### **3.4 CLEANING**

- A. Clean and swab out underfloor raceways, inserts, and junction boxes after finish has been applied to floor slab, and remove foreign material, dirt, and moisture. Leave interiors clean and dry.

**END OF SECTION**



## **SECTION 26 0543**

### **UNDERGROUND DUCTS AND RACEWAYS FOR ELECTRICAL SYSTEMS**

#### **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 SUMMARY**

- A. Section Includes:
  - 1. Metal conduits and fittings, including GRC and PVC-coated steel conduit.
  - 2. Rigid nonmetallic duct.
  - 3. Flexible nonmetallic duct.
  - 4. Duct accessories.
  - 5. Precast concrete handholes.
  - 6. Polymer concrete handholes and boxes with polymer concrete cover.
  - 7. Fiberglass handholes and boxes with polymer concrete cover.
  - 8. Fiberglass handholes and boxes.
  - 9. High-density plastic boxes.
  - 10. Utility structure accessories.

##### **1.3 DEFINITIONS**

- A. Direct Buried: Duct or a duct bank that is buried in the ground, without any additional casing materials such as concrete.
- B. Duct: A single duct or multiple ducts. Duct may be either installed singly or as component of a duct bank.
- C. Duct Bank:
  - 1. Two or more ducts installed in parallel, with or without additional casing materials.
  - 2. Multiple duct banks.
- D. GRC: Galvanized rigid (steel) conduit.
- E. Trafficways: Locations where vehicular or pedestrian traffic is a normal course of events.

##### **1.4 ACTION SUBMITTALS**

- A. Product Data: For each type of product.
  - 1. Include duct-bank materials, including spacers and miscellaneous components.

2. Include duct, conduits, and their accessories, including elbows, end bells, bends, fittings, and solvent cement.
3. Include accessories for handholes and boxes.
4. Include underground-line warning tape.
5. Include warning planks.

B. Shop Drawings:

1. Factory-Fabricated Handholes and Boxes Other Than Precast Concrete:
  - a. Include dimensioned plans, sections, and elevations, and fabrication and installation details.
  - b. Include duct entry provisions, including locations and duct sizes.
  - c. Include cover design.
  - d. Include grounding details.
  - e. Include dimensioned locations of cable rack inserts, and pulling-in and lifting irons.

## 1.5 INFORMATIONAL SUBMITTALS

- A. Duct and Duct-Bank Coordination Drawings: Show duct profiles and coordination with other utilities and underground structures.
  1. Include plans and sections, drawn to scale, and show bends and locations of expansion fittings.
  2. Drawings shall be signed and sealed by a qualified professional engineer.
- B. Qualification Data: For professional engineer and testing agency responsible for testing nonconcrete handholes and boxes.
- C. Product Certificates: For concrete and steel used in precast concrete handholes, as required by ASTM C 858.
- D. Source quality-control reports.
- E. Field quality-control reports.

## 1.6 MAINTENANCE MATERIALS SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
- B. Furnish cable-support stanchions, arms, insulators, and associated fasteners in quantities equal to 5 percent of quantity of each item installed.

## 1.7 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated.

## **1.8 FIELD CONDITIONS**

- A. Interruption of Existing Electrical Service: Do not interrupt electrical service to facilities occupied by Owner or others unless permitted under the following conditions, and then only after arranging to provide temporary electrical service according to requirements indicated:
  - 1. Notify Construction Manager and owner no fewer than five days in advance of proposed interruption of electrical service.
  - 2. Do not proceed with interruption of electrical service without Construction Manager's and Owner's written permission.
- B. Ground Water: Assume ground-water level is at grade level unless a lower water table is noted on Drawings.
- C. Ground Water: Assume ground-water level is 36 inches (900 mm) below ground surface unless a higher water table is noted on Drawings.

## **PART 2 - PRODUCTS**

### **2.1 METAL CONDUIT AND FITTINGS**

- A. GRC: Comply with ANSI C80.1 and UL 6.
- B. Coated Steel Conduit: PVC-coated GRC.
  - 1. Comply with NEMA RN 1.
  - 2. Coating Thickness: 0.040 inch (1 mm), minimum.
- C. Listed and labeled as defined in NFPA 70, by a nationally recognized testing laboratory, and marked for intended location and application.

### **2.2 RIGID NONMETALLIC DUCT**

- A. Underground Plastic Utilities Duct: Type EPC-80-PVC and Type EPC-40-PVC RNC, complying with NEMA TC 2 and UL 651, with matching fittings complying with NEMA TC 3 by same manufacturer as duct.
- B. Underground Plastic Utilities Duct: Type DB-60 PVC and Type DB-120 PVC RNC, complying with NEMA TC 6 & 8 and ASTM F 512 for direct burial, with matching fittings complying with NEMA TC 9 by same manufacturer as duct.
- C. Underground Plastic Utilities Duct: Type EB-20 PVC RNC, complying with NEMA TC 6 & 8, ASTM F 512, and UL 651, with matching fittings complying with NEMA TC 9 by same manufacturer as duct.
- D. Listed and labeled as defined in NFPA 70, by a nationally recognized testing laboratory, and marked for intended location and application.

## **2.3 FLEXIBLE NONMETALLIC DUCTS**

- A. HDPE Duct: Type EPEC-40 HDPE and Type EPEC-80 HDPE, complying with NEMA TC 7 and UL 651A.
  - 1. Listed and labeled as defined in NFPA 70, by a nationally recognized testing laboratory, and marked for intended location and application.

## **2.4 DUCT ACCESSORIES**

- A. Duct Spacers: Factory-fabricated, rigid, PVC interlocking spacers; sized for type and size of duct with which used, and selected to provide minimum duct spacing indicated while supporting duct during concreting or backfilling.
- B. Underground-Line Warning Tape: Comply with requirements for underground-line warning tape specified in Section 26 0553 "Identification for Electrical Systems."
- C. Concrete Warning Planks: Nominal 12 by 24 by 3 inches (300 by 600 by 75 mm) in size, manufactured from 6000-psi (41-MPa) concrete.
  - 1. Color: Red dye added to concrete during batching.
  - 2. Mark each plank with "ELECTRIC" in 2-inch- (50-mm-) high, 3/8-inch- (10-mm-) deep letters.

## **2.5 PRECAST CONCRETE HANDHOLES AND BOXES**

- A. Description: Factory-fabricated, reinforced-concrete, monolithically poured walls and bottom unless open-bottom enclosures are indicated. Frame and cover shall form top of enclosure and shall have load rating consistent with that of handhole or box.
- B. Comply with ASTM C 858 for design and manufacturing processes.
- C. Frame and Cover: Weatherproof cast-iron frame, with cast-iron cover with recessed cover hook eyes and tamper-resistant, captive, cover-securing bolts.
- D. Frame and Cover: Weatherproof steel frame, with steel cover with recessed cover hook eyes and tamper-resistant, captive, cover-securing bolts.
- E. Frame and Cover: Weatherproof steel frame, with hinged steel access door assembly with tamper-resistant, captive, cover-securing bolts.
  - 1. Cover Hinges: Concealed, with hold-open ratchet assembly.
  - 2. Cover Handle: Recessed.
- F. Frame and Cover: Weatherproof aluminum frame with hinged aluminum access door assembly with tamper-resistant, captive, cover-securing bolts.
  - 1. Cover Hinges: Concealed, with hold-open ratchet assembly.
  - 2. Cover Handle: Recessed.
- G. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.

- H. Cover Legend: Molded lettering, **"ELECTRIC"**
- I. Configuration: Units shall be designed for flush burial and have closed bottom unless otherwise indicated.
- J. Extensions and Slabs: Designed to mate with bottom of enclosure. Same material as enclosure.
  - 1. Extension shall provide increased depth of [12 inches (300 mm)].
  - 2. Slab: Same dimensions as bottom of enclosure, and arranged to provide closure.
- K. Joint Sealant: Asphaltic-butyl material with adhesion, cohesion, flexibility, and durability properties necessary to withstand maximum hydrostatic pressures at the installation location with the ground-water level at grade.
- L. Duct Entrances in Handhole Walls: Cast end-bell or duct-terminating fitting in wall for each entering duct.
  - 1. Type and size shall match fittings to duct to be terminated.
  - 2. Fittings shall align with elevations of approaching duct and be located near interior corners of handholes to facilitate racking of cable.
- M. Handholes [12 inches wide by 24 inches long (300 mm wide by 600 mm long)] and larger shall have inserts for cable racks and pulling-in irons installed before concrete is poured.

## **2.6 POLYMER CONCRETE HANDHOLES AND BOXES WITH POLYMER CONCRETE COVER**

- A. Description: Molded of sand and aggregate, bound together with a polymer resin, and reinforced with steel or fiberglass or a combination of the two.
- B. Standard: Comply with SCTE 77. Comply with tier requirements in "Underground Enclosure Application" Article.
- C. Color: Gray.
- D. Configuration: Units shall be designed for flush burial and have closed bottom unless otherwise indicated.
- E. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure.
- F. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
- G. Cover Legend: Molded lettering, **"ELECTRIC"**.
- H. Direct-Buried Wiring Entrance Provisions: Knockouts equipped with insulated bushings or end-bell fittings, selected to suit box material, sized for wiring indicated, and arranged for secure, fixed installation in enclosure wall.
- I. Duct Entrance Provisions: Duct-terminating fittings shall mate with entering duct for secure, fixed installation in enclosure wall.
- J. Handholes [12 inches wide by 24 inches long (300 mm wide by 600 mm long)] and larger shall have factory-installed inserts for cable racks and pulling-in irons.

## **2.7 FIBERGLASS HANDHOLES AND BOXES WITH POLYMER CONCRETE FRAME AND COVER**

- A. Description: Sheet-molded, fiberglass-reinforced, polyester resin enclosure joined to polymer concrete top ring or frame.
- B. Standard: Comply with SCTE 77. Comply with tier requirements in "Underground Enclosure Application" Article.
- C. Color: Gray.
- D. Configuration: Units shall be designed for flush burial and have closed bottom unless otherwise indicated.
- E. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure.
- F. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
- G. Cover Legend: Molded lettering, "**ELECTRIC**".
- H. Direct-Buried Wiring Entrance Provisions: Knockouts equipped with insulated bushings or end-bell fittings, selected to suit box material, sized for wiring indicated, and arranged for secure, fixed installation in enclosure wall.
- I. Duct Entrance Provisions: Duct-terminating fittings shall mate with entering duct for secure, fixed installation in enclosure wall.
- J. Handholes [12 inches wide by 24 inches long (300 mm wide by 600 mm long)] and larger shall have factory-installed inserts for cable racks and pulling-in irons.

## **2.8 FIBERGLASS HANDHOLES AND BOXES**

- A. Description: Molded of fiberglass-reinforced polyester resin, with covers made of hot-dip galvanized-steel diamond plate.
- B. Standard: Comply with SCTE 77. Comply with tier requirements in "Underground Enclosure Application" Article.
- C. Color: Gray.
- D. Configuration: Units shall be designed for flush burial and have closed bottom unless otherwise indicated.
- E. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure.
- F. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
- G. Cover Legend: Molded lettering, "**ELECTRIC**".
- H. Direct-Buried Wiring Entrance Provisions: Knockouts equipped with insulated bushings or end-bell fittings, selected to suit box material, sized for wiring indicated, and arranged for secure,

fixed installation in enclosure wall.

- I. Duct Entrance Provisions: Duct-terminating fittings shall mate with entering duct for secure, fixed installation in enclosure wall.
- J. Handholes [12 inches wide by 24 inches long (300 mm wide by 600 mm long)] and larger shall have factory-installed inserts for cable racks and pulling-in irons.

## **2.9 HIGH-DENSITY PLASTIC BOXES**

- A. Description: Injection molded of HDPE or copolymer-polypropylene. Cover shall be made of hot-dip galvanized-steel diamond plate.
- B. Standard: Comply with SCTE 77. Comply with tier requirements in "Underground Enclosure Application" Article.
- C. Color: Gray.
- D. Configuration: Units shall be designed for flush burial and have closed bottom unless otherwise indicated.
- E. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure.
- F. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
- G. Cover Legend: Molded lettering, "**ELECTRIC**".
- H. Direct-Buried Wiring Entrance Provisions: Knockouts equipped with insulated bushings or end-bell fittings, selected to suit box material, sized for wiring indicated, and arranged for secure, fixed installation in enclosure wall.
- I. Duct Entrance Provisions: Duct-terminating fittings shall mate with entering duct for secure, fixed installation in enclosure wall.
- J. Handholes [12 inches wide by 24 inches long (300 mm wide by 600 mm long)] and larger shall have factory-installed inserts for cable racks and pulling-in irons.

## **2.10 UTILITY STRUCTURE ACCESSORIES**

- A. Accessories for Utility Structures: Utility equipment and accessory items used for utility structure access and utility support, listed and labeled for intended use and application.

## **2.11 SOURCE QUALITY CONTROL**

- A. Test and inspect precast concrete utility structures according to ASTM C 1037.
- B. Nonconcrete Handhole and Pull-Box Prototype Test: Test prototypes of boxes for compliance with SCTE 77. Strength tests shall be for specified tier ratings of products supplied.
  - 1. Tests of materials shall be performed by an independent testing agency.

2. Strength tests of complete boxes and covers shall be by an independent testing agency or manufacturer. A qualified registered professional engineer shall certify tests by manufacturer.
3. Testing machine pressure gages shall have current calibration certification, complying with ISO 9000 and ISO 10012, and traceable to NIST standards.

## **PART 3 - EXECUTION**

### **3.1 PREPARATION**

- A. Coordinate layout and installation of duct, duct bank, handholes, and boxes with final arrangement of other utilities, site grading, and surface features as determined in the field. Notify Architect if there is a conflict between areas of excavation and existing structures or archaeological sites to remain.
- B. Coordinate elevations of duct and duct-bank entrances into handholes and boxes with final locations and profiles of duct and duct banks, as determined by coordination with other utilities, underground obstructions, and surface features. Revise locations and elevations as required to suit field conditions and to ensure that duct and duct bank will drain to handholes, and as approved by Architect.
- C. Clear and grub vegetation to be removed, and protect vegetation to remain.

### **3.2 UNDERGROUND DUCT APPLICATION**

- A. Duct for Electrical Branch Circuits: Type EPC-40-PVC RNC, direct-buried unless otherwise indicated.
- B. Bored Underground Duct: Type EPEC-40-HDPE unless otherwise indicated.
- C. Underground Ducts Crossing Paved Paths, Walk, Driveways, and Roadways: Type EPC-40 PVC RNC, encased in reinforced concrete.
- D. Stub-ups: Concrete-encased GRC.

### **3.3 UNDERGROUND ENCLOSURE APPLICATION**

- A. Handholes and Boxes for 600 V and Less:
  1. Units in Roadways and Other Deliberate Traffic Paths: Precast concrete. AASHTO HB 17, H-20 structural load rating.
  2. Units in Driveway, Parking Lot, and Off-Roadway Locations, Subject to Occasional, Nondeliberate Loading by Heavy Vehicles: Fiberglass-reinforced polyester resin, SCTE 77, Tier 15 structural load rating.
  3. Units in Sidewalk and Similar Applications with a Safety Factor for Nondeliberate Loading by Vehicles: Heavy-duty fiberglass units with polymer concrete frame and cover, SCTE 77, Tier 8 structural load rating.
  4. Units Subject to Light-Duty Pedestrian Traffic Only: Fiberglass-reinforced polyester resin, structurally tested according to SCTE 77 with 3000-lbf (13 345-N) vertical loading.
  5. Cover design load shall not exceed the design load of the handhole or box.



### **3.4 EARTHWORK**

- A. Excavation and Backfill: Comply with Section 31 2000 "Earth Moving" and/or Structural Engineer requirements.
- B. Restoration: Replace area immediately after backfilling is completed or after construction vehicle traffic in immediate area is complete.
- C. Restore surface features at areas disturbed by excavation, and re-establish original grades unless otherwise indicated. Replace removed sod immediately after backfilling is completed.
- D. Restore areas disturbed by trenching, storing of dirt, cable laying, and other work. Restore vegetation and include necessary topsoiling, fertilizing, liming, seeding, sodding, sprigging, and mulching.
- E. Cut and patch existing pavement in the path of underground duct, duct bank, and underground structures.

### **3.5 DUCT AND DUCT-BANK INSTALLATION**

- A. Where indicated on Drawings, install duct, spacers, and accessories into the duct-bank configuration shown. Duct installation requirements in this Section also apply to duct bank.
- B. Install duct according to NEMA TCB 2.
- C. Slope: Pitch duct a minimum slope of 1:300 down toward handholes and away from buildings and equipment.
- D. Curves and Bends: Use 5-degree angle couplings for small changes in direction. Use manufactured long sweep bends with a minimum radius of [48 inches (1200 mm)] [12.5 feet (4 m)] [25 feet (7.5 m)], both horizontally and vertically, at other locations unless otherwise indicated.
  - 1. Duct shall have maximum of two 90 degree bends or the total of all bends shall be no more 180 degrees between pull points.
- E. Joints: Use solvent-cemented joints in duct and fittings and make watertight according to manufacturer's written instructions. Stagger couplings so those of adjacent duct do not lie in same plane.
- F. Installation Adjacent to High-Temperature Steam Lines: Where duct is installed parallel to underground steam lines, perform calculations showing the duct will not be subject to environmental temperatures above 40 deg C. Where environmental temperatures are calculated to rise above 40 deg C, and anywhere the duct crosses above an underground steam line, install insulation blankets listed for direct burial to isolate the duct bank from the steam line.
- G. End Bell Entrances to Concrete and Polymer Concrete Handholes: Use end bells, spaced approximately 10 inches (250 mm) o.c. for 5-inch (125-mm) duct, and vary proportionately for other duct sizes.
  - 1. Begin change from regular spacing to end-bell spacing 10 feet (3 m) from the end bell, without reducing duct slope and without forming a trap in the line.

2. Expansion and Deflection Fittings: Install an expansion and deflection fitting in each duct in the area of disturbed earth adjacent to handhole. Install an expansion fitting near the center of all straight line direct-buried duct with calculated expansion of more than 3/4 inch (19 mm).
  3. Grout end bells into structure walls from both sides to provide watertight entrances.
- H. Terminator Entrances to Concrete and Polymer Concrete Handholes: Use manufactured, cast-in-place duct terminators, with entrances into structure spaced approximately 6 inches (150 mm) o.c. for 4-inch (100-mm) duct, and vary proportionately for other duct sizes.
1. Begin change from regular spacing to terminator spacing 10 feet (3 m) from the terminator, without reducing duct line slope and without forming a trap in the line.
  2. Expansion and Deflection Fittings: Install an expansion and deflection fitting in each duct in the area of disturbed earth adjacent to handhole. Install an expansion fitting near the center of all straight line duct with calculated expansion of more than 3/4 inch (19 mm).
- I. Building Wall Penetrations: Make a transition from underground duct to GRC at least 10 feet (3 m) outside the building wall, without reducing duct line slope away from the building and without forming a trap in the line. Use fittings manufactured for RNC-to-GRC transition. Install GRC penetrations of building walls as specified in Section 26 0544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."
- J. Sealing: Provide temporary closure at terminations of duct with pulled cables. Seal spare duct at terminations. Use sealing compound and plugs to withstand at least 15-psig (1.03-MPa) hydrostatic pressure.
- K. Pulling Cord: Install 200-lbf- (1000-N-) test nylon cord in empty ducts.
- L. Concrete-Encased Ducts and Duct Bank:
1. Excavate trench bottom to provide firm and uniform support for duct. Prepare trench bottoms as specified in Section 31 2000 "Earth Moving" for pipes less than 6 inches (150 mm) in nominal diameter.
  2. Width: Excavate trench 12 inches (300 mm) wider than duct on each side.
  3. Width: Excavate trench 3 inches (75 mm) wider than duct on each side.
  4. Depth: Install so top of duct envelope is at least 24 inches (600 mm) below finished grade in areas not subject to deliberate traffic, and at least 30 inches (750 mm) below finished grade in deliberate traffic paths for vehicles unless otherwise indicated.
  5. Support duct on duct spacers coordinated with duct size, duct spacing, and outdoor temperature.
  6. Spacer Installation: Place spacers close enough to prevent sagging and deforming of duct, with not less than four spacers per 20 feet (6 m) of duct. Place spacers within 24 inches (600 mm) of duct ends. Stagger spacers approximately 6 inches (150 mm) between tiers. Secure spacers to earth and to duct to prevent floating during concreting. Tie entire assembly together using fabric straps; do not use tie wires or reinforcing steel that may form conductive or magnetic loops around ducts or duct groups.
  7. Minimum Space between Duct: 3 inches (75 mm) between edge of duct and exterior envelope wall, 2 inches (50 mm) between ducts for like services, and 4 inches (100 mm) between power and communications ducts.
  8. Elbows: Use manufactured duct elbows for stub-ups, at building entrances, and at changes of direction in duct unless otherwise indicated. Extend encasement throughout length of elbow.
  9. Elbows: Use manufactured GRC elbows for stub-ups, at building entrances, and at changes of direction in duct run.

- a. Couple RNC duct to GRC with adapters designed for this purpose, and encase coupling with 3 inches (75 mm) of concrete.
  - b. Stub-ups to Outdoor Equipment: Extend concrete-encased GRC horizontally a minimum of 60 inches (1500 mm) from edge of base. Install insulated grounding bushings on terminations at equipment.
    - 1) Stub-ups shall be minimum 4 inches (100 mm) above finished floor and minimum 3 inches (75 mm) from conduit side to edge of slab.
  - c. Stub-ups to Indoor Equipment: Extend concrete-encased GRC horizontally a minimum of 60 inches (1500 mm) from edge of wall. Install insulated grounding bushings on terminations at equipment.
    - 1) Stub-ups shall be minimum 4 inches (100 mm) above finished floor and no less than 3 inches (75 mm) from conduit side to edge of slab.
10. Reinforcement: Reinforce concrete-encased duct where crossing disturbed earth and where indicated. Arrange reinforcing rods and ties without forming conductive or magnetic loops around ducts or duct groups.
  11. Forms: Use walls of trench to form side walls of duct bank where soil is self-supporting and concrete envelope can be poured without soil inclusions; otherwise, use forms.
  12. Concrete Cover: Install a minimum of 3 inches (75 mm) of concrete cover between edge of duct to exterior envelope wall, 2 inches (50 mm) between duct of like services, and 4 inches (100 mm) between power and communications ducts.
  13. Pouring Concrete: Place concrete carefully during pours to prevent voids under and between duct and at exterior surface of envelope. Do not allow a heavy mass of concrete to fall directly onto ducts. Allow concrete to flow around duct and rise up in middle, uniformly filling all open spaces. Do not use power-driven agitating equipment unless specifically designed for duct-installation application.

M. Direct-Buried Duct and Duct Bank:

1. Excavate trench bottom to provide firm and uniform support for duct. Comply with requirements in Section 31 2000 "Earth Moving" for preparation of trench bottoms for pipes less than 6 inches (150 mm) in nominal diameter.
2. Width: Excavate trench 12 inches (300 mm) wider than duct on each side.
3. Width: Excavate trench 3 inches (75 mm) wider than duct on each side.
4. Depth: Install top of duct at least 36 inches (900 mm) below finished grade unless otherwise indicated.
5. Set elevation of bottom of duct bank below frost line.
6. Support ducts on duct spacers coordinated with duct size, duct spacing, and outdoor temperature.
7. Spacer Installation: Place spacers close enough to prevent sagging and deforming of duct, with not less than four spacers per 20 feet (6 m) of duct. Place spacers within 24 inches (600 mm) of duct ends. Stagger spacers approximately 6 inches (150 mm) between tiers. Secure spacers to earth and to ducts to prevent floating during concreting. Tie entire assembly together using fabric straps; do not use tie wires or reinforcing steel that may form conductive or magnetic loops around ducts or duct groups.
8. Install duct with a minimum of 3 inches (75 mm) between ducts for like services and 6 inches (150 mm) between power and communications duct.
9. Elbows: Install manufactured duct elbows for stub-ups, at building entrances, and at changes of direction in duct direction unless otherwise indicated. Encase elbows for stub-up ducts throughout length of elbow.
10. Install manufactured GRC elbows for stub-ups, at building entrances, and at changes of

direction in duct.

- a. Couple RNC duct to GRC with adapters designed for this purpose, and encase coupling with 3 inches (75 mm) of concrete.
  - b. Stub-ups to Outdoor Equipment: Extend concrete-encased GRC horizontally a minimum of 60 inches (1500 mm) from edge of base. Install insulated grounding bushings on terminations at equipment.
    - 1) Stub-ups shall be minimum 4 inches (100 mm) above finished floor and minimum 3 inches (75 mm) from conduit side to edge of slab.
  - c. Stub-ups to Indoor Equipment: Extend concrete-encased GRC horizontally a minimum of 60 inches (1500 mm) from edge of wall. Install insulated grounding bushings on terminations at equipment.
    - 1) Stub-ups shall be minimum 4 inches (100 mm) above finished floor and no less than 3 inches (75 mm) from conduit side to edge of slab.
11. After installing first tier of duct, backfill and compact. Start at tie-in point and work toward end of duct run, leaving ducts at end of run free to move with expansion and contraction as temperature changes during this process. Repeat procedure after placing each tier. After placing last tier, backfill duct and tamp. Firmly tamp backfill around ducts to provide maximum supporting strength. After placing controlled backfill over final tier, make final duct connections at end of run and complete backfilling with compaction. Comply with requirements in Section 31 2000 "Earth Moving" and/or Structural Engineer requirements for installation of backfill materials.
- N. Warning Planks: Bury warning planks approximately 12 inches (300 mm) above direct-buried duct, placing them 24 inches (600 mm) o.c. Align planks along the width and along the centerline of duct or duct bank. Provide an additional plank for each 12-inch (300-mm) increment of duct-bank width over a nominal 18 inches (450 mm). Space additional planks 12 inches (300 mm) apart, horizontally.
- O. Underground-Line Warning Tape: Bury conducting underground line specified in Section 26 0553 "Identification for Electrical Systems" no less than 12 inches (300 mm) above all concrete-encased duct and duct banks and approximately 12 inches (300 mm) below grade. Align tape parallel to and within 3 inches (75 mm) of centerline of duct bank. Provide an additional warning tape for each 12-inch (300-mm) increment of duct-bank width over a nominal 18 inches (450 mm). Space additional tapes 12 inches (300 mm) apart, horizontally.

### **3.6 INSTALLATION OF CONCRETE HANDHOLES AND BOXES**

- A. Precast Concrete Handhole Installation:
- 1. Comply with ASTM C 891 unless otherwise indicated.
  - 2. Install units level and plumb and with orientation and depth coordinated with connecting duct, to minimize bends and deflections required for proper entrances.
  - 3. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1-inch (25-mm) sieve to No. 4 (4.75-mm) sieve and compacted to same density as adjacent undisturbed earth.
- B. Elevations:
- 1. Install handholes with bottom below frost line.
  - 2. Handhole Covers: In paved areas and trafficways, set surface flush with finished grade.

- Set covers of other handholes 1 inch (25 mm) above finished grade.
3. Where indicated, cast handhole cover frame integrally with handhole structure.
- C. Waterproofing: Apply waterproofing to exterior surfaces of handholes after concrete has cured at least three days. After duct has been connected and grouted, and before backfilling, waterproof joints and connections, and touch up abrasions and scars.
- D. Dampproofing: Apply dampproofing to exterior surfaces of handholes after concrete has cured at least three days. After ducts are connected and grouted, and before backfilling, dampproof joints and connections, and touch up abrasions and scars.
- E. Hardware: Install removable hardware, including pulling eyes, cable stanchions, and cable arms, and insulators, as required for installation and support of cables and conductors and as indicated.
- F. Field-Installed Bolting Anchors in Concrete Handholes: Do not drill deeper than 2 inches (50 mm) for handholes, for anchor bolts installed in the field. Use a minimum of two anchors for each cable stanchion.

### **3.7 INSTALLATION OF HANDHOLES AND BOXES OTHER THAN PRECAST CONCRETE**

- A. Install handholes and boxes level and plumb and with orientation and depth coordinated with connecting duct, to minimize bends and deflections required for proper entrances. Use box extension if required to match depths of duct, and seal joint between box and extension as recommended by manufacturer.
- B. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1/2-inch (12.5-mm) sieve to No. 4 (4.75-mm) sieve and compacted to same density as adjacent undisturbed earth.
- C. Elevation: In paved areas and trafficways, set cover flush with finished grade. Set covers of other handholes 1 inch (25 mm) above finished grade.
- D. Install handholes and boxes with bottom below frost line.
- E. Install removable hardware, including pulling eyes, cable stanchions, cable arms, and insulators, as required for installation and support of cables and conductors and as indicated. Select arm lengths to be long enough to provide spare space for future cables, but short enough to preserve adequate working clearances in enclosure.
- F. Field cut openings for duct according to enclosure manufacturer's written instructions. Cut wall of enclosure with a tool designed for material to be cut. Size holes for terminating fittings to be used, and seal around penetrations after fittings are installed.
- G. For enclosures installed in asphalt paving or other type of paving and subject to occasional, nondeliberate, heavy-vehicle loading, form and pour a concrete ring encircling, and in contact with, enclosure and with top surface screeded to top of box cover frame. Bottom of ring shall rest on compacted earth.
1. Concrete: 3000 psi (20 kPa), 28-day strength.
  2. Dimensions:

### **3.8 GROUNDING**

- A. Ground underground ducts and utility structures according to Section 26 0526 "Grounding and Bonding for Electrical Systems."

### **3.9 FIELD QUALITY CONTROL**

- A. Perform the following tests and inspections:
  - 1. Demonstrate capability and compliance with requirements on completion of installation of underground duct, duct bank, and utility structures.
  - 2. Pull solid aluminum or wood test mandrel through duct to prove joint integrity and adequate bend radii, and test for out-of-round duct. Provide a minimum 12-inch- (300-mm-) long mandrel equal to duct size minus 1/4 inch (6 mm). If obstructions are indicated, remove obstructions and retest.
  - 3. Test handhole grounding to ensure electrical continuity of grounding and bonding connections. Measure and report ground resistance as specified in Section 26 0526 "Grounding and Bonding for Electrical Systems."
- B. Correct deficiencies and retest as specified above to demonstrate compliance.
- C. Prepare test and inspection reports.

### **3.10 CLEANING**

- A. Pull leather-washer-type duct cleaner, with graduated washer sizes, through full length of duct until duct cleaner indicates that duct is clear of dirt and debris. Follow with rubber duct swab for final cleaning and to assist in spreading lubricant throughout ducts.

**END OF SECTION**

## **SECTION 26 0544**

### **SLEEVES AND SLEEVE SEALS FOR ELECTRICAL RACEWAYS AND CABLING**

#### **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 SUMMARY**

- A. Section Includes:
  - 1. Sleeves for raceway and cable penetration of non-fire-rated construction walls and floors.
  - 2. Sleeve-seal systems.
  - 3. Sleeve-seal fittings.
  - 4. Grout.
  - 5. Silicone sealants.
- B. Related Requirements:
  - 1. Section 07 8413 "Penetration Firestopping" for penetration firestopping installed in fire-resistance-rated walls, horizontal assemblies, and smoke barriers, with and without penetrating items.

##### **1.3 ACTION SUBMITTALS**

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

#### **PART 2 - PRODUCTS**

##### **2.1 SLEEVES**

- A. Wall Sleeves:
  - 1. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, plain ends.
  - 2. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.
- B. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies: Galvanized-steel sheet; 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint, with tabs for screw-fastening the sleeve to the board.

- C. PVC-Pipe Sleeves: ASTM D 1785, Schedule 40.
- D. Molded-PVC Sleeves: With nailing flange for attaching to wooden forms.
- E. Molded-PE or -PP Sleeves: Removable, tapered-cup shaped, and smooth outer surface with nailing flange for attaching to wooden forms.
- F. Sleeves for Rectangular Openings:
  - 1. Material: Galvanized sheet steel.
  - 2. Minimum Metal Thickness:
    - a. For sleeve cross-section rectangle perimeter less than 50 inches and with no side larger than 16 inches, thickness shall be 0.052 inch.
    - b. For sleeve cross-section rectangle perimeter 50 inches or more and one or more sides larger than 16 inches, thickness shall be 0.138 inch.

## **2.2 SLEEVE-SEAL SYSTEMS**

- A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.
  - 1. Sealing Elements: EPDM rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
  - 2. Pressure Plates: Carbon steel.
  - 3. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements.

## **2.3 SLEEVE-SEAL FITTINGS**

- A. Description: Manufactured plastic, sleeve-type, waterstop assembly made for embedding in concrete slab or wall. Unit shall have plastic or rubber waterstop collar with center opening to match piping OD.

## **2.4 GROUT**

- A. Description: Nonshrink; recommended for interior and exterior sealing openings in non-fire-rated walls or floors.
- B. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
- C. Design Mix: 5000-psi, 28-day compressive strength.
- D. Packaging: Premixed and factory packaged.

## **2.5 SILICONE SEALANTS**

- A. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants of grade indicated below.



1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces that are not fire rated.
- B. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.

### **PART 3 - EXECUTION**

#### **3.1 SLEEVE INSTALLATION FOR NON-FIRE-RATED ELECTRICAL PENETRATIONS**

- A. Comply with NECA 1.
- B. Comply with NEMA VE 2 for cable tray and cable penetrations.
- C. Sleeves for Conduits Penetrating Above-Grade Non-Fire-Rated Concrete and Masonry-Unit Floors and Walls:
  1. Interior Penetrations of Non-Fire-Rated Walls and Floors:
    - a. Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Section 07 9200 "Joint Sealants."
    - b. Seal space outside of sleeves with mortar or grout. Pack sealing material solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect material while curing.
  2. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
  3. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and raceway or cable unless sleeve seal is to be installed or unless seismic criteria require different clearance.
  4. Install sleeves for wall penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of walls. Cut sleeves to length for mounting flush with both surfaces of walls. Deburr after cutting.
  5. Install sleeves for floor penetrations. Extend sleeves installed in floors 2 inches above finished floor level. Install sleeves during erection of floors.
- D. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies:
  1. Use circular metal sleeves unless penetration arrangement requires rectangular sleeved opening.
  2. Seal space outside of sleeves with approved joint compound for gypsum board assemblies.
- E. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.
- F. Aboveground, Exterior-Wall Penetrations: Seal penetrations using steel pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
- G. Underground, Exterior-Wall and Floor Penetrations: Install cast-iron pipe sleeves. Size sleeves

to allow for 1-inch annular clear space between raceway or cable and sleeve for installing sleeve-seal system.

### **3.2 SLEEVE-SEAL-SYSTEM INSTALLATION**

- A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at raceway entries into building.
- B. Install type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

### **3.3 SLEEVE-SEAL-FITTING INSTALLATION**

- A. Install sleeve-seal fittings in new walls and slabs as they are constructed.
- B. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position waterstop flange to be centered in concrete slab or wall.
- C. Secure nailing flanges to concrete forms.
- D. Using grout, seal the space around outside of sleeve-seal fittings.

**END OF SECTION**

## **SECTION 26 0553**

### **IDENTIFICATION FOR ELECTRICAL SYSTEMS**

#### **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 SUMMARY**

- A. Section Includes:
  - 1. Color and legend requirements for raceways, conductors, and warning labels and signs.
  - 2. Labels.
  - 3. Bands and tubes.
  - 4. Tapes and stencils.
  - 5. Tags.
  - 6. Signs.
  - 7. Cable ties.
  - 8. Paint for identification.
  - 9. Fasteners for labels and signs.

##### **1.3 ACTION SUBMITTALS**

- A. Product Data: For each type of product.
  - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for electrical identification products.
- B. Identification Schedule: For each piece of electrical equipment and electrical system components to be an index of nomenclature for electrical equipment and system components used in identification signs and labels. Use same designations indicated on Drawings.
- C. Delegated-Design Submittal: For arc-flash hazard study.

#### **PART 2 - PRODUCTS**

##### **2.1 PERFORMANCE REQUIREMENTS**

- A. Comply with ASME A13.1 and IEEE C2.
- B. Comply with NFPA 70.
- C. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.

- D. Comply with ANSI Z535.4 for safety signs and labels.
- E. Comply with NFPA 70E and Section 26 0574 "Overcurrent Protective Device Arc-Flash Study" requirements for arc-flash warning labels.
- F. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.
- G. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.
  - 1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

## **2.2 COLOR AND LEGEND REQUIREMENTS**

- A. Raceways and Cables Carrying Circuits at 600 V or Less:
  - 1. Black letters on an orange field.
  - 2. Legend: Indicate voltage and system or service type.
- B. Color-Coding for Phase- and Voltage-Level Identification, 600 V or Less: Use colors listed below for ungrounded service, feeder, and branch-circuit conductors.
  - 1. Color shall be factory applied or field applied for sizes larger than No. 8 AWG if authorities having jurisdiction permit.
  - 2. Colors for 208/120-V Circuits:
    - a. Phase A: Black.
    - b. Phase B: Red.
    - c. Phase C: Blue.
  - 3. Colors for 240-V Circuits:
    - a. Phase A: Black.
    - b. Phase B: Red.
  - 4. Colors for 480/277-V Circuits:
    - a. Phase A: Brown.
    - b. Phase B: Orange.
    - c. Phase C: Yellow.
  - 5. Color for Neutral: White.
  - 6. Color for Equipment Grounds: Green.
  - 7. Colors for Isolated Grounds: Green with white stripe.
- C. Raceways and Cables Carrying Circuits at More Than 600 V:
  - 1. Black letters on an orange field.
  - 2. Legend: "DANGER - CONCEALED HIGH VOLTAGE WIRING."
- D. Warning Label Colors:
  - 1. Identify system voltage with black letters on an orange background.

- E. Warning labels and signs shall include, but are not limited to, the following legends:
  - 1. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."
  - 2. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES."
- F. Equipment Identification Labels:
  - 1. Black letters on a white field.

## **2.3 LABELS**

- A. Self-Adhesive Labels: Vinyl, thermal, transfer-printed, 3-mil-thick, multicolor, weather- and UV-resistant, pressure-sensitive adhesive labels, configured for intended use and location.
  - 1. Minimum Nominal Size:
    - a. 1-1/2 by 6 inches for raceway and conductors.
    - b. 3-1/2 by 5 inches for equipment.
    - c. As required by authorities having jurisdiction.

## **2.4 TAPES AND STENCILS**

- A. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.
- B. Self-Adhesive Vinyl Tape: Colored, heavy duty, waterproof, fade resistant; not less than 3 mils thick by 1 to 2 inches wide; compounded for outdoor use.
- C. Tape and Stencil: 4-inch-wide black stripes on 10-inch centers placed diagonally over orange background and is 12 inches wide. Stop stripes at legends.
- D. Floor Marking Tape: 2-inch-wide, 5-mil pressure-sensitive vinyl tape, with black and white stripes and clear vinyl overlay.
- E. Underground-Line Warning Tape:
  - 1. Tape:
    - a. Recommended by manufacturer for the method of installation and suitable to identify and locate underground electrical and communications utility lines.
    - b. Printing on tape shall be permanent and shall not be damaged by burial operations.
    - c. Tape material and ink shall be chemically inert and not subject to degradation when exposed to acids, alkalis, and other destructive substances commonly found in soils.
  - 2. Color and Printing:
    - a. Comply with ANSI Z535.1, ANSI Z535.2, ANSI Z535.3, ANSI Z535.4, and ANSI Z535.5.
    - b. Inscriptions for Red-Colored Tapes: "ELECTRIC LINE, HIGH VOLTAGE".

- c. Inscriptions for Orange-Colored Tapes: "TELEPHONE CABLE, CATV CABLE, COMMUNICATIONS CABLE, OPTICAL FIBER CABLE".

## **2.5 TAGS**

- A. Metal Tags: Brass or aluminum, 2 by 2 by 0.05 inch, with stamped legend, punched for use with self-locking cable tie fastener.
- B. Nonmetallic Preprinted Tags: Polyethylene tags, 0.015 inch thick, color-coded for phase and voltage level, with factory printed permanent designations; punched for use with self-locking cable tie fastener.
  - 1.

## **2.6 SIGNS**

- A. Baked-Enamel Signs:
  - 1. Preprinted aluminum signs, high-intensity reflective, punched or drilled for fasteners, with colors, legend, and size required for application.
  - 2. 1/4-inch grommets in corners for mounting.
  - 3. Nominal Size: 7 by 10 inches.
- B. Laminated Acrylic or Melamine Plastic Signs:
  - 1. Engraved legend.
  - 2. Thickness:
    - a. For signs up to 20 sq. in., minimum 1/16 inch thick.
    - b. For signs larger than 20 sq. in., 1/8 inch thick.
    - c. Engraved legend with black letters on white face.
    - d. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.

## **2.7 CABLE TIES**

- A. General-Purpose Cable Ties: Fungus inert, self-extinguishing, one piece, self-locking, and Type 6/6 nylon.
  - 1. Minimum Width: 3/16 inch.
  - 2. Tensile Strength at 73 Deg F according to ASTM D 638: 12,000 psi.
  - 3. Temperature Range: Minus 40 to plus 185 deg F.
  - 4. Color: Black, except where used for color-coding.
- B. UV-Stabilized Cable Ties: Fungus inert, designed for continuous exposure to exterior sunlight, self-extinguishing, one piece, self-locking, and Type 6/6 nylon.
  - 1. Minimum Width: 3/16 inch.
  - 2. Tensile Strength at 73 Deg F according to ASTM D 638: 12,000 psi.
  - 3. Temperature Range: Minus 40 to plus 185 deg F.
  - 4. Color: Black.
- C. Plenum-Rated Cable Ties: Self-extinguishing, UV stabilized, one piece, and self-locking.

1. Minimum Width: 3/16 inch.
2. Tensile Strength at 73 Deg F according to ASTM D 638: 7000 psi.
3. UL 94 Flame Rating: 94V-0.
4. Temperature Range: Minus 50 to plus 284 deg F.
5. Color: Black.

## **2.8 MISCELLANEOUS IDENTIFICATION PRODUCTS**

- A. Paint: Comply with requirements in painting Sections for paint materials and application requirements. Retain paint system applicable for surface material and location (exterior or interior).
- B. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

## **PART 3 - EXECUTION**

### **3.1 PREPARATION**

- A. Self-Adhesive Identification Products: Before applying electrical identification products, clean substrates of substances that could impair bond, using materials and methods recommended by manufacturer of identification product.

### **3.2 INSTALLATION**

- A. Verify and coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and operation and maintenance manual. Use consistent designations throughout Project.
- B. Install identifying devices before installing acoustical ceilings and similar concealment.
- C. Verify identity of each item before installing identification products.
- D. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and operation and maintenance manual.
- E. Apply identification devices to surfaces that require finish after completing finish work.
- F. Install signs with approved legend to facilitate proper identification, operation, and maintenance of electrical systems and connected items.
- G. System Identification for Raceways and Cables under 600 V: Identification shall completely encircle cable or conduit. Place identification of two-color markings in contact, side by side.
  1. Secure tight to surface of conductor, cable, or raceway.
- H. System Identification for Raceways and Cables over 600 V: Identification shall completely encircle cable or conduit. Place adjacent identification of two-color markings in contact, side by side.

1. Secure tight to surface of conductor, cable, or raceway.
- I. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, and signal connections.
- J. Emergency Operating Instruction Signs: Install instruction signs with white legend on a red background with minimum 3/8-inch-high letters for emergency instructions at equipment used for power transfer.
- K. Elevated Components: Increase sizes of labels, signs, and letters to those appropriate for viewing from the floor.
- L. Accessible Fittings for Raceways: Identify the covers of each junction and pull box of the following systems with the wiring system legend and system voltage. System legends shall be as follows:
  1. "EMERGENCY POWER."
  2. "POWER."
  3. "UPS."
- M. Vinyl Wraparound Labels:
  1. Secure tight to surface of raceway or cable at a location with high visibility and accessibility.
  2. Attach labels that are not self-adhesive type with clear vinyl tape, with adhesive appropriate to the location and substrate.
- N. Snap-around Labels: Secure tight to surface at a location with high visibility and accessibility.
- O. Self-Adhesive Wraparound Labels: Secure tight to surface at a location with high visibility and accessibility.
- P. Self-Adhesive Labels:
  1. On each item, install unique designation label that is consistent with wiring diagrams, schedules, and operation and maintenance manual.
  2. Unless otherwise indicated, provide a single line of text with 1/2-inch-high letters on 1-1/2-inch-high label; where two lines of text are required, use labels 2 inches high.
- Q. Snap-around Color-Coding Bands: Secure tight to surface at a location with high visibility and accessibility.
- R. Heat-Shrink, Preprinted Tubes: Secure tight to surface at a location with high visibility and accessibility.
- S. Marker Tapes: Secure tight to surface at a location with high visibility and accessibility.
- T. Self-Adhesive Vinyl Tape: Secure tight to surface at a location with high visibility and accessibility.
  1. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding.



- U. Tape and Stencil: Comply with requirements in painting Sections for surface preparation and paint application.
- V. Floor Marking Tape: Apply stripes to finished surfaces following manufacturer's written instructions.
- W. Underground Line Warning Tape:
  - 1. During backfilling of trenches, install continuous underground-line warning tape directly above cable or raceway at 6 to 8 inches below finished grade. Use multiple tapes where width of multiple lines installed in a common trench or concrete envelope exceeds 16 inches overall.
  - 2. Limit use of underground-line warning tape to direct-buried cables.
  - 3. Install underground-line warning tape for direct-buried cables and cables in raceways.
- X. Baked-Enamel Signs:
  - 1. Attach signs that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.
  - 2. Unless otherwise indicated, provide a single line of text with 1/2-inch-high letters on minimum 1-1/2-inch-high sign; where two lines of text are required, use signs minimum 2 inches high.
- Y. Metal-Backed Butyrate Signs:
  - 1. Attach signs that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.
  - 2. Unless otherwise indicated, provide a single line of text with 1/2-inch-high letters on 1-1/2-inch-high sign; where two lines of text are required, use labels 2 inches high.
- Z. Laminated Acrylic or Melamine Plastic Signs:
  - 1. Attach signs that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.
  - 2. Unless otherwise indicated, provide a single line of text with 1/2-inch-high letters on 1-1/2-inch-high sign; where two lines of text are required, use labels 2 inches high.
- AA. Cable Ties: General purpose, for attaching tags, except as listed below:
  - 1. Outdoors: UV-stabilized nylon.
  - 2. In Spaces Handling Environmental Air: Plenum rated.

### **3.3 IDENTIFICATION SCHEDULE**

- A. Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment. Install access doors or panels to provide view of identifying devices.
- B. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, pull points, and locations of high visibility. Identify by system and circuit designation.
- C. Concealed Raceways, Duct Banks, More Than 600 V, within Buildings: Tape and stencil. Stencil legend "DANGER - CONCEALED HIGH-VOLTAGE WIRING" with 3-inch-high, black letters on 20-inch centers.

1. Locate identification at changes in direction, at penetrations of walls and floors, and at 10-foot maximum intervals.
- D. Accessible Raceways, Armored and Metal-Clad Cables, More Than 600 V: Self-adhesive labels.
  1. Locate identification at changes in direction, at penetrations of walls and floors, at 50-foot maximum intervals in straight runs, and at 25-foot maximum intervals in congested areas.
- E. Accessible Raceways and Metal-Clad Cables, 600 V or Less, for Service, Feeder, and Branch Circuits, More Than 20 A and 120 V to Ground: Identify with self-adhesive raceway labels.
  1. Locate identification at changes in direction, at penetrations of walls and floors, at 50-foot maximum intervals in straight runs, and at 25-foot maximum intervals in congested areas.
- F. Accessible Fittings for Raceways and Cables within Buildings: Identify the covers of each junction and pull box of the following systems with self-adhesive labels containing the wiring system legend and system voltage. System legends shall be as follows:
  1. "EMERGENCY POWER."
  2. "POWER."
  3. "UPS."
- G. Power-Circuit Conductor Identification, 600 V or Less: For conductors in vaults, pull and junction boxes, manholes, and handholes, use self-adhesive wraparound labels to identify the phase.
  1. Locate identification at changes in direction, at penetrations of walls and floors, at 50-foot maximum intervals in straight runs, and at 25-foot maximum intervals in congested areas.
- H. Conductors to Be Extended in the Future: Attach write-on tags to conductors and list source.
- I. Locations of Underground Lines: Underground-line warning tape for power, lighting, communication, and control wiring and optical-fiber cable.
- J. Concealed Raceways and Duct Banks, More Than 600 V, within Buildings: Apply floor marking tape to the following finished surfaces:
  1. Floor surface directly above conduits running beneath and within 12 inches of a floor that is in contact with earth or is framed above unexcavated space.
  2. Wall surfaces directly external to raceways concealed within wall.
  3. Accessible surfaces of concrete envelope around raceways in vertical shafts, exposed in the building, or concealed above suspended ceilings.
- K. Workspace Indication: Apply floor marking tape to finished surfaces. Show working clearances in the direction of access to live parts. Workspace shall comply with NFPA 70 and 29 CFR 1926.403 unless otherwise indicated. Do not install at flush-mounted panelboards and similar equipment in finished spaces.
- L. Instructional Signs: Self-adhesive labels, including the color code for grounded and ungrounded conductors.
- M. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Self-adhesive labels.

1. Apply to exterior of door, cover, or other access.
2. For equipment with multiple power or control sources, apply to door or cover of equipment, including, but not limited to, the following:
  - a. Power-transfer switches.
  - b. Controls with external control power connections.

N. Arc Flash Warning Labeling: Self-adhesive labels.

O. Equipment Identification Labels:

1. Indoor Equipment: Self-adhesive label.
2. Outdoor Equipment: Laminated acrylic or melamine sign.
3. Equipment to Be Labeled:
  - a. Panelboards: Typewritten directory of circuits in the location provided by panelboard manufacturer. Panelboard identification shall be in the form of a self-adhesive, engraved, laminated acrylic or melamine label.
  - b. Enclosures and electrical cabinets.
  - c. Access doors and panels for concealed electrical items.
  - d. Switchgear.
  - e. Switchboards.
  - f. Transformers: Label that includes tag designation indicated on Drawings for the transformer, feeder, and panelboards or equipment supplied by the secondary.
  - g. Substations.
  - h. Emergency system boxes and enclosures.
  - i. Motor-control centers.
  - j. Enclosed switches.
  - k. Enclosed circuit breakers.
  - l. Enclosed controllers.
  - m. Variable-speed controllers.
  - n. Push-button stations.
  - o. Power-transfer equipment.
  - p. Contactors.
  - q. Remote-controlled switches, dimmer modules, and control devices.
  - r. Battery-inverter units.
  - s. Battery racks.
  - t. Power-generating units.
  - u. Monitoring and control equipment.
  - v. UPS equipment.
  - w. Generator Grounding Method for switched or un-switched neutral conductor.

**END OF SECTION**



## **SECTION 26 4113**

### **LIGHTNING PROTECTION FOR STRUCTURES**

#### **PART 1 - GENERAL**

##### **1.1 RELATED DOCUMENTS**

Retain or delete this article in all Sections of Project Manual.

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

##### **1.2 SUMMARY**

Retain one of two paragraphs below. See Table 2 in the Evaluations for a list of the standards and the miscellaneous structures and special occupancies that are covered by the referenced standards.

- A. Section includes lightning protection system for ordinary structures.

##### **1.3 ACTION SUBMITTALS**

- A. Product Data: For each type of product.
- B. Shop Drawings:
  - 1. Include layouts of the lightning protection system, with details of the components to be used in the installation.
  - 2. Include raceway locations needed for the installation of conductors.
  - 3. Details of air terminals, ground rods, ground rings, conductor supports, splices, and terminations, including concealment requirements.

Retain first subparagraph below to ensure coordination with roof installation, so as not to void roof warranty.

- 4. Include roof attachment details, coordinated with roof installation.

The calculations referred to by the subparagraph below determine the sideflash distance. Calculate according to NFPA 780; for UL 96A, use the 6-foot (1.8 m) rule. Metal bodies inside this distance need to be bonded, whereas the metal bodies outside the distance do not.

- 5. Calculations required by NFPA 780 for bonding of metal bodies.

##### **1.4 INFORMATIONAL SUBMITTALS**

Retain "Coordination Drawings" Paragraph below for situations where limited space necessitates maximum utilization for efficient installation of different components or if coordination is required for installation of products and materials by separate installers. Coordinate paragraph with other Sections specifying products listed below. Preparation of coordination drawings requires the participation of each trade involved in installations within the limited space.

- A. Coordination Drawings: Lightning protection system Shop Drawings, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
1. Lightning protection cabling attachments to roofing systems and accessories.
  2. Lightning protection strike termination device attachment to roofing systems, coordinated with the roofing system manufacturer.
  3. Lightning protection system components penetrating roofing and moisture protection systems and system components, coordinated with the roofing system manufacturer.

Coordinate "Qualification Data" Paragraph below with qualification requirements in Section 01 4000 "Quality Requirements" and as may be supplemented in "Quality Assurance" Article.

- B. Qualification Data: For Installer.

Retain "Product Certificates" Paragraph below to require submittal of product certificates from manufacturers.

- C. Product Certificates: For each type of roof adhesive for attaching the roof-mounted air terminal assemblies, approved by the roofing-material manufacturer.
- D. Field quality-control reports.

## **1.5 CLOSEOUT SUBMITTALS**

- A. Maintenance Data: For lightning protection system to include in maintenance manuals.
1. In addition to items specified in Section 01 7823 "Operation and Maintenance Data," include the following:
    - a. Dimensioned site plan showing dimensioned route of the ground loop conductor and the ground rod locations. Comply with requirements of Section 01 7839 "Project Record Documents."
    - b. A system testing and inspection record, listing the results of inspections and ground resistance tests, as recommended by NFPA 780, Annex D.
- B. Completion Certificate:

Retain one of four options in subparagraph below. Coordinate subparagraph below with "Special Inspections" Paragraph in Part 3 "Field Quality Control" Article.

1. UL Master Label Certificate

## **1.6 QUALITY ASSURANCE**

Retain one of or both installer options in "Installer Qualifications" Paragraph below. Either installer is qualified to install UL- or LPI-certified lightning protection systems.

- A. Installer Qualifications: UL-listed installer, category OWAY

## **PART 2 - PRODUCTS**

Manufacturers and products listed in SpecAgent and Masterworks Paragraph Builder are neither recommended nor endorsed by the AIA or AVITRU. Before inserting names, verify that manufacturers and products listed there comply with requirements retained or revised in descriptions and are both available and suitable for the intended applications. For definitions of terms and requirements for Contractor's product selection, see Section 01 6000 "Product Requirements."

### **2.1 MANUFACTURERS**

- A. Roof-Mounted Air Terminals: NFPA 780, Class I, copper unless otherwise indicated.
  - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. East Coast Lightning Equipment Inc.
    - b. ERICO International Corporation.
    - c. Harger.
    - d. Heary Bros. Lightning Protection Co. Inc.
    - e. Independent Protection Co.
    - f. Preferred Lightning Protection.
    - g. Robbins Lightning, Inc.
    - h. Thompson Lightning Protection, Inc.

### **2.2 PERFORMANCE REQUIREMENTS**

Retain "NFPA Lightning Protection Standard" or "UL Lightning Protection Standard" Paragraph below. See "Lightning Protection Standards" Article in the Evaluations for a discussion of whether or not to retain the requirement of complying with NFPA 780 or UL 96.

- A. NFPA Lightning Protection Standard: Comply with NFPA 780 requirements for Class I buildings.

Retain "Lightning Protection Components, Devices, and Accessories" Paragraph below to specify that components of lightning protection system comply with requirements of lightning protection standard chosen in retained paragraph above.

### **2.3 MATERIALS**

NFPA 780, LPI 175, and UL 96A stipulate minimum size requirements for components, depending on selected metal and class of building. To require components larger than minimum size, to specify component material composition, or for Projects with unique lightning protection requirements, add component requirements here.

The specified standards prohibit the use of aluminum conductors and materials embedded in concrete or masonry, or installed in a location subject to excessive moisture, and within 18 in (460 mm) of the point where the lightning protection system conductor comes into contact with the earth.

- A. Air Terminals:
  - 1. Copper unless otherwise indicated.
  - 2. 24 inches (610 mm)] long.
  - 3. Rounded tip.
  - 4. Threaded base support.

Retain "Air Terminal Bracing" Paragraph below for terminals more than 24 inches (610 mm) in height that require bracing.

B. Air Terminal Bracing:

1. Copper.
2. 1/4-inch (6-mm)] diameter rod.

Retain "Class 1 Main Conductors" Paragraph for structures less than 75 feet (23 m) high, or retain "Class II Main Conductors" Paragraph below for structures more than 75 feet (23 m) high. Secondary conductor shall be of same material composition as main conductor.

C. Class 1 Main Conductors:

1. Stranded Copper: 57,400 circular mils in diameter.

D. Secondary Conductors:

1. Stranded Copper: 26,240 circular mils in diameter.

Retain "Ground Loop Conductor" Paragraph below if soil conditions at the Project site dictate the use of tinned conductors. If a ground ring is present, a ground loop may not be required. See discussion of ground rings in "Grounding and Bonding" Article in the Evaluations.

E. Ground Loop Conductor: Tinned copper

Copper-clad, steel ground rods are the most common grounding electrodes. See "Corrosion" Article in the Evaluations for assistance in selecting ground rod materials. UL 96 and NFPA 780 allow the use of ground rods no less than 1/2 inch (12.7 mm) in diameter and 96 inches (2400 mm) long. The smallest ground rod size commonly available is 5/8 inches (16 mm) in diameter by 96 inches (2400 mm) long.

F. Ground Rods:

1. Material: Copper-clad steel

Retain one of first two subparagraphs below if minimum dimensioned rods do not comply with Project requirements. The heavier rod dimensions give additional strength that may be needed due to soil conditions, but do not improve ground resistance.

2. Diameter: [5/8 inch (16 mm)] [3/4 inch (19 mm)].
3. Rods shall be not less than 120 inches (3050 mm) long.

Retain "Conductor Splices and Connectors" Paragraph below to prevent use of finger-, crimp-, and saddle-type cable connectors.

G. Conductor Splices and Connectors: Compression fittings that are installed with hydraulically operated tools, or exothermic welds, approved for use with the class type.



## **PART 3 - EXECUTION**

### **3.1 INSTALLATION**

Revise first paragraph below to indicate which standards apply. Retain UL 96A if just compliance with UL Master Label or LPI certification is desired. Retain NFPA 780 if the most stringent or comprehensive requirements are needed.

- A. Install lightning protection components and systems according to NFPA 780.
- B. Install conductors with direct paths from air terminals to ground connections. Avoid bends less than 90 degrees and 8 inches (203 mm) in radius and narrow loops.
- C. Conceal conductors within normal view from exterior locations at grade within 200 feet (60 m) of building. Comply with requirements for concealed systems in NFPA 780.
  - 1. Roof penetrations required for down conductors and connections to structural-steel framework shall be made using listed through-roof fitting and connector assemblies with solid rods and appropriate roof flashings. Use materials approved by the roofing manufacturer for the purpose. Conform to the methods and materials required at roofing penetrations of the lightning protection components to ensure compatibility with the roofing specifications and warranty.
  - 2. Install conduit where necessary to comply with conductor concealment requirements.

Comply with requirements for raceways and boxes specified in Section 26 0533 "Raceways and Boxes for Electrical Systems." Retain "Air Terminals on Single-Ply Membrane Roofing" Subparagraph below for single-ply membrane roofing.

- 3. Air Terminals on Single-Ply Membrane Roofing: Comply with adhesive manufacturer's written instructions.

A ground ring installation based on requirements in Section 26 0526 "Grounding and Bonding for Electrical Systems" may be used as a ground loop for the lightning protection system, provided the counterpoise conductor complies with or exceeds minimum NFPA 780 requirements.

- D. Ground Ring Electrode: The conductor shall be not less than the main-size lightning conductor.

### **3.2 CONNECTIONS**

NFPA 780 allows for four different connection types (bolted, welded, high compression, and crimp). High-compression connectors and exothermic welds are the only type of connections suitable for both underground and concealed connections. Bolted- or crimp-type connections are suitable for aboveground, interior, and exterior exposed applications.

- A. Aboveground concealed connections, and connections in earth or concrete, shall be done by exothermic welds or by high-compression fittings listed for the purpose.
- B. Aboveground exposed connections shall be done using the following types of connectors, listed and labeled for the purpose: exothermic weld.
- C. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance, except where routed through short lengths of conduit.

1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install bonding so vibration is not transmitted to rigidly mounted equipment.

### **3.3 CORROSION PROTECTION**

- A. Do not combine materials that can form an electrolytic couple that will accelerate corrosion in the presence of moisture unless moisture is permanently excluded from junction of such materials.
- B. Use conductors with protective coatings where conditions would cause deterioration or corrosion of conductors.

### **3.4 FIELD QUALITY CONTROL**

Retain first option in "Special Inspections" Paragraph below if Owner engages special inspector. Consider retaining second option if authorities having jurisdiction allow Contractor to engage special inspector. If retaining second option, retain "Field quality-control reports" Paragraph in "Informational Submittals" Article. See "Lightning Protection System Certificates" Article in the Evaluations.

- A. Special Inspections: Engage a qualified special inspector to perform the following special inspections:

Retain one of two subparagraphs below.

1. Perform inspections as required to obtain a UL Master Label for system.
- B. Prepare test and inspection reports and certificates.

**END OF SECTION**

## SECTION 31 1000

### SITE CLEARING

#### 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 SITE CLEARING 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 SITE CLEARING shall be included in the bid prices for the work.

##### 1.01 SECTION INCLUDES

- A. Clearing and Grubbing
- B. Soil Stripping and Stockpiling

##### 1.03 RELATED SECTIONS

- A. 02 4113 Selective Site Demolition
- B. 31 2300 Excavation and Fill
- C. 31 2500 Erosion and Sedimentation Controls

##### 1.04 DEFINITIONS

- A. AHJ – Authority Having Jurisdiction
  - 1. City of Tahlequah
  - 2. United States Environmental Protection Agency (USEPA)
  - 3. Oklahoma Department of Environmental Quality (ODEQ)
- B. Subsoil: All soil beneath the topsoil layer of the soil profile, and typified by the lack of organic matter and soil organisms.
- C. Surface Soil: Soil that is present at the top layer of the existing soil profile at the Project site. In undisturbed areas, the surface soil is typically topsoil; but in disturbed areas such as urban environments, the surface soil can be subsoil.
- D. Topsoil: Top layer of the soil profile consisting of existing native surface topsoil or existing in-place surface soil and is the zone where plant roots grow.
- E. Topsoil: Top layer of the soil profile consisting of existing native surface topsoil or existing in-place surface soil and is the zone where plant roots grow. Its appearance is generally friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects more than 2 inches in diameter; and free of subsoil and weeds, roots, toxic materials, or other non-soil materials.
- F. Plant-Protection Zone: Area surrounding individual trees, groups of trees, shrubs, or other vegetation to be protected during construction, and indicated on Drawings.
- G. Tree-Protection Zone: Area surrounding individual trees or groups of trees to be protected during construction

- H. Vegetation: Trees, shrubs, groundcovers, grass, and other plants.
- 1.05 MATERIAL OWNERSHIP
  - A. Except for stripped topsoil and other materials indicated to be stockpiled or otherwise remain Owner's property, cleared materials shall become Contractor's property and shall be removed from Project site.
- 1.06 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.
- 1.07 PRECONSTRUCTION CONFERENCE
  - A. Conduct a preconstruction conference. Subcontractors that will be performing the work shall attend the preconstruction conference.
- 1.08 REGULATORY REQUIREMENTS
  - A. All materials and methods shall comply with the requirements of the AHJ.
  - B. If the AHJ has not adopted specifications for materials and methods, the Oklahoma Department of Transportation's 2009 Specifications 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. 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 CONDITIONS

- 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.

#### 1.14 UTILITY INTERRUPTIONS

- A. 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.

#### 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 PERFORMANCE REQUIREMENTS

- A. Comply with governing CITY, STATE, and FEDERAL notification regulations before beginning SITE CLEARING. Comply with hauling and disposal regulations of authorities having jurisdiction.

#### 2.02 MATERIALS

- A. Satisfactory Soil Material: Requirements for satisfactory soil material are specified in Section 312300 "Excavation and Fill."
- B. Obtain approved borrow soil material off-site when satisfactory soil material is not available on-site.

### PART 3 - EXECUTION

#### 3.01 PRE SITE CLEARING WORK

- A. Contact OKIE (811 or 1-800-522-OKIE) prior to construction for locating existing utilities.
- B. 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. CONTRACTOR shall also coordinate the construction activities with the utility companies to ensure compliance with the project schedule.
- C. 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.

- D. 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 demolition. 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.
- E. Verify that utilities have been disconnected and capped before starting SITE CLEARING operations.
- F. Protect and maintain benchmarks and survey control points from disturbance during construction.
- G. Locate and clearly identify trees, shrubs, and other vegetation to remain.
- H. Protect existing site improvements to remain from damage during construction.
  - 1. Restore damaged improvements to their original condition, as acceptable to Owner.

### 3.02 CONSTRUCTION CONTROL

- A. 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.
- B. 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.

### 3.03 TEMPORARY EROSION CONTROLS

- A. See 31 25 00 Erosion and Sedimentation Controls.
- B. Comply with the City, State, and Federal requirements for the minimization and control of sediment erosion and site run-off in storm water resulting from construction activities. Install temporary erosions controls prior to SITE CLEARING. Comply with the requirements of the Storm Water Pollution Prevention Plan and the permit(s) issued by the City and State.

### 3.04 CLEARING AND GRUBBING

- A. The limits of the area(s) to be cleared and grubbed shall be marked by stakes, flags, tree markings, or other suitable methods.

- B. Protect trees or groups of trees, designated to remain, from damage by all construction operations by erecting suitable barriers, or by other approved means. Clearing operations shall be conducted in a manner to prevent falling trees from damaging trees designated to remain.
- C. Except as otherwise directed, cut, grub, remove and dispose of all trees, stumps, brush, shrubs, roots and any other objectionable material within the limits defined on the Plans.
- D. All trees, stumps, brush, shrubs, roots and other objectionable material shall be cut, grubbed, removed and disposed of from areas to be occupied by buildings, structures, roads, pipelines and any other areas to be stripped. Trees and brush shall be removed to a depth at least three (5) feet below the existing grade.
- E. In addition, heavy growths of weeds or other plants shall be stripped from the surface in order to provide clear access to the work site and to prevent their inclusion in stockpiled soil which is to be reused later. Trees, stumps, surface plants and all debris removed from the site shall be disposed of off-site by the CONTRACTOR at his own expense.
- F. Areas outside the limits of clearing shall be protected from damage and no equipment or materials shall be stored in these areas.
- G. No stumps, trees, limbs, or brush shall be buried in any fills or embankments.

### 3.05 SOIL STRIPPING AND STOCKPILING

- A. Remove sod and grass before stripping topsoil.
- B. Strip topsoil to depth of 6 inches in a manner to prevent intermingling with underlying subsoil or other waste materials.
  - 1. Remove subsoil and non-soil materials from topsoil, including clay lumps, gravel, and other objects more than 2 inches in diameter; trash, debris, weeds, roots, and other waste materials.
- C. Stockpile topsoil away from edge of excavations without intermixing with subsoil. Grade and shape stockpiles to drain surface water. Cover to prevent windblown dust and erosion by water.
  - 1. Limit height of topsoil stockpiles to 72 inches.
  - 2. Do not stockpile topsoil within protection zones.
  - 3. Dispose of surplus topsoil. Surplus topsoil is that which exceeds quantity indicated to be stockpiled or reused.
  - 4. Stockpile surplus topsoil to allow for re-spreading deeper topsoil.

### 3.06 SITE IMPROVEMENTS

- A. Remove existing above- and below-grade improvements as indicated and necessary to facilitate new construction.
- B. Remove slabs, paving, curbs, gutters, and aggregate base as indicated.
  - 1. Unless existing full-depth joints coincide with line of demolition, neatly saw-cut a straight line of existing pavement to remain before removing adjacent existing pavement. Saw-cut faces vertically.
  - 2. Paint cut ends of steel reinforcement in concrete to remain with two coats of antirust coating, following coating manufacturer's written instructions. Keep paint off surfaces that will remain exposed.



3.07 BACKFILL

- A. Backfill any voids resulting from structures, vegetation, and objects removed according to 31 23 00 Excavation and Fill.

3.08 DISPOSAL OF MATERIALS

- A. All tree trunks, limbs, roots, stumps, brush, foliage, other vegetation and objectionable material shall be removed from the site and disposed of in a permitted disposal site in a manner satisfactory to the Engineer.
- B. Burning of cleared and grubbed materials will not be permitted.
- C. Suitable excavated materials may be stockpiled to be used for backfilling. Excess excavated materials and unsuitable backfill materials shall be disposed offsite by the CONTRACTOR according to City, State, and Federal regulations.

END OF SECTION 31 10 00

## SECTION 31 2311

### EARTHWORK FOR BUILDING CONSTRUCTION

#### PART 1 - GENERAL

##### 1.1 WORK INCLUDED

- A. The work covered by this Section consists of furnishing all plant, labor, equipment, appurtenances and material in performing all operations, hauling, placing, spreading, watering, processing, compacting and shaping earth sections, within the building limits, complete in place in accordance with the Project Manual and Drawings.

##### 1.2 RELATED WORK ELSEWHERE

- A. Site Clearing - Section 31 1000
- B. Under-Slab Vapor Retarder – Section 07 2600
- C. General Foundation Notes on Drawings.
- D. Project Soils Report – shall be completely reviewed and understood by the contractor. In case of conflict or omission, the Project Soils Report shall govern.

##### 1.3 SUBSURFACE SOIL DATA

- A. Subsurface soil investigations have been made and the results are available for examination by the Contractor. This is not a warranty of conditions; the Contractor is expected to examine the site and determine for himself the character of materials to be encountered.
- B. No additional allowance will be made for rock removal, site clearing and grading, filling, compaction, disposal, or removal of any unclassified materials.

##### 1.4 REFERENCES

- A. ASTM International, latest versions.
  - 1. ASTM D 1556 Standard Test Method for Density of Soil in Place by the Sand-Cone Method
  - 2. ASTM D 698 Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard effort (12,400 ft-lbf/ft<sup>3</sup>)(600kN-m/m<sup>3</sup> )]
  - 3. ASTM D 4318 Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils
  - 4. ASTM D 6938 Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)

## 1.5 SUBMITTALS

- A. Submit copies of materials certificates and test results for materials in accordance with type of tests, frequencies and remarks as outlined in the sampling and testing schedule.

## 1.6 TESTING AND INSPECTION

- A. General: The Owner shall employ the services of a registered, licensed Geotechnical Engineer to observe all controlled earthwork soil testing. The testing laboratory shall provide continuous on-site observation by experienced personnel during construction of fill material. The Contractor shall notify the testing laboratory at least two working days in advance of any field operations of controlled earthwork, or of any resumption of operations after stoppages.
- B. Report of Field Density Tests
  - 1. The Geotechnical Engineer shall submit, daily, the results of field density tests required by these specifications.
- C. Costs of Tests and Inspection
  - 1. The cost of testing, inspecting and engineering, as specified in this section of the specifications, shall be borne by the Owner.
- D. Lines and Grades: Alignment and grade of all elements shall be made on true tangents and curves. Grades shall conform to the elevations indicated on Drawings, with minor adjustments, to provide a smooth approach at building lines, at connections to existing paving and to provide proper drainage. Correct irregularities at no cost to the Owner.

## 1.7 WEATHER LIMITATIONS

- A. Controlled fill shall not be constructed when the atmospheric temperature is below 35 degrees F. When the temperature falls below 35 degrees, it shall be the responsibility of the Contractor to protect all areas of completed work against any detrimental effects of ground freezing by methods approved by the testing laboratory. Any areas that are damaged by freezing shall be reconditioned, reshaped, and compacted by the Contractor in conformance with the requirements of this specification without additional cost to the Owner.

## PART 2 - PRODUCTS

### 2.1 STRUCTURAL FILL MATERIAL

- A. On-Site Soils / Imported Fill: GC, SC, SW or GW.
- B. Low volume Change (LVC) Engineered Fill: CL, GC or SC (LL<50).
  - a. CL materials shall not be placed below slabs or foundations.
- C. On-Site Soils: CH - **SHALL NOT BE PLACED WITHIN UPPER 2 FEET BENEATH FOUNDATIONS, FLOOR SLABS AND PAVEMENTS.**
- D. On-Site Soils: ML soils are only considered suitable as controlled fill if containing at least 35% gravel sized particles.
- E. Material shall consist of soils that conform to the following physical characteristics:

Sieve Size Sq. Openings	Percent Passing By Weight
12 inch*	100
No. 200	85 or less

\* or lift thickness whichever is less

- F. The liquid limit of the material to be used for fill within 2 feet of bottom of foundations or slabs or backfill, as determined in accordance with ASTM D 4318 shall not exceed 50.

## **PART 3 - EXECUTION**

### **3.1 PREPARATION**

- A. Clearing and Grubbing: Prior to placing structural fill all borrow areas and areas to receive structural fill shall be stripped of vegetation and deleterious materials. Strippings shall be hauled offsite or stockpiled for subsequent use in landscaped areas or non-structural fill areas as designated by the Owner or his representative and approved by the Geotechnical Engineer.

### **3.2 CONSTRUCTION AREA TREATMENT**

- A. Site Preparation - Fill Areas: Prior to placing structural fill the areas to be filled shall be scarified to a depth of eight inches and moisture conditioned as described below. The area to be filled shall then be compacted to a minimum of 95 percent of standard proctor density as determined in accordance with ASTM D 698. Any soft or "spongy" areas shall be removed as directed by the Geotechnical Engineer and replaced with structural fill as described herein.
- B. Site Preparation - Cut Areas: Following excavation to rough grade all building and pavement areas shall be scarified to a depth of eight inches and moisture conditioned as described below. All building and paved areas shall be compacted to a minimum of 95 percent of standard proctor density as determined by ASTM D 698.

### **3.3 EQUIPMENT AND METHODS**

- A. In areas not accessible to heavy equipment, distribute by and compact with hand operated vibratory compactors.

### **3.4 BORROW**

- A. The Contractor shall provide sufficient material for fill to the lines, elevations and cross sections as shown on the contract drawings from borrow areas.
- B. The Contractor shall obtain from the Owners of said borrow areas the right to excavate material, shall pay all royalties and other charges involved, and shall pay all expenses in developing the source including the cost of right-of-way required for hauling the material.

### **3.5 COMPACTION**

- A. Fill shall be spread in layers not exceeding 12 inches (loose), watered as necessary, and compacted. Moisture content at time of compaction shall plus/minus 2 percent of optimum moisture for CL, SC, GC, GW and SW soil types and 0-4% above optimum for CH soil types. A density of not less than 95 percent of maximum dry density shall be obtained within the building pads.

- B. Optimum moisture content and maximum dry density for each soil type used shall be determined in accordance with ASTM D 698.
- C. Compaction of the fill shall be by mechanical means only. Where vibratory compaction equipment is used, it shall be the Contractor's responsibility to ensure that the vibrations do not damage nearby buildings or other adjacent property. Where vibratory compaction is not possible, pneumatic rolling equipment shall be used.

MATERIAL	MINIMUM PERCENT COMPACTION
Structural & granular fill in construction area	95
Subgrade below structural fill	95
Structural fill under exterior walls	95
Miscellaneous backfill	90

### **3.6 MOISTURE CONTROL**

- A. The material moisture content, while being compacted, shall be plus/minus 2 percent of optimum moisture for CL, SC, GC, GW and SW soil types and 0-4% above optimum for CH soil types.

### **3.7 DENSITY REQUIREMENTS**

- A. Density of undisturbed soils, in-place fill and backfill shall be determined in accordance with the procedures of ASTM D 1556 or ASTM D 6938. If tests indicate that the density of in-place soil is less than required, the material shall be scarified, moistened or dried as necessary to obtain proper moisture content and recompact as necessary to achieve the proper densities. Sufficient density tests shall be made and reports submitted by the Testing Laboratory indicating all cut and fill areas were compacted and graded in accordance with the requirements.

### **3.8 SLOPE PROTECTION & DRAINAGE**

- A. Berming and grading shall be done as may be necessary to prevent surface water from flowing into and out of the construction area. Any water accumulating therein shall be removed by pumping or by other methods.

### **3.9 SOIL EROSION PROTECTION**

- A. The Contractor shall ensure that no soil erodes or blows from the site into public right-of-way or onto private property.
- B. The Contractor shall promptly clean up any material which erodes or blows into the public right-of-way or onto private property.

### **3.10 PRESERVATION OF PROPERTY**

- A. Provide temporary fences, barricades, coverings, or other protections to preserve existing items indicated to remain and to prevent injury or damage to persons or property. Apply protections to adjacent properties as required.
- B. Restore damaged work to condition existing prior to start of work, unless otherwise directed.

### 3.11 EXISTING UTILITIES

- A. The Contractor shall verify the location of any utility lines, pipelines, or underground utility lines in or near the area of the work in advance of and during Earthwork. The Contractor is fully responsible for any and all damage caused by failure to locate, identify and preserve any and all existing utilities, pipelines and underground utility lines. Repair damaged utilities to the satisfaction of the utility owner at no expense to the Owner.
- B. Should uncharted or incorrectly charted piping or other utilities be encountered during grading, consult the Architect immediately for directions as to procedures.
- C. Cooperate with the Owner and public or private utility companies in keeping service and facilities in operation.

### 3.12 WASTE

- A. Dispose of all waste off Owner's property.
- B. Burning of waste will not be permitted.

### 3.13 AIR POLLUTION

- A. Use water sprinkling, temporary enclosures, and other suitable methods to limit dust and dirt air pollution. Comply with governing regulations pertaining to environmental protection.

SAMPLING AND TESTING SCHEDULE FOR EARTHWORK			
FIELD QUALITY CONTROL			
MATERIAL	TEST FOR	FREQUENCY	REMARKS
NATURAL GROUND	Compaction in accordance with ASTM D 1556 or ASTM D 6938	1 per 2500 square feet of surface	Conduct a minimum of 3 tests on each section.
EMBANKMENT AND/OR SUBGRADE	Soil Conditions Moisture-Density in accordance with ASTM D 698	Test 1 per soil classification	
	Compaction control in accordance with ASTM D 1556 or ASTM D 6938	1 per each lift every 2500 square feet of surface	Immediately after placing, Conduct a minimum of 3 tests per section
		1 per each lift for each 2500 square feet of fill	

END OF SECTION

## SECTION 31 2500

### EROSION AND SEDIMENTATION CONTROLS

#### PART 1 - GENERAL

##### 1.01 RELATED DOCUMENTS

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

##### 1.02 SUMMARY

1. The work under this section of the Specifications includes all labor, materials, equipment, and services necessary for EROSION AND SEDIMENTATION CONTROLS 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 EROSION AND SEDIMENTATION CONTROLS shall be included in the bid prices for the work.

##### 1.03 SECTION INCLUDES

##### 1.04 RELATED SECTIONS

1. 31 1000 Site Clearing
2. 31 2300 Excavation and Fill

##### 1.05 DEFINITIONS

1. AHJ – Authority Having Jurisdiction
  - A. City of Tahlequah
  - B. United States Environmental Protection Agency (USEPA)
  - C. Oklahoma Department of Environmental Quality (ODEQ)

##### 1.06 ACTION SUBMITTALS

##### 1.07 INFORMATIONAL SUBMITTALS

##### 1.08 DELIVERY, STORAGE, AND HANDLING

##### 1.09 QUALITY ASSURANCE

##### 1. PRECONSTRUCTION CONFERENCE

- A. 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.

##### 2. REGULATORY REQUIREMENTS

- A. All materials and methods shall comply with the requirements of the AHJ.
- B. 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

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

##### 1.11 TOPOGRAPHIC SURVEY

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

##### 1.12 UNDERGROUND UTILITIES

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

2. 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.
3. 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.
4. 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.
5. 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

1. 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.
2. 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.

### PART 2 - PRODUCTS

#### 2.01 SILT FENCE FABRIC

1. Provide fabric for temporary silt fence in accordance with AASHTO M 288, "Temporary Silt Fence Property Requirements" Table 6 for unsupported silt fence with less than 50 percent elongation.

#### 2.02 SILT FENCE POSTS

1. Minimum 5 feet long;
2. Steel U- or T-section, with minimum mass of 1.33 lb per linear foot.



## 2.03 TEMPORARY CONSTRUCTION FENCE

1. Provide plastic mesh fencing supported by steel posts driven into ground.
  - A. Height: 36 inch minimum.
  - B. Color: Safety orange.

## PART 3 - EXECUTION

### 3.01 EROSION AND SEDIMENT CONTROLS, GENERAL

1. Construction and placement of erosion and sediment control devices shall be performed in conjunction with the progress of general construction. Contractor shall install the erosion control devices shown and install additional erosion control devices as necessary to prevent silt runoff from the work area onto adjacent areas.
2. The erosion and sediment controls to be used for this site are:
  - A. Temporary construction entrance/exit - stabilized construction entrances shall be installed at all points where construction or employee vehicles enter or leave the construction or staging areas.
  - B. Rock bag filter berms - rock bag filter berms shall be placed in small open channels. The berms shall be placed so that the toe of the upstream dam is at the same elevation as the top of the downstream dam.
  - C. Rock bag inlet barrier - rock bag inlet barriers shall be placed around all inlets proposed and existing that are receiving runoff from the site.
  - D. Silt fences - silt fences shall be placed along the perimeter of the project where storm water will exit the site. Silt fences shall also be utilized along slope contours where vegetative cover is not sufficiently established to prevent erosion.
  - E. Sodding/site seeding - sodding and seeding shall be used to establish final vegetative cover.
3. The following are some other controls that may be used in the course of this project.
  - A. Common vegetative practices
    1. Temporary seeding, mulching, permanent seeding and planting, preservation of natural vegetation, dust control
  - B. Structural erosion and sediment control practices
    1. Silt fence, storm drain inlet protection, outlet protection, berms for fuel storage and dispensing areas
4. Additional controls not listed above may also be considered for use.

### 3.02 OTHER CONTROLS

1. The premises and the job site shall be maintained in a reasonably neat and orderly condition and kept free from accumulations of waste materials and rubbish during the entire construction period. Remove crates, cartons, and flammable waste materials or trash from the work areas at the end of each working day.
2. Pavement on-site and on adjoining streets shall be kept free of any sediment or mud tracking from truck tires or from other equipment.
3. Chemical toilets for the use of all construction personnel shall be provided at a location within the limits of the site. Chemical toilets shall be maintained in a sanitary condition.
4. Any disposal of construction wastes, hazardous products, and contaminated soils shall be disposed of according to requirements of the City, County, ODEQ, and the U.S. Environmental Protection Agency.
5. The wheels of vehicles leaving the construction areas shall be cleaned of mud prior to leaving the construction or staging areas. Wheel washing shall be performed in an area stabilized with stone that drains into an approved sediment trapping device.

6. Adequate controls shall be made to prevent and/or control any release of pesticides, petroleum products, fertilizers and detergents, and hazardous products.
7. Any spill of pesticides, petroleum products, fertilizers and detergents, and hazardous products shall be contained and removed according to state and federal requirements. Any spill of pesticides, petroleum products, fertilizers and detergents, and hazardous products shall be reported according to state and federal requirements.

### 3.03 STORM WATER POLLUTION PREVENTION PLAN

1. A Storm Water Pollution Prevention plan (SWP3) has been prepared for the work. Contractor shall implement the SWP3, and construct, inspect, and maintain the erosion controls to prevent runoff of silt and sediment from the site. A copy of the SWP3 shall be kept at the site at all times and be made available to inspectors upon request. Inspections reports shall be maintained in the swp3 and the swp3 shall be updated when necessary.

### 3.04 POSTING OF PUBLIC NOTICE

1. Contractor shall be responsible for posting public notice. the notice shall be posted near the main entrance of the construction site that indicates the following information:
  - A. The permit number for the project or a copy of the NOI if a permit number has not yet been assigned.
  - B. The name and telephone number of a local contact person.
  - C. A brief description of the project.
  - D. The location of this SWP3 if the site is inactive or does not have an on-site location to store the plan.

### 3.05 SCOPE OF PREVENTIVE MEASURES

1. In all cases, if permanent erosion resistant measures have been installed temporary preventive measures are not required.
2. Construction Entrances:
  - A. Width: As required; 20 feet, minimum.
  - B. Length: 50 feet, minimum.
  - C. Provide at each construction entrance from public right-of-way.
  - D. Where necessary to prevent tracking of mud onto right-of-way, provide wheel washing area out of direct traffic lane, with drain into sediment trap or basin.
3. Linear Sediment Barriers: Made of silt fences.
  - A. Provide linear sediment barriers:
    1. Along downhill perimeter edge of disturbed areas, including soil stockpiles.
    2. Along the top of the slope or top bank of drainage channels and swales that traverse disturbed areas.
    3. Along the toe of cut slopes and fill slopes.
    4. Perpendicular to flow across the bottom of existing and new drainage channels and swales that traverse disturbed areas or carry runoff from disturbed areas; space at maximum of 200 feet apart.
    5. Across the entrances to culverts that receive runoff from disturbed areas.
  - B. Space sediment barriers with the following maximum slope length upslope from barrier:
    1. Slope of Less Than 2 Percent: 100 feet.
    2. Slope between 2 and 5 Percent: 75 feet.
    3. Slope between 5 and 10 Percent: 50 feet.
    4. Slope between 10 and 20 Percent: 25 feet.

- 5. Slope over 20 Percent: 15 feet.
- C. Soil Stockpiles: Protect using one of the following measures:
  - 1. Cover with polyethylene film, secured by placing soil on outer edges.
  - 2. Cover with mulch at least 4 inches thickness of pine needles, sawdust, bark, wood chips, or shredded leaves, or 6 inches of straw or hay.
- D. Temporary Seeding: Use where temporary vegetated cover is required.

### 3.06 INSTALLATION

- 1. Traffic-Bearing Aggregate Surface:
  - A. Excavate minimum of 6 inches.
  - B. Place geotextile fabric full width and length, with minimum 12 inch overlap at joints.
  - C. Place and compact at least 6 inches of 1.5 to 3.5 inch diameter stone.
- 2. Temporary Construction Fences:
  - A. Space steel support posts to insure mesh remains vertical and at proper height. Securely tie to posts.
- 3. Silt Fences:
  - A. Store and handle fabric in accordance with ASTM D 4873.
  - B. Where slope gradient is less than 3:1 or barriers will be in place less than 6 months, use nominal 16 inch high barriers with minimum 36 inch long posts spaced at 6 feet maximum, with fabric embedded at least 4 inches in ground.
  - C. Where slope gradient is steeper than 3:1 or barriers will be in place over 6 months, use nominal 28 inch high barriers, minimum 48 inch long posts spaced at 6 feet maximum, with fabric embedded at least 6 inches in ground.
  - D. Where slope gradient is steeper than 3:1 and vertical height of slope between barriers is more than 20 feet, use nominal 32 inch high barriers with woven wire reinforcement and steel posts spaced at 4 feet maximum, with fabric embedded at least 6 inches in ground.
  - E. Install with top of fabric at nominal height and embedment as specified.
  - F. Do not splice fabric width; minimize splices in fabric length; splice at post only, overlapping at least 18 inches, with extra post.
  - G. Fasten fabric to steel posts using wire, nylon cord, or integral pockets.
  - H. Wherever runoff will flow around end of barrier or over the top, provide temporary splash pad or other outlet protection; at such outlets in the run of the barrier, make barrier not more than 12 inches high with post spacing not more than 4 feet.
- 4. Temporary Seeding:
  - A. When hydraulic seeder is used, seedbed preparation is not required.
  - B. When surface soil has been sealed by rainfall or consists of smooth undisturbed cut slopes, and conventional or manual seeding is to be used, prepare seedbed by scarifying sufficiently to allow seed to lodge and germinate.
  - C. If temporary mulching was used on planting area but not removed, apply nitrogen fertilizer at 1 pound per 1000 sq ft.
  - D. On soils of very low fertility, apply 10-10-10 fertilizer at rate of 12 to 16 pounds per 1000 sq ft.
  - E. Incorporate fertilizer into soil before seeding.
  - F. Apply seed uniformly; if using drill or cultipacker seeders place seed 1/2 to 1 inch deep.
  - G. Irrigate as required to thoroughly wet soil to depth that will ensure germination, without causing runoff or erosion.

H. Repeat irrigation as required until grass is established.

### 3.07 MAINTENANCE

1. All erosion and sediment control measures and other protective measures shall be maintained in effective operating condition. If site inspections identify erosion controls that are not operating effectively, maintenance shall be performed before the next anticipated storm event, or as necessary to maintain the continued effectiveness of storm water controls. If maintenance prior to the next anticipated storm event is impracticable, maintenance must be scheduled and accomplished as soon as practicable.
2. If sediment escapes the construction site, off-site accumulations of sediment shall be removed at a frequency sufficient to minimize offsite impacts (e.g., fugitive sediment in street could be washed into storm sewers by the next rain and/or pose a safety hazard to users of public streets).
3. Sediment shall be removed from sediment traps or sedimentation ponds when the design capacity has been reduced by 50%.
4. Litter, construction debris, and construction chemicals exposed to storm water shall be prevented from becoming a pollutant source for storm water discharges (e.g., screening outfalls, picked up daily).

### 3.08 INSPECTIONS

1. Contractor shall inspect disturbed areas of the construction site that have not been finally stabilized, areas used for storage of materials that are exposed to precipitation, structural control measures, and locations where vehicles enter or exit the site, at least once every fourteen (14) calendar days and within 24 hours of the end of a storm event of 0.25 inches or greater.
2. The following items, locations, and areas shall be inspected.
  - A. Disturbed areas and areas used for storage of materials that are exposed to precipitation shall be inspected for evidence of, or the potential for, pollutants entering the drainage system.
  - B. Sediment and erosion control measures shall be observed to ensure that they are operating correctly.
  - C. Where discharge locations or points are accessible, they shall be inspected to ascertain whether erosion control measures are effective in preventing significant impacts to receiving waters.
  - D. Where discharge locations are inaccessible, nearby downstream locations shall be inspected to the extent that such inspections are practicable.
  - E. Locations where vehicles enter or exit the site shall be inspected for evidence of offsite sediment tracking.

### 3.09 REPORTS

1. A report summarizing the scope of the inspection, name(s) and qualifications of personnel making the inspection, the date(s) of the inspection, and major observations relating to the implementation of erosion controls shall be made.
2. major observations should include: the location(s) of discharges of sediment or other pollutants from the site; location(s) of erosion controls that need to be maintained; location(s) of erosion controls that failed to operate as designed or proved inadequate for a particular location; and location(s) where additional erosion controls are needed that did not exist at the time of inspection.
3. Modifications made to erosion controls as a result of inspections shall be recorded.
4. Reports shall identify any incidents of noncompliance.

5. Where a report does not identify any incidents of noncompliance, the report shall contain a certification that the facility is in compliance with the storm water pollution prevention plan and this permit. The owner or contractor shall sign the report.
6. Any person signing the report shall make the following certification. I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.
7. Inspection reports shall be maintained on site.

#### 3.10 MODIFICATIONS OR ADDITIONS TO EROSION CONTROLS

1. Based on the results of the inspection, erosion controls shall be modified as necessary or additional control shall be provided to correct the problems identified. If existing erosion controls need to be modified or if additional controls are necessary, implementation shall be completed before the next anticipated storm event. If implementation before the next anticipated storm event is impracticable, they shall be implemented as soon as practicable.

#### 3.11 STABILIZATION REQUIREMENTS

1. Fine grading shall be performed according to the grading plan.
2. All areas disturbed during the course of construction shall be revegetated according to the landscaping plan. If a landscaping plan is not provided, the disturbed areas shall be seeded or hydro-mulched.
3. Except where the landscaping plan identifies other grasses, groundcover, plants, or shrubs to be planted, a 4 ft wide strip of Bermuda grass sod shall be placed behind all curbs.
4. Contractor shall provide sufficient water and fertilizer to establish the sufficient growth of sod and seeds until final stabilization of the area is achieved.
5. Stabilization measures shall be initiated as soon as practicable in portions of the site where construction activities have temporarily or permanently ceased, but in no case more than 14 days after the construction activity in that portion of the site has temporarily or permanently ceased.
6. where the initiation of stabilization measures by the 14th day after construction activity temporary or permanently ceases is precluded by snow cover or frozen ground conditions, stabilization measures shall be initiated as soon as practicable
7. Where construction activity on a portion of the site is temporarily ceased, and earth-disturbing activities will be resumed within 21 days, temporary stabilization measures do not have to be initiated on that portion of site.
8. in areas experiencing droughts where the initiation of stabilization measures by the 14th day after construction activity has temporarily or permanently ceased is precluded by seasonal arid conditions, stabilization measures shall be initiated as soon as practicable.
9. Temporary seeding or hydro-mulching may be used for temporary stabilization, if necessary.

#### 3.12 CONSTRUCTION COMPLETION AND FINAL STABILIZATION

1. Contractor shall remove all temporary erosion control structures upon completion of construction and the establishment of final stabilization.
2. Final stabilization shall be complete when all soil disturbing activities at the site have been completed and a uniform (e.g., evenly distributed, without large bare areas) perennial

vegetative cover with a density of 70% of the native background vegetative cover for the area has been established on all unpaved areas and areas not covered by permanent structures, or equivalent permanent stabilization measures (such as the use of riprap, gabions, or geotextiles) have been employed.

END OF SECTION 31 25 00

**SECTION 313116**  
**TERMITE CONTROL**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Work required for this Section includes soil treatment for termite control including supplementary Work necessary for its installation.

**1.2 DEFINITIONS**

- A. EPA: Environmental Protection Agency.
- B. PCO: Pest control operator.

**1.3 ACTION SUBMITTALS**

- A. Product Data: Treatments and application instructions, including EPA-Registered Label.

**1.4 INFORMATIONAL SUBMITTALS**

- A. Product Certificates: Signed by manufacturers of termite control products certifying that treatments furnished comply with requirements.
- B. Soil Treatment Application Report: After application of termiticide is completed, submit report for Owner's record information, including the following as applicable:
  - 1. Date and time of application.
  - 2. Moisture content of soil before application.
  - 3. Brand name and manufacturer of termiticide.
  - 4. Quantity of undiluted termiticide used.
  - 5. Dilutions, methods, volumes, and rates of application used.
  - 6. Areas of application.
  - 7. Water source for application.
- C. Qualification Data:
  - 1. For firms and persons specified in "Quality Assurance" to demonstrate their capabilities and experience. Include list of completed projects.
- D. Warranties: Special warranties specified in this Section.

**1.5 QUALITY ASSURANCE**

- A. Applicator Qualifications: A PCO who is licensed according to regulations of authorities having jurisdiction to apply termite control treatment in jurisdiction where Project is located and who is experienced and has completed termite control treatment similar to that indicated for this Project and whose work has a record of successful in-service performance.

- B. Regulatory Requirements: Formulate and apply termiticides, and label with a Federal registration number, to comply with EPA regulations and authorities having jurisdiction.

## **1.6 PROJECT CONDITIONS**

- A. Environmental Limitations: To ensure penetration, do not treat soil that is water saturated or frozen. Do not treat soil while precipitation is occurring. Comply with EPA-Registered Label requirements and requirements of authorities having jurisdiction.

## **1.7 COORDINATION**

- A. Coordinate soil treatment application with excavating, filling, and grading and concreting operations. Treat soil under footings, grade beams, and ground-supported slabs, before construction.

## **1.8 WARRANTY**

- A. Special Warranty: Written warranty, signed by applicator and Contractor certifying that termite control work, consisting of applied soil termiticide treatment, will prevent infestation of subterranean termites. If subterranean termite activity or damage is discovered during warranty period, re-treat soil and repair or replace damage caused by termite infestation.
- B. Warranty Period: Five years from date of Substantial Completion.

## **1.9 MAINTENANCE SERVICE**

- A. Continuing Service: Provide a proposal for continuing service, including monitoring, inspection, and retreatment for occurrences of termite activity, from applicator to Owner, in the form of a standard yearly (or other period) continuing service agreement, starting on the date of Substantial Completion. State services, obligations, conditions, and terms for agreement period and for future renewal options.

# **PART 2 - PRODUCTS**

## **2.1 SOIL TREATMENT**

- A. Termiticide: Provide an EPA-registered termiticide complying with requirements of authorities having jurisdiction, in a soluble or emulsible, concentrated formulation that dilutes with water or foaming agent, and formulated to prevent termite infestation. Use only soil treatment solutions that are not harmful to plants. Provide quantity required for application at the label volume and rate for the maximum termiticide concentration allowed for each specific use, according to the product's EPA-Registered Label.

# **PART 3 - EXECUTION**

## **3.1 EXAMINATION**

- A. Examine substrates, areas, and conditions, with Applicator present, for compliance with requirements for moisture content of the soil, interfaces with earth moving, slab and foundation work, landscaping, and other conditions affecting performance of termite control.



- B. Proceed with application only after unsatisfactory conditions have been corrected. Starting of Work will be construed as installers acceptance of installation conditions.

### **3.2 PREPARATION**

- A. General: Comply with the most stringent requirements of authorities having jurisdiction and with manufacturer's written instructions for preparing substrate. Remove all extraneous sources of wood cellulose and other edible materials such as wood debris, tree stumps and roots, stakes, formwork, and construction waste wood from soil and around foundations.
- B. Soil Treatment Preparation: Remove foreign matter and impermeable soil materials that could decrease treatment effectiveness on areas to be treated. Loosen, rake, and level soil to be treated, except previously compacted areas under slabs and footings. Termiticides may be applied before placing compacted fill under slabs if recommended by termiticide manufacturer.
- C. Fit filling hose connected to water source at the site with a backflow preventer, complying with requirements of authorities having jurisdiction.

### **3.3 APPLYING SOIL TREATMENT**

- A. General: Apply soil treatment under all enclosed structures. Comply with the most stringent requirements of authorities having jurisdiction and with manufacturer's EPA-Registered Label for products.
- B. Application: Mix soil treatment termiticide solution to a uniform consistency. Provide quantity required for application at the label volume and rate for the maximum specified concentration of termiticide, according to manufacturer's EPA-Registered Label, to the following so that a continuous horizontal and vertical termiticidal barrier or treated zone is established around and under building construction. Distribute the treatment evenly.
- C. Slabs-on-Grade and Basement Slabs: Under ground-supported slab construction, including footings, building slabs, and attached slabs as an overall treatment. Treat soil materials before concrete footings and slabs are placed.
- D. Foundations: Adjacent soil including soil along entire inside perimeter of foundation walls, along both sides of interior partition walls, around plumbing pipes and electric conduit penetrating slab, and around interior column footers, piers, and chimney bases; and along entire outside perimeter, from grade to bottom of footing. Avoid soil washout around footings.
- E. Crawlspace: Soil under and adjacent to foundations as previously indicated.
- F. Adjacent Areas: Around entrance platform, porches, and equipment bases. Apply overall treatment only where attached concrete platform and porches are on fill or ground.
- G. Penetrations: At expansion joints, control joints, and area where slabs will be penetrated.
- H. Avoid disturbance of treated soil after application. Keep off treated areas until completely dry.
- I. Protect termiticide solution, dispersed in treated soils and fills, from being diluted until ground-supported slabs are installed. Use waterproof barrier according to EPA-Registered Label instructions.
- J. Post warning signs in areas of application.

- K. Reapply soil treatment solution to areas disturbed by subsequent excavation, grading, landscaping, or other construction activities following application.

END OF SECTION

## SECTION 31 2200

## GRADING

## 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 GRADING 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 GRADING shall be included in the bid prices for the work.

## 1.03 SECTION INCLUDES

## 1.04 RELATED SECTIONS

- A. 31 2300 Excavation and Fill
- B. 31 2500 Erosion and Sedimentation Controls

## 1.05 DEFINITIONS

- A. AHJ – Authority Having Jurisdiction
  - 1. City of Tahlequah
  - 2. United State Environmental Protection Agency (USEPA)

## 1.06 ACTION SUBMITTALS

## 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 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. 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.

## 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.

## 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 CONDITIONS

## 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 EQUIPMENT

#### A. Subgrade Planer

1. An approved subgrade planer shall be provided, mounted on visible rollers riding on the forms, having adjustable cutting blades which shall trim the subgrade to exact sections shown on the plans. Planer frames shall be heavy enough to remain on the forms at all times and shall be of such strength and rigidity that, under a test made by changing the support from the wheels to the center for the type pavements as set out under "Subgrade Planer," they shall not develop a deflection of more than 1/8 inch. Tractive power equipment used on the subgrade to pull the planer shall not be such as to produce ruts or indentations in the subgrade.

#### B. Subgrade Template

1. The template for checking the contour of the subgrade shall be provided and operated by the CONTRACTOR. The template shall rest upon the side forms and shall be of such strength and rigidity that, under a test made by changing the support to the center, it shall not develop a deflection of more than 1/8 inch. It shall be provided with accurately adjustable rods projecting downward to the subgrade at 1 foot intervals, and these rods shall be adjusted to the required cross-section when the template is resting on the side forms.

#### C. Compacting Equipment

1. Compacting equipment shall be designed to produce the pavement density and surface smoothness herein specified, and shall be maintained in first-class operating condition.

## PART 3 EXECUTION

- 3.01 After the excavation and embankment has been substantially completed, the subgrade shall be brought to the proper alignment, cross section and elevation, so that after rolling and subsequent finishing operations, it shall conform to the correct alignment, cross section and elevation. Rolling and sprinkling shall be performed when and to the extent directed and the roadbed shall be completed to or above the plane of the typical section shown on the plans and the lines and grades established by the OWNER.
- 3.02 After completion of the compaction and immediately before the application of base or pavement, the subgrade planer shall be operated from approved forms in a manner to finish the subgrade to the required section. The subgrade shall then be tested with the approved template, operated and maintained by the CONTRACTOR. All irregularities which develop in excess of 1/2 inch in a length of 16 feet measured longitudinally shall be corrected by loosening, adding or removing material; reshaping; and re-compacting by sprinkling and rolling.
- 3.03 The subgrade shall be maintained in a smooth, compacted condition, in conformity with the required section and established grade, until the base or pavement is placed, and shall be kept wetted down sufficiently in advance of placing any base or pavement to insure its being in a firm and moist condition for at least 2 inch below surface of the prepared subgrade. Only such subgrade as is necessary for the satisfactory prosecution of the work shall be completed ahead of the placement of base or pavement. Hauling or operating of unnecessary equipment on the completed

subgrade shall be kept to a minimum. Complete drainage of the subgrade shall be provided at all times.

- 3.04 Finishing of the subgrade by hand shall be permitted on sections where the pavement width is not uniform, at intersections and elsewhere where the operation of the subgrade planer would not be practical. Subgrade finished by hand shall conform to the requirements above specified.
- 3.05 Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.
  - A. Provide a smooth transition between adjacent existing grades and new grades.
  - B. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.
- 3.06 Site Rough Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to required elevations within the following tolerances:
  - A. Turf or Unpaved Areas: Plus or minus 1 inch.
  - B. Walks: Plus or minus 1 inch.
  - C. Pavements: Plus or minus 1/2 inch.
- 3.07 Grading inside Building Lines: Finish subgrade to a tolerance of 1/2 inch when tested with a 10-foot straightedge.

END OF SECTION 31 2200

## SECTION 31 2300

## EXCAVATION AND FILL

## 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 EXCAVATION AND FILL 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 EXCAVATION AND FILL shall be included in the bid prices for the work.

## 1.03 SECTION INCLUDES

- A. Subgrade Preparation
- B. Excavation
  - 1. Trenching
- C. Dewatering
- D. Fill
  - 1. Backfill
  - 2. Compaction

## 1.04 RELATED SECTIONS

- A. 31 1000 Site Clearing
- B. 31 2200 Grading
- C. 31 2500 Erosion and Sedimentation Controls
- D. 32 1100 Base Courses

## 1.05 DEFINITIONS

- A. AHJ – Authority Having Jurisdiction
  - 1. City of Tahlequah
  - 2. United States Environmental Protection Agency
- B. Backfill - Soil material or controlled low-strength material used to fill an excavation.
- C. Initial Backfill - Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
- D. Final Backfill - Backfill placed over initial backfill to fill a trench.
- E. Borrow - Borrow shall consist of required excavation, removal, and proper utilization of materials obtained from designated or approved sources for use as fill or backfill.
- F. Excavation - Removal of material encountered above subgrade elevations and to lines and dimensions indicated.
  - 1. Authorized Additional Excavation - Excavation below subgrade elevations or beyond indicated lines and dimensions as directed by Architect. Authorized additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.
  - 2. Unauthorized Excavation - Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by Architect. Unauthorized



excavation, as well as remedial work directed by Architect, shall be without additional compensation.

- G. Embankment - The placement and compaction of all suitable materials obtained from excavation or borrow to raise existing grades.
- H. Structures - Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.
- I. Subgrade - Uppermost surface of an excavation or the top surface of a fill or backfill immediately below subbase, drainage fill, drainage course, or topsoil materials.
- J. Utilities - On-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.
- K. Rock - Rock material in beds, ledges, unstratified masses, conglomerate deposits, and boulders of rock material that exceed 1 cu. yd. (0.76 cu. m) for bulk excavation or 3/4 cu. yd. (0.57 cu. m) for footing, trench, and pit excavation that cannot be removed by rock excavating equipment equivalent to the following in size and performance ratings, without systematic drilling, ram hammering, or ripping.
  - 1. For classifying rock excavation in bulk or mass excavations, use a late model, well-maintained tractor-mounted hydraulic ripper equipped with one digging point of standard manufacturer's design sized for use with, and propelled by, a crawler-type tractor with a minimum net flywheel power rating of 370 hp (276 kW), operating in low gear.
  - 2. For classifying rock excavation in footing, trench, and pit excavations, use a late model, well-maintained, track-mounted hydraulic excavator; equipped with a 42-inch wide, maximum, short-tip-radius rock bucket; rated at not less than 138-hp flywheel power with bucket-curling force of not less than 28,700 lbf and stick-crowd force of not less than 18,400 lbf with extra-long reach boom; measured according to SAE J-1179.

#### 1.06 ACTION SUBMITTALS

- A. For each type of the following manufactured products:
  - 1. Geotextiles
  - 2. Warning tapes

#### 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.
- B. Material Test Reports: For each borrow material proposed for fill and backfill as follows:
  - 1. Source of borrow material.
  - 2. Classification according to ASTM D-2487.
  - 3. Laboratory Compaction curve according to ASTM D-698.

#### 1.08 DELIVERY, STORAGE, AND HANDLING

- A. See Execution.

#### 1.09 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.
- 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.
- 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, depth, or both. 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 CONDITIONS

##### 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 EQUIPMENT

- A. Excavating and grading equipment shall be approved types and designs, and shall be maintained in first class condition. Equipment used for disposing of excavated materials outside of the limits of the work shall be such as will avoid scattering or wasting material along the line of haul.

#### 2.02 MATERIALS

- A. Provide borrow materials when sufficient satisfactory soil materials are not available from excavations.
- B. Satisfactory Soils
  - 1. Controlled, compacted fill shall consist of approve materials that are free of organic matter and debris and contain maximum rock size of 12 inches, or the lift thickness, whichever is less. Frozen material shall not be used, and fill shall not be placed on a frozen subgrade. A sample of each material type shall be submitted to the Geotechnical Engineer for evaluation prior to its use.
  - 2. On-Site Soils / Imported Fill
    - a. USCS Classification Groups: Gravelly CL, or CL-CH, GC, SC, SW, or GW
    - b. These soils are acceptable for placement at all locations and elevations.
  - 3. Low Volume Change (LVC) Engineered Fill
    - a. USCS Classification Groups: Gravelly CL, GC, or SC with a liquid limit less than 50.
    - b. Low plasticity cohesive soil or granular soil shall have a liquid limit of less than 50%, contain at least 15% fines retained on the No. 200 sieve, and be preapproved by the Geotechnical Engineer for evaluation prior to its use.
    - c. LVC soils are acceptable for placement within 2 ft below the bottom of the slab elevation.
    - d. On-site soils classified as CL, SC or GC segregated during earthwork may be used as LVC material.
    - e. Topsoil strippings or material containing organics shall not be used as LVC material.
  - 4. On-Site Natural Soils
    - a. USCS Classification: CH
      - 1) These soils shall not be placed within the upper 2 ft beneath foundations, floor slabs and pavements.
    - b. CH Clays with Liquid Limit equal to or above 50 are considered suitable for use as controlled fill only if the percentage of rock fragments

exceeds 35% or if placed 2 ft below shallow foundations, slab, or pavement areas.

- C. Unsatisfactory Soils: Soil Classification Groups OL, CH, MH, OH, and PT according to ASTM D 2487, or a combination of these groups; rock or gravel larger than 12 inches in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter.
  - 1. Unsatisfactory soils also include satisfactory soils not maintained within the required optimum moisture content at the time of compaction.
- D. Engineered Fill shall be Low Volume Change Engineered Fill.
- E. Bedding Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; except with 100 percent passing a 1-inch sieve and not more than 8 percent passing a No. 200 sieve.
- F. Drainage Course: Narrowly graded mixture of washed crushed stone, or crushed or uncrushed gravel; ASTM D 448; coarse-aggregate grading Size 57; with 100 percent passing a 1-1/2-inch sieve and 0 to 5 percent passing a No. 8 sieve.
- G. Filter Material: Narrowly graded mixture of natural or crushed gravel, or crushed stone and natural sand; ASTM D 448; coarse-aggregate grading Size 67; with 100 percent passing a 1-inch sieve and 0 to 5 percent passing a No. 4 sieve.
- H. Sand: ASTM C 33; fine aggregate.
- I. Impervious Fill: Clayey gravel and sand mixture capable of compacting to a dense state.

## 2.03 GEOTEXTILES

- A. Geotextiles for Erosion Control
  - 1. Pervious fabric under riprap for slope protection and gabion separation shall meet the requirements of AASHTO M 288, "Permanent Erosion Control Geotextile Requirements."
- B. Geotextiles for Subsurface Drainage Purposes
  - 1. 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.
- C. Geotextiles for Subgrade Reinforcement
  - 1. Geotextiles for subgrade reinforcement under pavement structures shall meet the requirements of AASHTO M 288, "Stabilization Geotextile Property Requirements."
- D. Geotextiles for Bases
  - 1. Geotextiles used for separation under base courses shall be a non-woven fabric for base course separation in accordance with AASHTO M 288, "Separation Geotextile Property Requirements" with a Class 2 Degree of Survivability.

## 2.04 CONTROLLED LOW-STRENGTH MATERIAL

- A. Controlled Low-Strength Material (CLSM) shall be a self-compacting low strength material with a flowable consistency.
- B. CLSM shall be produced from the following materials:
  - 1. Portland Cement: ASTM C 150, Type I.
  - 2. Fly Ash: ASTM C 618, Class C or F.
  - 3. Normal-Weight Aggregate: ASTM C 33, 3/8-inch nominal maximum aggregate size.
  - 4. Foaming Agent: ASTM C 869.

5. Water: ASTM C 94.
  6. Air-Entraining Admixture: ASTM C 260.
- C. CLSM shall meet the following requirements:
1. Spread diameter of 8 inches or greater according to ASTM D 6103.
  2. Minimum strength of 300 psi according to ASTM D 4832 at 28 days after placement.
  3. Unit weight of 115 to 145 lb/cu.ft measured at the point of placement according to ASTM D 6023.

#### 2.05 ACCESSORIES

- A. Detectable Warning Tape: Acid- and alkali-resistant, polyethylene film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches wide and 4 mils thick, continuously inscribed with a description of the utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches deep; colored as follows:
1. Red: Electric.
  2. Yellow: Gas, oil, steam, and dangerous materials.
  3. Orange: Telephone and other communications.
  4. Blue: Water systems.
  5. Green: Sewer systems.

### PART 3 EXECUTION

#### 3.01 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earth moving operations.
- B. Protect and maintain erosion and sedimentation controls during earth moving operations.
- C. Protect subgrades and foundation soils from freezing temperatures and frost. Remove temporary protection before placing subsequent materials.

#### 3.02 EXPLOSIVES

- A. Do not use explosives.

#### 3.03 EXCAVATION, GENERAL

- A. Classified Excavation: Excavate to subgrade elevations. Material to be excavated will be classified as earth and rock. Do not excavate rock until it has been classified and cross sectioned by Engineer.
  1. Earth excavation includes excavating pavements and obstructions visible on surface; underground structures, utilities, and other items indicated to be removed; together with soil, boulders, and other materials not classified as rock or unauthorized excavation.
    - a. Intermittent drilling; ram hammering; or ripping of material not classified as rock excavation is earth excavation.
  2. Rock excavation includes removal and disposal of rock. Remove rock to lines and subgrade elevations indicated to permit installation of permanent construction without exceeding the following dimensions:
    - a. 24 inches outside of concrete forms other than at footings.
    - b. 12 inches outside of concrete forms at footings.
    - c. 6 inches outside of minimum required dimensions of concrete cast against grade.

- d. Outside dimensions of concrete walls indicated to be cast against rock without forms or exterior waterproofing treatments.
  - e. 6 inches beneath bottom of concrete slabs-on-grade.
  - f. 6 inches beneath pipe in trenches, and the greater of 24 inches wider than pipe or 42 inches wide.
- 3. All existing fill material shall be removed and properly replaced according to these specifications.
- B. Construction Methods
  - 1. All excavation shall be in accordance with the lines, grades and typical sections as shown on the plans or as established by the OWNER. Unless otherwise shown on the plans or established by the OWNER, the excavation shall be made to the subgrade. Where excavation to grades established in the field by the OWNER would terminate in unstable soil, the CONTRACTOR shall remove the unstable soil and backfill to the required grade.
  - 2. The on-site soils typically classify as Type B in accordance with OSHA regulations. Temporary excavations classifying as Type B with a total height of less than 20 ft shall be cut no steeper than 1H:1V in accordance with OSHA guidelines.
  - 3. Where excavation to grade established in the field by the OWNER terminates in loose or solid rock, the CONTRACTOR shall extend the depth of excavation 6 inches and backfill with select material compacted as required.
  - 4. The CONTRACTOR shall conduct his operation in such a manner that adequate measurements may be taken before any backfill, as required above, is placed.
- C. Provisions for Drainage
  - 1. If it is necessary in the execution of the work to interrupt the natural drainage of the surface or the flow of artificial drains, the CONTRACTOR shall provide temporary drainage facilities that shall prevent damage to public or private interest and shall restore the original drains as soon as the work shall permit.
  - 2. The CONTRACTOR shall be held liable for all damages which may result from neglecting to provide for either natural or artificial drainage which his work may have interrupted.
- D. Excess Excavation
  - 1. Excavation in excess of that needed for construction shall be disposed of by the CONTRACTOR. In general, suitable excess excavation shall be used in construction of streets, drives, parking lots, widening of embankments, flattening of slopes, etc., but, if it becomes necessary to waste any material, it shall be disposed of in such a manner as to present a neat appearance and to not obstruct proper drainage or cause injury to any street improvements or abutting property. If necessary to haul off excess or unsuitable material, the CONTRACTOR should ask approval of the OWNER as to disposition site and method.

### 3.04 EXCAVATION FOR STRUCTURES

- A. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 1 inch. If applicable, extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections.
  - 1. Excavations for Footings and Foundations: Do not disturb bottom of excavation. Excavate by hand to final grade just before placing concrete reinforcement. Trim bottoms to required lines and grades to leave solid base to receive other work.

2. Pile Foundations: Stop excavations 6 to 12 inches above bottom of pile cap before piles are placed. After piles have been driven, remove loose and displaced material. Excavate to final grade, leaving solid base to receive concrete pile caps.
  3. Excavation for Underground Tanks, Basins, and Mechanical or Electrical Utility Structures: Excavate to elevations and dimensions indicated within a tolerance of plus or minus 1 inch. Do not disturb bottom of excavations intended as bearing surfaces.
- B. All existing fill material shall be removed and properly replaced according to these specifications.
- C. If relatively chert free fat clay zones are encountered at footing bottom and finish subgrade elevation, they should be undercut 2 ft, or to gravelly clays/clayey gravels, whichever is shallower, and replaced with LVC fill material.
- 3.05 EXCAVATION FOR WALKS AND PAVEMENTS
- A. Excavate surfaces under walks and pavements to indicated lines, cross sections, elevations, and subgrades.
- 3.06 EXCAVATION FOR UTILITY TRENCHES
- A. The length of trench excavated approximately to grade shall not exceed one hundred-fifty feet (150') and no trench excavation whatsoever shall be made farther than three hundred feet (300') in advance of completed backfill.
- B. Trenches shall be excavated to a width which will provide adequate working space and sidewall clearances for proper pipe installation, joining, and embedment. Stipulated minimum trench widths are not minimum average widths, but are minimum widths that shall be required. Stipulated maximum trench widths shall not be exceeded. Trench width shall be the width of the trench excavation measured from bank to bank at the top of the pipe. For rigid pipes, when the maximum trench width is exceeded, the Contractor shall be required to provide a higher strength pipe or higher bedding classification, singly or in combination as directed by the Engineer, at the Contractor's expense. Any additional foundation material and/or embedment material required due to over excavation, beyond the maximum trench width shall be at the Contractor's expense.
- C. Where trenches are excavated in soil of such nature as to require sheeting and shoring to assure proper installation, and safety of the workmen and any adjacent structures or other objects, the Contractor shall provide the necessary sheeting and shoring. Where possible, shields designed to be portable and moved along as work progresses may be used. The contract pay widths shown in the above shall apply to all trenches with or without sheeting or shoring.
- D. Excavation shall be made in open-cut from the surface of the ground and shall be made no larger than necessary to permit proper construction of the work in accordance with the plans and specifications. The entire foundation area in the bottom of all excavations shall be firm, stable and of uniform density as nearly as practical, and unless necessary, materials shall not be disturbed below grade. Where trenches are excavated in soft, unsuitable materials, trench bottom may be stabilized by over-excavating unsuitable materials and replaced with engineered fill.
- E. Where depth of trenching and other excavations are greater than twenty feet (20'), and when not provided for in the plans, an engineer shall be retained by the Contractor to design bank protection as per OSHA rules and regulations. The bank protection design, signed and sealed by a Professional Engineer registered in the State of Oklahoma, shall be submitted to the Engineer.
- F. The sides of all excavations shall be sufficiently sheeted, shored and braced so as to prevent slides, cave-ins, settlement or movement of the banks. In wet, saturated or



flowing ground where it is necessary to install tight sheeting or cofferdams, wood or steel sheet piling of approved design and type shall be used. All sheeting, shoring and bracing shall have sufficient strength and rigidity to withstand the pressures exerted and maintain the walls of the excavation properly in place and protect all persons or property from injury or damage. When excavations are made adjacent to existing buildings or other structures, or in paved streets or alleys, particular care shall be taken to adequately sheet, shore, and brace the sides of the excavation to prevent any undermining of or settlement beneath the structures or the pavement. Underpinning of adjacent structures, when necessary, shall be done in an approved manner. The foundation material that is undermined shall be replaced and compacted in accordance with the requirements of this section. Sheeting, shoring, and bracing shall not be left in place unless otherwise shown on the plans or authorized by the Engineer. The removal of sheeting, shoring and bracing shall be done in such a manner as not to endanger or damage either the new structure or any existing structure or property, either private or public, and so as to avoid cave-ins or sliding of the banks. If for any reason the Contractor, with the approval of the Engineer, leaves in place any sheeting, shoring or bracing, no payment will be allowed for such material left in place unless it is classified as a contract pay item. All holes or voids left by the removal of sheeting, shoring or bracing shall be satisfactorily filled and compacted in accordance with the requirements of this section.

### 3.07 SUBGRADE PREPARATION AND INSPECTION

- A. Notify Architect when excavations have reached required subgrade.
- B. If unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material as directed.
- C. Areas to receive controlled fill, building subgrades, pavement subgrades, and undercut bottoms shall be proof-rolled with a fully loaded tandem axle dump truck or similar heavy rubber-tired construction equipment. All soft subgrade areas shall be undercut and replaced with compacted fill.
- D. Proof-roll subgrade below the building slabs and pavements with a pneumatic-tired and loaded 10-wheel, tandem-axle dump truck weighing not less than 25 tons to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.
  - 1. Completely proof-roll subgrade in one direction, repeating proof-rolling in direction perpendicular to first direction. Limit vehicle speed to 3 mph.
  - 2. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Architect, and replace with compacted backfill or fill as directed.
- E. After proof-rolling, scarify exposed subgrade to a minimum depth of 8 inches and compact to a least 95 percent of its maximum dry density as determined by the ASTM D-698 at a moisture content of optimum or above.
- F. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Architect, without additional compensation.

### 3.08 GROUND PENETRATING RADAR

- A. Once final excavation within the building footprint is achieved, the subsurface area within the footprint shall be inspected with ground penetrating radar (GPR) to potentially locate large shallow subsurface voids, if present.

### 3.09 STORAGE OF SOIL MATERIALS

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

- B. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

### 3.10 FILL

- A. Prior to the placing of any fill, all clearing and grubbing and site preparation shall have been completed. Stump holes or other small excavations within the limits of the embankment shall have been backfilled before commencing the embankment construction. The surface of the ground, including plowed or loosened ground or small ditches or washes, shall be restored to approximately its original slope.
- B. Embankments shall be constructed to the established grade and to the shape of the typical section shown on the plans, and each section shall conform to the detailed sections of slopes. After completion of the embankment, it shall be continuously maintained to its finished section and grade until the project is accepted.
- C. Earth embankments shall be constructed in successive horizontal layers, for the full width of specified depth or cross sections; and in such lengths as are suitable for the sprinkling and compaction methods to be used. Each layer of earth embankment shall be uniform as to material, density, and moisture content before beginning compaction. Layers of embankment shall be brought up uniformly on each side of the structure, and special care shall be taken to prevent any wedging action against the structure. For such distances along embankments adjacent to structures where it is impracticable to obtain compaction by rolling, the embankment material shall be placed in layers not exceeding 6 inches in depth of loose material wetted uniformly to the moisture content directed; and shall then be compacted by methods approved by the OWNER, maintaining the required moisture content by additional sprinkling, if necessary, supplemented by such hand work as is necessary to secure a uniform and thoroughly compacted fill, until each layer has been uniformly compacted to the satisfaction of OWNER.
- D. Place backfill on subgrades free of mud, frost, snow, or ice.

### 3.11 TRENCH BACKFILL

- A. Backfill is that portion of the total trench backfill down to but not including the pipe embedment material. The backfill shall be only material approved by the Engineer consisting of loose earth, free of clods, stones, organic matter, debris or other objectionable materials.
- B. All backfilling shall be done in such a manner as not to disturb or injure the pipe or structures over or against which it is being placed. Any pipe or structure injured, damaged or moved from its proper line or grade during backfilling operations shall be opened up and repaired and then re-backfilled as herein specified.
- C. The top surface or slopes of all backfill shall be neatly graded off where select topsoil, sod or other material is removed and piled separately; such material shall be carefully replaced in a manner satisfactory to the Engineer. The top twelve inches (12") of backfill material shall be of as good quality as the original topsoil that was removed.
- D. A clay trench plug shall be constructed at the edge of the building and extend at least 5 feet out from the face. The clay shall have a minimum plasticity index (PI) of 15 and be placed in controlled lifts not exceeding 9 inches in loose thickness. Each lift of clay backfill shall be compacted to at least 95 percent of the material's maximum standard Proctor dry density, ASTM 698, at a minimum moisture content that is above its optimum value.
- E. Place trench backfill on subgrades free of mud, frost, snow, or ice.
- F. Place trench backfill and fill soil materials in layers not more than 6 inches in loose depth.
- G. Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.
- H. Backfill voids with satisfactory soil while removing shoring and bracing.

- I. Place and compact initial backfill, free of particles larger than 1 inch in any dimension, to a height of 12 inches over the pipe or conduit.
- J. Carefully compact initial backfill under pipe haunches and compact evenly up on both sides and along the full length of piping or conduit to avoid damage or displacement of piping or conduit. Coordinate backfilling with utilities testing.
- K. Install warning tape directly above utilities, 12 inches below finished grade, except 6 inches below subgrade under pavements and slabs.

### 3.12 SOIL MOISTURE CONTROL

- A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to within 2 percent of optimum moisture content for CL, ML, SC, GC, GW & SW Soil Types; and between 0 and 4% above optimum for CH soil types.
- B. Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain frost or ice.
- C. Remove and replace, or scarify and air dry, otherwise satisfactory soil material that exceeds optimum moisture content by 2 percent and is too wet to compact to specified dry unit weight.

### 3.13 COMPACTION OF SOIL BACKFILLS AND FILLS

- A. Place backfill and fill soil materials in layers not more than 12 inches in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers.
- B. Place backfill and fill soil materials evenly on all sides of structures to required elevations, and uniformly along the full length of each structure.
- C. Compact backfills and fills to not less than the following percentages of maximum dry unit weight according to ASTM D-698:
  - 1. Fill shall be compacted with six (6) passes (3 each direction) minimum using a self-propelled vibratory compactor with a minimum drum diameter of 48-inches for granular soils, or 95% Standard Proctor Density (ASTM D698) for materials containing sufficient fines content.
  - 2. Pavements, sidewalks and exterior slabs shall be compacted to 95% Standard Proctor Density.
  - 3. Non-structural areas shall be compacted to 90% Standard Proctor Density.
  - 4. For utility trenches, compact each layer of initial and final backfill soil material at 95 percent.

### 3.14 SUBBASE AND BASE COURSES UNDER PAVEMENTS AND WALKS

- A. Place subbase course and base course on subgrades free of mud, frost, snow, or ice.
- B. On prepared subgrade, place subbase course and base course under pavements and walks as follows:
  - 1. Place base course material over subbase course under hot-mix asphalt pavement.
  - 2. Shape subbase course and base course to required crown elevations and cross-slope grades.
  - 3. Place subbase course and base course 6 inches or less in compacted thickness in a single layer.
  - 4. Place subbase course and base course that exceeds 6 inches in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches thick or less than 3 inches thick.
  - 5. Compact subbase course and base course at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 100 percent of Standard Proctor Compaction according to ASTM D-698.

- C. Pavement Shoulders: Place shoulders along edges of subbase course and base course to prevent lateral movement. Construct shoulders, at least 12 inches wide, of satisfactory soil materials and compact simultaneously with each subbase and base layer to not less than 100 percent of Standard Proctor Compaction according to ASTM D-698.

### 3.15 PROTECTION

- A. Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.
- B. Repair and reestablish grades to the specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.
  - 1. Scarify or remove and replace soil material to depth as directed by Architect; reshape and recompact.
- C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.
  - 1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

### 3.16 DISPOSAL OF SURPLUS AND WASTE MATERIALS

- A. Remove surplus satisfactory soil and waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of them off Owner's property.
- B. Transport surplus satisfactory soil to designated storage areas on Owner's property. Stockpile or spread soil as directed by Architect.
- C. Remove waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of them off Owner's property.

### 3.17 DEWATERING

- A. PERFORMANCE
  - 1. Design, furnish, install, test, operate, monitor, and maintain dewatering system of sufficient scope, size, and capacity to control hydrostatic pressures and to lower, control, remove, and dispose of ground water and permit excavation and construction to proceed on dry, stable subgrades.
  - 2. Continuously monitor and maintain dewatering operations to ensure erosion control, stability of excavations and constructed slopes, that excavation does not flood, and that damage to subgrades and permanent structures is prevented.
  - 3. Prevent surface water from entering excavations by grading, dikes, or other means.
  - 4. Accomplish dewatering without damaging existing buildings, structures, and site improvements adjacent to excavation.
  - 5. Remove dewatering system when no longer required for construction.
- B. PREPARATION
  - 1. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by dewatering operations.
  - 2. Prevent surface water and subsurface or ground water from entering excavations, from ponding on prepared subgrades, and from flooding site and surrounding area.
  - 3. Protect subgrades and foundation soils from softening and damage by rain or water accumulation.

4. Install dewatering system to ensure minimum interference with roads, streets, walks, and other adjacent occupied and used facilities.
5. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.
6. Provide temporary grading to facilitate dewatering and control of surface water.
7. Monitor dewatering systems continuously.
8. Promptly repair damages to adjacent facilities caused by dewatering.
9. Protect and maintain temporary erosion and sedimentation controls during dewatering operations.

C. INSTALLATION

1. Install dewatering system utilizing wells, well points, or similar methods complete with pump equipment, standby power and pumps, filter material gradation, valves, appurtenances, water disposal, and surface-water controls.
2. Space well points or wells at intervals required to provide sufficient dewatering.
3. Use filters or other means to prevent pumping of fine sands or silts from the subsurface.
4. Before excavating below ground-water level, place system into operation to lower water to specified levels. Operate system continuously until drains, sewers, and structures have been constructed and fill materials have been placed or until dewatering is no longer required.
5. Provide an adequate system to lower and control ground water to permit excavation, construction of structures, and placement of fill materials on dry subgrades. Install sufficient dewatering equipment to drain water-bearing strata above and below bottom of foundations, drains, sewers, and other excavations.
6. Do not permit open-sump pumping that leads to loss of fines, soil piping, subgrade softening, and slope instability.
7. Reduce hydrostatic head in water-bearing strata below subgrade elevations of foundations, drains, sewers, and other excavations.
8. Maintain piezometric water level a minimum of 60 inches below surface of excavation.
9. Dispose of water removed by dewatering in a manner that avoids endangering public health, property, and portions of work under construction or completed. Dispose of water and sediment in a manner that avoids inconvenience to others. Provide sumps, sedimentation tanks, and other flow-control devices as required by authorities having jurisdiction.
10. Provide standby equipment on site, installed and available for immediate operation, to maintain dewatering on continuous basis if any part of system becomes inadequate or fails. If dewatering requirements are not satisfied due to inadequacy or failure of dewatering system, restore damaged structures and foundation soils at no additional expense to Owner.
11. Remove dewatering system from Project site on completion of dewatering. Plug or fill well holes with sand or cut off and cap wells a minimum of 36 inches below overlying construction.
12. Promptly repair damages to adjacent facilities caused by dewatering operations.

3.18 FIELD QUALITY CONTROL

- A. OWNER shall engage a qualified soils testing laboratory. Contractor shall coordinate and order all testing in conjunction with earthwork operations. The results of the tests shall be forwarded to ENGINEER. The soils laboratory shall determine the suitability of existing site material prior to beginning fill operations.

- B. The soils testing laboratory shall:
1. Classify excavation material as satisfactory soils or unsatisfactory soils.
  2. Determine rock excavation.
  3. Determine prior to placement of fill that site has been prepared in compliance with requirements and determine that fill material.
  4. Determine that maximum lift thickness comply with requirements.
  5. Determine, at the required frequency, that in-place density of compacted fill complies with requirements.
- C. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earth moving only after test results for previously completed work comply with requirements.
- D. Testing agency shall test compaction of soils in place, as applicable. Tests will be performed at the following locations and frequencies:
1. Building Slab Areas: At subgrade and at each compacted fill and backfill layer, at least one test for every 2,500 sq. ft. or less of building slab area, but in no case fewer than three tests.
  2. Paved Areas: At subgrade and at each compacted fill and backfill layer, at least one test for every 5,000 sq. ft. or less of paved area, but in no case fewer than three tests.
  3. Foundation Wall Backfill: At each compacted backfill layer, at least one test for every 100 feet or less of wall length, but no fewer than two tests.
  4. Trench Backfill: At each compacted initial and final backfill layer, at least one test for every 150 feet or less of trench length, but no fewer than two tests.
  5. Non-Structural Areas: One test for every 5,000 sq. ft. or less, but in no case fewer than three tests.
- E. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil materials to depth required; re-compact and retest until specified compaction is obtained.

END OF SECTION 31 2300

SECTION 32 1100

BASE COURSES

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 BASE COURSES 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 BASE COURSES shall be included in the bid prices for the work.

1.03 SECTION INCLUDES

- A. Subgrade Modification
- B. Aggregate Base Course

1.04 RELATED SECTIONS

- A. 31 22 00 Grading
- B. 31 23 00 Excavation and Fill
- C. 31 25 00 Erosion and Sedimentation Controls

1.05 DEFINITIONS

- A. AHJ – Authority Having Jurisdiction
  - 1. City of Tahlequah

1.06 ACTION SUBMITTALS

1.07 INFORMATIONAL SUBMITTALS

- A. Material Test Reports: For each base course material proposed as follows:
  - 1. Source of base course material.
  - 2. Classification according to ASTM D-2487.
  - 3. Laboratory Compaction curve according to ASTM D-698.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. See Execution.

1.09 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.

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.

## 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, depth, or both. 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 CONDITIONS

## PART 2 PRODUCTS

## 2.01 ADOPTED PRODUCT REQUIREMENTS

- A. All materials and products shall comply with the Oklahoma Department of Transportation's 2009 Specifications.

## 2.02 AGGREGATE BASE FOR VEHICULAR PAVEMENTS

## A. General Requirements

1. Provide aggregate base course material consisting of a mixture of coarse and fine graded aggregate that is free of vegetation and other deleterious materials.
2. Coarse aggregate is the material retained on a No. 10 sieve. Provide coarse aggregate consisting of the following durable particles or fragments:
  - a. Gravel, Stone, Disintegrated granite, crushed concrete, or
  - b. Provide fine aggregate made of sand, stone dust, or other inert, finely-divided mineral.
3. Ensure at least 40% of the completed Type A or Type B mixture retained on the No. 4 sieve contains uniformly graded, mechanically crushed particles with at least one fractured face.
4. Ensure 100 percent of the completed Type C or Type D mixture retained on the No. 4 sieve contains uniformly graded, mechanically crushed particles with at least two fractured faces. Ensure the completed Type C mixture contains no more than 15 percent natural sand.

## B. Physical Properties

1. Ensure the coarse aggregate retained on the 3/8 in sieve of the completed mixture has no more than 50 percent wear in accordance with the Los Angeles Abrasion Test in accordance with AASHTO T 96. Ensure the aggregate has an Aggregate Durability Index of at least 40 in accordance with AASHTO T 210.

## C. Gradation and Other Requirements

1. Sample the uniform mixture from the project site before compacting. Ensure samples are in accordance with the following Table for Gradation, Plasticity Index, and Liquid Limit for the provided aggregate base types.

Aggregate Base Gradation				
Sieve Size	Percent Passing per Type			
	Type A	Type B	Type C	Type D
3 in	---	100	---	---
2 in	---	---	100	---
1-1/2 in	100	40 -100	90 – 100	100
1 in	---	---	80 – 100	95 – 100
3/4 in	40 – 100	30 – 75	---	---
1/2 in	---	---	60 – 80	25 – 60
3/8 in	30 - 75	25 -60	---	---
No. 4	25 - 60	20 - 50	40 - 60	0 - 10
No. 8	---	---	---	0 – 5
No. 10	20 – 43	15 – 35	25 – 45	---
No. 40	8 – 26	7 – 22	15 – 30	---
No. 200 <sup>a</sup>	40 – 12.0	3.0 – 10.0	0 – 5.0	0 – 2.0

Other Requirements				
Plasticity Index	≤ 6	≤ 6	≤ 6	---
Liquid Limit	≤ 25	≤ 25	≤ 25	---
<sup>a</sup> Ensure the material passing the No. 200 sieve comprises no greater than two-thirds of the quantity of material passing the No. 40 sieve.				
<sup>b</sup> When separate aggregates are blended to produce an aggregate mixture, no individual aggregate shall have a plasticity index higher than 8.				

### 2.03 SAND BASE FOR SIDEWALKS

#### A. General Requirements

1. Sand base for sidewalks shall consist of sand, stone, rock, screenings, or select sandy soil free of organic material. Ensure there are no frozen lumps or moisture that may prevent the required compaction.

#### B. Gradation Requirements

Sand Base Material Gradation	
Sieve Size	Percent Passing
3/8 in	100
No. 200	0 - 10

## PART 3 EXECUTION

### 3.01 ADOPTED PLACEMENT REQUIREMENTS

- A. The placement of BASE COURSES shall comply with the Oklahoma Department of Transportation's 2009 Specifications.

### 3.02 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earth moving operations.
- B. Protect and maintain erosion and sedimentation controls during earth moving operations.
- C. Protect subgrades and foundation soils from freezing temperatures and frost. Remove temporary protection before placing subsequent materials.

### 3.03 STORAGE OF MATERIALS

- A. Stockpile base course materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
- B. Stockpile base course materials away from edge of excavations. Do not store within drip line of remaining trees.

### 3.04 SUBGRADE PREPARATION AND INSPECTION

- A. Notify Architect when excavations have reached required subgrade.
- B. Proof-roll subgrade below the building slabs and pavements with a pneumatic-tired and loaded 10-wheel, tandem-axle dump truck weighing not less than 25 tons to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.
  1. Completely proof-roll subgrade in one direction, repeating proof-rolling in direction perpendicular to first direction. Limit vehicle speed to 3 mph.

2. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Architect, and replace with compacted backfill or fill as directed.
  - C. After proof-rolling, scarify exposed subgrade to a minimum depth of 8 inches and compact to a least 95 percent of its maximum dry density as determined by the ASTM D-698 at a moisture content within +/- 2% of optimum.
  - D. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities.
- 3.05 SOIL MOISTURE CONTROL
  - A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to between +/-2 percent of optimum moisture content.
  - B. Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain frost or ice.
  - C. Remove and replace, or scarify and air dry, otherwise satisfactory soil material that exceeds optimum moisture by +/-2 percent to compact to specified dry unit weight.
- 3.06 COMPACTION OF SUBGRADE
  - A. Compact subgrade to not less than the following percentages of maximum dry unit weight according to ASTM D-698:
    1. Under pavements, scarify and recompact top 8 inches of existing subgrade and each layer of backfill or fill soil material at 95 percent.
    2. Under walkways, scarify and recompact top 8 inches below subgrade and compact each layer of backfill or fill soil material at 95 percent.
- 3.07 BASE COURSES UNDER PAVEMENTS AND WALKS
  - A. Place base course on subgrades free of mud, frost, snow, or ice.
  - B. On prepared subgrade, place base course under pavements and walks as follows:
    1. Install separation geotextile on prepared subgrade according to manufacturer's written instructions, overlapping sides and ends.
    2. Place base course material over subbase course under hot-mix asphalt pavement.
    3. Shape subbase course and base course to required crown elevations and cross-slope grades.
    4. Place base course 6 inches or less in compacted thickness in a single layer.
    5. Place base course that exceeds 6 inches in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches thick or less than 3 inches thick.
    6. Compact base course at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 100 percent Standard Proctor Compaction according to ASTM D-698.
  - C. Pavement Shoulders: Place shoulders along edges of base course to prevent lateral movement. Construct shoulders, at least 12 inches wide, of satisfactory soil materials and compact simultaneously with each subbase and base layer to not less than 100 percent Standard Proctor Compaction according to ASTM D-698.
- 3.08 DISPOSAL OF SURPLUS AND WASTE MATERIALS
  - A. Remove surplus base course material and waste materials and legally dispose of them off Owner's property.

3.09 FIELD QUALITY CONTROL

- A. CONTRACTOR shall engage a qualified soils testing laboratory. Contractor shall coordinate and order all testing in conjunction with base course placement. The results of the tests shall be forwarded to ENGINEER. The soils laboratory shall determine the suitability of existing site material prior to placement of base courses.
- B. The soils testing laboratory shall:
  - 1. Determine prior to placement of fill that site has been prepared in compliance with requirements and determine that fill material.
  - 2. Determine that maximum lift thickness comply with requirements.
  - 3. Determine, at the required frequency, that in-place density of compacted fill complies with requirements.
- C. Allow testing agency to inspect and test subgrades and each fill or backfill layer.
- D. Testing agency shall test compaction of soils in place and base courses as applicable. Tests will be performed at the following locations and frequencies:
  - 1. Paved Areas: At subgrade and at each compacted fill and backfill layer, at least one test for every 5,000 sq. ft. or less of paved area, but in no case fewer than three tests.
- E. When testing agency reports that subgrades or base courses have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace materials to depth required; re-compact and retest until specified compaction is obtained.

END OF SECTION 32 1100

## SECTION 32 1300

## RIGID PAVING

## 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 RIGID PAVING 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 RIGID PAVING shall be included in the bid prices for the work.

## 1.03 SECTION INCLUDES

- A. Concrete Paving

## 1.04 RELATED SECTIONS

- A. 31 2300 Excavation and Fill
- B. 31 2500 Erosion and Sedimentation Controls
- C. 32 1100 Base Courses
- D. 32 1600 Curbs and Gutters
- E. 32 1373 Concrete Paving Joint Sealants

## 1.05 DEFINITIONS

- A. AHJ – Authority Having Jurisdiction
  - 1. City of Tahlequah
- B. Cementitious Materials - Portland cement alone or in combination with one or more of blended hydraulic cement, fly ash and other pozzolans, and ground granulated blast-furnace slag.

## 1.06 ACTION SUBMITTALS

- A. Design Mixtures: For each concrete paving mixture. Include alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.
- B. Paving Plan:
  - 1. Provide a paving plan that shows the proposed concrete placed each day.
  - 2. Provide a joint layout plan that shows isolation joints, longitudinal construction joints, longitudinal contraction joints, transverse contraction joints, and planned transverse construction joints.

## 1.07 INFORMATIONAL SUBMITTALS

- A. Material Certificates: For the following, from manufacturer:
  - 1. Cementitious materials.
  - 2. Steel reinforcement and reinforcement accessories.
  - 3. Applied finish materials.
  - 4. Bonding agent or epoxy adhesive.
  - 5. Joint fillers.

- B. Material Test Reports: For each of the following:
  - 1. Aggregates. Include service-record data indicating absence of deleterious expansion of concrete due to alkali-aggregate reactivity.

#### 1.08 QUALITY ASSURANCE

- A. Ready-Mix-Concrete Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94 requirements for production facilities and equipment.
  - 1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities" (Quality Control Manual - Section 3, "Plant Certification Checklist").
- B. Concrete Testing Service: Engage a qualified testing agency to perform material evaluation tests and to design concrete mixtures.
- C. ACI Publications: Comply with ACI 301 unless otherwise indicated.
- D. 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.
  - 2. Review methods and procedures related to concrete paving, including but not limited to, the following:
    - a. Concrete mixture design.
    - b. Quality control of concrete materials and concrete paving construction practices.
  - 3. Require representatives of each entity directly concerned with concrete paving to attend, including the following:
    - a. Contractor's superintendent.
    - b. Independent testing agency responsible for concrete design mixtures.
    - c. Ready-mix concrete manufacturer.
    - d. Concrete paving subcontractor.
- E. 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.

#### 1.09 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 CONDITIONS

- A. TRAFFIC
  - 1. A Work Zone Permit must be obtained 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 REQUIREMENTS

- A. All materials and products shall comply with the Oklahoma Department of Transportation's 2009 Specifications.

2.02 CONCRETE MIXTURES

- A. Prepare design mixtures, proportioned according to ACI 301, for each type and strength of normal-weight concrete, and as determined by either laboratory trial mixtures or field experience.



1. Use a qualified independent testing agency for preparing and reporting proposed concrete design mixtures for the trial batch method.
  2. When automatic machine placement is used, determine design mixtures and obtain laboratory test results that meet or exceed requirements.
- B. Proportion mixtures to provide normal-weight concrete with the following properties:
1. Class AA
    - a. Minimum 28 Day Compressive Strength: 4,000-psi
    - b. Minimum Cement Content: 564 lb/yd<sup>3</sup>
    - c. Air Content: 6.5% plus or minus 1.5%
    - d. Water/Cement Ratio: 0.25 to 0.44 lb/lb
    - e. Slump: 2 inches, plus or minus 1 inch.
  2. Class A
    - a. Minimum 28 Day Compressive Strength: 3,000-psi
    - b. Minimum Cement Content: 517 lb/yd<sup>3</sup>
    - c. Air Content: 6% plus or minus 1.5%
    - d. Water/Cement Ratio: 0.25 to 0.48 lb/lb
    - e. Slump: 2 inches, plus or minus 1 inch.
  3. Class A (vehicular pavement)
    - a. Minimum 28 Day Compressive Strength: 4,000-psi
    - b. Minimum Cement Content: 517 lb/yd<sup>3</sup>
    - c. Air Content: 6.5% plus or minus 1.5%
    - d. Water/Cement Ratio: 0.25 to 0.48 lb/lb
    - e. Slump: 2 inches, plus or minus 1 inch.
  4. Class AP
    - a. Minimum 28 Day Compressive Strength: 3,000-psi
    - b. Minimum Cement Content: 470 lb/yd<sup>3</sup>
    - c. Air Content: 6% plus or minus 1.5%
    - d. Water/Cement Ratio: 0.25 to 0.48 lb/lb
    - e. Slump: 2 inches, plus or minus 1 inch.
  5. Class C
    - a. Minimum 28 Day Compressive Strength: 2,400-psi
    - b. Minimum Cement Content: 395 lb/yd<sup>3</sup>
    - c. Air Content: 6% plus or minus 1.5%
    - d. Water/Cement Ratio: 0.25 to 0.62 lb/lb
    - e. Slump: 3 inches, plus or minus 1 inch.
- C. Cementitious Materials: Use fly ash, ground granulated blast-furnace slag, as needed to reduce the total amount of portland cement which would otherwise be used. Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:
1. November through March: Fly ash meeting the requirements of this section may be substituted for up to 15% of the required cement. Ground granulated blast furnace slag meeting the requirements of AASHTO M 302 Grade 100 or Grade 120 may be substituted for up to 25% of the required cement. A combination of up to 25% ground granulated blast furnace slag and up to 15% fly ash may be substituted for up to 40% of the required cement.
  2. April through October: A combination of up to 25% ground granulated blast furnace slag and up to 20% fly ash may be substituted for up to 45% of the required cement.
  3. Substitution shall be by weight: 1.0 pound for each 1.0 pound of cement. The concrete mix design shall be appropriately adjusted. These substitutions will not be allowed for high early strength concrete, Class P concrete or concrete

containing Type IP, Type I (PM), or Type I (SM) cement. If the specified minimum cement content is satisfied, additional fly ash or ground granulated blast furnace slag, or silica fume complying with ASTM C 1240, may be added to the mix when approved as part of the mix design.

- D. Water Cement Ratio. Using the weight in pounds of each material, calculate the water-cement ratio (W/C) by the following equation:  $W/C = \text{Water} / (\text{Cement} + \text{Fly Ash} + \text{Blast Furnace Slag} + \text{Silica Fume})$ . The water actually used is determined by the water measured into the batch plus the free water on wet aggregate minus the water absorbed by dry aggregate plus water in any admixture solutions and shall not exceed the limit specified.
- E. Slump. The slump shall be as shown, or as specified in the contract documents, or as approved by the Engineer, and the consistency required shall be that which will provide satisfactory workability for the type work being done. Slump tests will be made during the progress of the work as a measure of uniformity of the consistency of the concrete. If using a high-range water reducing admixture, limit the slump to a maximum of 9 inches.
- F. Compressive Strength. Compressive strength is based on the average of three test cylinders. When the class of concrete is not expressly indicated on the Plans, the following requirements shall govern:
  - 1. Class AA. Use Class AA concrete in superstructure items, such as bridge floors, approach slabs, reinforced concrete piles, drilled shaft foundations, parapet walls, concrete rail and handrails.
  - 2. Class A. Use Class A concrete for pavements and in substructures items, such as pier caps, columns, abutments, retaining walls, box culverts, and all reinforced concrete not requiring Class AA concrete.
  - 3. Class AP. Use Class AP concrete in shoulders, merge areas and gore areas for PCC pavements, unless otherwise directed by plan notes.
  - 4. Class C. Use Class C concrete for soil erosion control structures.

## 2.03 CONCRETE MIXING

- A. Design and produce concrete mixtures that conform to the Class of concrete specified in this section and base the mix design on absolute volume. Proportion the coarse and fine aggregate in accordance with ACI 211.1. Use the least amount of sand and mixing water which will ensure concrete of the required workability for placement conditions. Meet the minimum strength within 72 hours of placement for high early strength concrete. Submit the mix design at least 14 days before production to the Engineer. Include at least the following information with each mix design:
  - 1. Project identification
  - 2. Name and address of contractor and producer
  - 3. Mix design designation
  - 4. Intended use of the mix design
  - 5. Expected travel time from batch to placement
  - 6. If the concrete will be pumped or not
  - 7. Aggregate sources, gradation, moisture content, saturated surface dry batch mass, LA abrasion (AASHTO T 96), and freeze thaw durability (AASHTO T 103).
  - 8. Fineness modulus of fine aggregate.
  - 9. Cement type and source
  - 10. Type of cement replacement, if used, and source
  - 11. Type of admixtures and sources
  - 12. Material proportions
  - 13. Air content
  - 14. Slump
  - 15. Water / cement ratio

- 16. Strengths at 7 and 28 days
- 17. Strengths at 72 hours for high early strength concrete.
- B. Do not place any concrete until the mix design is approved. Submit new mix designs if the mix design is rejected by the Engineer, the source of any material changes, or the mix design produces unacceptable workability or production test results.

#### 2.04 CONCRETE MATERIALS

- A. Portland cement: Shall conform to the requirements of AASHTO M 85 or AASHTO M 240. Type I, Type I (SM), Type I (PM), and Type IP shall be used in concrete for general concrete construction. Type II shall be used in concrete exposed to moderate sulphate action or moderate heat of hydration. Type III may be used when high early strength concrete is required. Unless otherwise approved by the Engineer, the product of only one mill of any one brand and type of portland cement shall be used on any structure or adjacent structures. Provide suitable means of storing and protecting the cement against dampness.
  - 1. Cement which for any reason has become partially set or which contains lumps of caked cement will be rejected. Cement salvaged from discarded or used bags shall not be used. All methods of sampling and testing shall be in accordance with the requirements of AASHTO M 85 or AASHTO M 240.
- B. Water
  - 1. Provide water in accordance with AASHTO M 157, except as modified by the following:
    - a. Water quality testing is not required if obtained from an approved ODEQ public water source.
    - b. For other water sources, submit water quality test from the concrete producer showing compliance with AASHTO M 157 and the Chemical Limits for Mix Water listed below before use.
    - c. A blend of concrete wash water and other water sources may be used if the concrete producer submits certification that the water meets the requirements of AASHTO M 157 and Chemical Limits for Mix Water and Acceptance Criteria for Questionable Water Supplies listed below.
    - d. Test the blended water weekly for 4 weeks, or provide previous test reports. Test blended water monthly for compliance.
    - e. Chemical Limits for Mix Water
      - 1) Chloride (Cl) shall less than 1,000 ppm (ASTM D 512)
      - 2) Sulfate shall be less than 1,000 ppm (ASTM D 516)
      - 3) Alkalis shall be less than 600 ppm (ASTM D 4191 and ASTM D 4192)
      - 4) Total solids shall be less than 50,000 ppm (AASHTO T 26)
    - f. Acceptance Criteria for Questionable Water Supplies
      - 1) Compressive strength shall be a minimum 90% of the control at 7 days (AASHTO T 106)
      - 2) The time of set shall not deviate from the control less than 1 or more than 1.5 (AASHTO T 131)
- C. Fine Aggregates
  - 1. This specification applies to the quality and size of fine aggregates for Portland cement concrete pavements or bases, and incidental structures. Mortar sand shall meet the requirements of AASHTO M 45.
  - 2. General Requirements.

- a. Provide fine aggregates that consists of a single source natural sand in accordance with AASHTO M 6, Class A, except as modified by the Gradation paragraph below.
  - b. Alternatively, provide a fine aggregate that consists of a combination of natural sands or a combination of natural na manufactured sands in accordance with AASHTO M 6, Class A, except as modified by the following:
    - 1) Mix the two materials under controlled conditions and stockpile as a finished aggregate. Alternatively, the two materials may be combined from separate stockpiles during batching operations at a hydraulic cement concrete plant.
    - 2) Ensure the combined fine aggregate meets the gradation requirements below.
    - 3) If a manufactured sand is used in combination with natural sand, ensure the fine aggregate blend has an acid insoluble residue of at least 60 percent by weight when tested in accordance with OHD L-25.
    - 4) Obtain crushed fine aggregate (manufactured sand) from a coarse aggregate source on ODOT Material Division's "Approved Products List" for use in hydraulic cement concrete.
- 3. Deleterious Substances
  - a. The amount of deleterious substances shall not exceed the following limits: Clay lumps and friable particles 3%, Coal and Lignite 0.25%
- 4. Organic Impurities
  - a. All fine aggregate shall be free from injurious amounts of organic impurities. Aggregates subjected to the colorimetric test for organic impurities and producing a color darker than the standard shall be rejected unless they pass the mortar strength test as specified below. Should the aggregate show a darker color than that of samples originally approved for the work, its use shall be withheld until tests satisfactory to the Engineer have been made to determine whether the increased color is indicative of an injurious amount of deleterious substances. A fine aggregate failing in the test may be used provided that, when tested for the effect of organic impurities on strength of mortar, the relative strength at 7 and 28 days calculated in accordance with Section 10 of AASHTO T 71 is not less than 95 percent.
- 5. Gradation
  - a. Provide fine aggregate with a fineness modulus between 2.3 and 3.1, that is well graded from coarse to fine, and when tested in accordance with AASHTO T 27 and AASHTO T11 meets the following gradation requirements.
    - 1) Sieve size: 3/8-in, percent passing: 100%.
    - 2) Sieve size: No. 4, percent passing 95-100%.
    - 3) Sieve size: No. 8, percent passing 80-100%.
    - 4) Sieve size: No. 16, percent passing 50-85%.
    - 5) Sieve size: No. 30, percent passing 25-60%.
    - 6) Sieve size: No. 50, percent passing 5-30%.
    - 7) Sieve size: No. 100, percent passing 0-10%.
  - b. The gradation requirements above represent the extreme limits of suitability. Ensure the gradation from one source does not have large changes in percentages of gradation.

- c. Use the average fineness modulus to determine the uniformity of the fine aggregate. The average fineness modulus is the average of the last 10 tests maintained by the ODOT Division Resident Engineer. Fine aggregates will be rejected from any one source having a variation in fineness modulus greater than 0.20 either way from the average. The fineness modulus of an aggregate is determined by adding the total percentages of material in the sample that are coarser than each of the following sieves (cumulative percentages retained), and dividing the sum by 100; No. 100, No. 50, No. 30, No. 16, No. 8, No. 4, 3/8 inch.

D. Coarse Aggregate

1. Provide coarse aggregate in accordance with AASHTO M 80, Class A, except as modified by the following:
  - a. Ensure coarse aggregate produces Class A concrete with a durability factor of at least 50. Determine the durability factor after 350 cycles of alternate freezing and thawing in accordance with AASHTO T 161, Procedure A.
  - b. The Los Angeles Abrasion percent wear shall be limited to a maximum of 40 percent after 500 revolutions when tested in accordance with AASHTO T 96.
  - c. The sodium sulfate soundness requirement shall not apply.
  - d. Ensure at least 70 percent of the coarse aggregate retained on the No. 4 sieve is crushed stone or mechanically crushed gravel with at least two fractured faces.
  - e. Limit the quantity of flat or elongated pieces to 15 percent or less, at a ratio of 1:5, when tested in accordance with ASTM D 4791.
2. Gradation
  - a. No. 357
    - 1) Sieve size 2-1/2-in., percent passing 100%.
    - 2) Sieve size 2-in., percent passing 95-100%.
    - 3) Sieve size 1-in., percent passing 35-70%.
    - 4) Sieve size 1/2-in., percent passing 10-30%.
    - 5) Sieve size No. 4, percent passing 0-5%.
    - 6) Sieve size No. 200, percent passing 0-1.5%.
  - b. No. 57
    - 1) Sieve size 1-1/2-in., percent passing 100%.
    - 2) Sieve size 1-in., percent passing 95-100%.
    - 3) Sieve size 1/2-in., percent passing 25-60%.
    - 4) Sieve size No. 4, percent passing 0-10%.
    - 5) Sieve size No. 8, percent passing 0-5%.
    - 6) Sieve size No. 200, percent passing 0-2%.
  - c. No. 67
    - 1) Sieve size 1-in., percent passing 100%.
    - 2) Sieve size 3/4-in., percent passing 90-100%.
    - 3) Sieve size 3/8-in., percent passing 20-55%.
    - 4) Sieve size No. 4, percent passing 0-10%.
    - 5) Sieve size No. 8, percent passing 0-5%.
    - 6) Sieve size No. 200, percent passing 0-2%.
  - d. No. 7
    - 1) Sieve size 3/4-in., percent passing 100%.
    - 2) Sieve size 1/2-in., percent passing 90-100%.
    - 3) Sieve size 3/8-in., percent passing 40-70%.

- 4) Sieve size No. 4, percent passing 0-15%.
- 5) Sieve size No. 8, percent passing 0-5%.
- 6) Sieve size No. 200, percent passing 0-2%.
- e. No. 8
  - 1) Sieve size 1/2-in., percent passing 100%.
  - 2) Sieve size 3/8-in., percent passing 85-100%.
  - 3) Sieve size No. 4, percent passing 10-30%.
  - 4) Sieve size No. 8, percent passing 0-10%.
  - 5) Sieve size No. 16, percent passing 0-5%.
  - 6) Sieve size No. 200, percent passing 0-2%.
3. Provide the specified sizes of coarse aggregate for the following types of concrete:
  - a. No. 57 for Class A and Class AP concrete;
  - b. No. 357 for massive Class A concrete;
  - c. No. 57, No. 67, or No. 357 for Class C concrete;
  - d. No. 57 or No. 67 for Class AA concrete.

## 2.05 ADMIXTURES

- A. Provide air entraining admixtures in accordance with AASHTO M 154 and ASTM C 260.
- B. Provide chemical admixtures in accordance with AASHTO M 194 for the type of admixture supplied. Admixtures certified by manufacturer to be compatible with other admixtures and to contain not more than 0.1 percent water-soluble chloride ions by mass of cementitious material.
  1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
  2. Retarding Admixture: ASTM C 494/C 494M, Type B.
  3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
  4. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
  5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
  6. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.
- C. Color Pigment: ASTM C 979, synthetic mineral-oxide pigments or colored water-reducing admixtures; color stable, free of carbon black, nonfading, and resistant to lime and other alkalis.
  1. Color: As indicated on Drawings.

## 2.06 FORMS

- A. Form Materials: Plywood, metal, metal-framed plywood, or other approved panel-type materials to provide full-depth, continuous, straight, and smooth exposed surfaces.
- B. Use flexible or uniformly curved forms for curves with a radius of 100 feet or less. Do not use notched and bent forms.
- C. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and that will not impair subsequent treatments of concrete surfaces.

## 2.07 STEEL REINFORCEMENT

- A. Bar Steel Reinforcement – Billet Steel
  1. Provide plain or deformed billet steel bars for concrete reinforcement and dowels in accordance with AASHTO M 31, Grade 60, except provide deformed billet steel bars for bent tie bars used in concrete paving in accordance with AASHTO M 31, Grade 40.
- B. Welded Steel Wire Fabric

1. Provide cold drawn steel wire fabric for concrete reinforcement in accordance with AASHTO M 55 or AASHTO M 221.
  2. Provide reinforcing fabric in flat sheets or rolls. Straighten bent or distorted materials before use. Ensure the fabric is free of excessive rust, scale, or coating that may impair the concrete bond.
- C. Cold Drawn Steel Wire
1. Provide cold drawn steel wire, in accordance with AASHTO M 32, for spiral ties and other reinforcing shown on the Plans as "W" (Wire) sizes.
- D. Epoxy Coated Reinforcing Bars
1. Provide epoxy coated (an electro-statically applied organic coating) reinforcing bars and epoxy coating material in accordance with AASHTO M 285, except the following:
    - a. Provide reinforcing steel bars in accordance with Bar Steel Reinforcement – Billet Steel.
    - b. Provide finished epoxy coating in a color and tone that easily gives visual indications of damage or corrosion staining.
- E. Tie Bars
1. ASTM A 615, Grade 60, deformed.
- F. Hook Bolts
1. ASTM A 307, Grade A, internally and externally threaded. Design hook-bolt joint assembly to hold coupling against paving form and in position during concreting operations, and to permit removal without damage to concrete or hook bolt.
- G. Bar Supports
1. Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars, welded wire reinforcement, and dowels in place. Manufacture bar supports according to CRSI's "Manual of Standard Practice" from steel wire, plastic, or precast concrete of greater compressive strength than concrete specified, and as follows:
    - a. Equip wire bar supports with sand plates or horizontal runners where base material will not support chair legs.
    - b. For epoxy-coated reinforcement, use epoxy-coated or other dielectric-polymer-coated wire bar supports.
- 2.08 FIBER REINFORCEMENT
- A. Polypropylene fibers shall be 100 percent polypropylene, collated, fibrillated fibers manufactured to graduated lengths of equal proportions for secondary reinforcement. Polypropylene fibers shall be in accordance with ASTM C 1116 for Type III.
  - B. Steel fibers shall be in accordance with ASTM A 820, for Type II, cut-sheet steel. Provide steel fibers with an aspect ratio of 30:60 and from 1-1/2 to 2 inches long.
- 2.09 CURING MATERIALS
- A. Absorptive Cover: AASHTO M 182, Class 3, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. dry or cotton mats.
  - B. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.
  - C. Water: Potable.
  - D. Evaporation Retarder: Waterborne, monomolecular, film forming, manufactured for application to fresh concrete.

- E. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, dissipating.
- F. White, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 2, Class B, dissipating.

#### 2.10 RELATED MATERIALS

- A. Slip-Resistive Aggregate Finish: Factory-graded, packaged, rustproof, nonglazing, abrasive aggregate of fused aluminum-oxide granules or crushed emery aggregate containing not less than 50 percent aluminum oxide and not less than 20 percent ferric oxide; unaffected by freezing, moisture, and cleaning materials.
- B. Bonding Agent: ASTM C 1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene.
- C. Epoxy Bonding Adhesive: ASTM C 881, two-component epoxy resin capable of humid curing and bonding to damp surfaces; of class suitable for application temperature, of grade complying with requirements, and of the following types:
  - 1. Types IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.

#### 2.11 DETECTABLE WARNING MATERIALS

- A. Detectable Warning Stamp: Semi-rigid polyurethane mats with formed underside capable of imprinting detectable warning pattern on plastic concrete; perforated with a vent hole at each dome.
  - 1. Size of Stamp: One piece matching detectable warning area shown on Drawings.
- B. Liquid Release Agent: Manufacturer's standard, clear, evaporating formulation designed to facilitate release of stamp mats.

### PART 3 EXECUTION

#### 3.01 ADOPTED PLACEMENT REQUIREMENTS

- A. The placement of RIGID PAVING shall comply with the Oklahoma Department of Transportation's 2009 Specifications.

#### 3.02 EARTHWORK AND BASE COURSE

- A. Perform earthwork according to 31 2300 Excavation and Fill.
- B. Provide base course according to 32 1100 Base Courses.

#### 3.03 EDGE FORMS AND SCREED CONSTRUCTION

- A. Set, brace, and secure edge forms, bulkheads, and intermediate screed guides to required lines, grades, and elevations. Install forms to allow continuous progress of work and so forms can remain in place at least 24 hours after concrete placement.
- B. Clean forms after each use and coat with form-release agent to ensure separation from concrete without damage.

#### 3.04 STEEL REINFORCEMENT

- A. General: Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.
- B. Clean reinforcement of loose rust and mill scale, earth, ice, or other bond-reducing materials.
- C. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement. Maintain minimum cover to reinforcement.
- D. Install welded wire reinforcement in lengths as long as practicable. Lap adjoining pieces at least one full mesh, and lace splices with wire. Offset laps of adjoining widths to prevent continuous laps in either direction.



- E. Zinc-Coated Reinforcement: Use galvanized-steel wire ties to fasten zinc-coated reinforcement. Repair cut and damaged zinc coatings with zinc repair material.
- F. Epoxy-Coated Reinforcement: Use epoxy-coated steel wire ties to fasten epoxy-coated reinforcement. Repair cut and damaged epoxy coatings with epoxy repair coating according to ASTM D 3963.
- G. Install fabricated bar mats in lengths as long as practicable. Handle units to keep them flat and free of distortions. Straighten bends, kinks, and other irregularities, or replace units as required before placement. Set mats for a minimum 2-inch overlap of adjacent mats.

### 3.05 JOINTS

- A. General: Form construction, isolation, and contraction joints and tool edges true to line, with faces perpendicular to surface plane of concrete. Construct transverse joints at right angles to centerline unless otherwise indicated.
  - 1. When joining existing paving, place transverse joints to align with previously placed joints unless otherwise indicated.
- B. Joint Spacing Requirements
  - 1. Avoid odd-shaped slabs.
  - 2. In parking lots, longitudinal joints shall be parallel to the direction of vehicle travel, and can be made to delineate drive lanes and parking stalls. Transverse joints shall divide the paving lanes into panels.
  - 3. Longitudinal joint spacing shall not exceed 12.5 feet.
  - 4. The maximum transverse joint spacing for drives shall be 24 to 30 times the slab thickness or 15 ft, whichever is less. Divide the length between the concrete being placed into equally spaced joints.
  - 5. Slabs shall be as square as possible. The length of a panel shall not be more than 25% greater than its width.
  - 6. All transverse contraction joints shall be continuous through the curb and have a depth equal to  $\frac{1}{4}$  to  $\frac{1}{3}$  the pavement thickness.
  - 7. In isolation joints, the filler shall be full depth and extend through the curb. Isolation joints shall be used to isolate the pavement from light standard foundations, storm sewer inlets, manholes, and buildings.
  - 8. If there is no curb, longitudinal joints shall be tied with deformed tiebars.
  - 9. Offsets at radius points shall be at least 1.5 ft wide. Joint intersection angles less than 60 degrees shall be avoided.
  - 10. Minor adjustments in joint location made by shifting or skewing to meet inlets and manholes is allowable.
  - 11. Place joints to meet drainage structures, if possible.
- C. Construction Joints: Set construction joints at side and end terminations of paving and at locations where paving operations are stopped for more than one-half hour unless paving terminates at isolation joints.
  - 1. Continue steel reinforcement across construction joints unless otherwise indicated. Do not continue reinforcement through sides of paving strips unless otherwise indicated.
  - 2. Provide tie bars at sides of paving strips where indicated.
  - 3. Butt Joints: Use epoxy bonding adhesive at joint locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
  - 4. Keyed Joints: Provide preformed keyway-section forms or bulkhead forms with keys unless otherwise indicated. Embed keys at least 1-1/2 inches into concrete.

5. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or coat with asphalt one-half of dowel length to prevent concrete bonding to one side of joint.
- D. Isolation Joints: Form isolation joints of preformed joint-filler strips abutting concrete curbs, catch basins, manholes, inlets, structures, other fixed objects, and where indicated.
  1. Locate expansion joints at intervals of 50 feet unless otherwise indicated.
  2. Extend joint fillers full width and depth of joint.
  3. Terminate joint filler not less than 1/2 inch or more than 1 inch below finished surface if joint sealant is indicated.
  4. Place top of joint filler flush with finished concrete surface if joint sealant is not indicated.
  5. Furnish joint fillers in one-piece lengths. Where more than one length is required, lace or clip joint-filler sections together.
  6. During concrete placement, protect top edge of joint filler with metal, plastic, or other temporary preformed cap. Remove protective cap after concrete has been placed on both sides of joint.
- E. Contraction Joints: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of the concrete thickness, as follows:
  1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint with grooving tool to a 1/4-inch radius. Repeat grooving of contraction joints after applying surface finishes. Eliminate grooving-tool marks on concrete surfaces.
    - a. Tolerance: Ensure that grooved joints are within 3 inches either way from centers of dowels.
  2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before developing random contraction cracks.
    - a. Tolerance: Ensure that sawed joints are within 3 inches either way from centers of dowels.
  3. Doweled Contraction Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or coat with asphalt one-half of dowel length to prevent concrete bonding to one side of joint.
- F. Edging: After initial floating, tool edges of paving, gutters, curbs, and joints in concrete with an edging tool to a 1/4-inch radius. Repeat tooling of edges after applying surface finishes. Eliminate edging-tool marks on concrete surfaces.

### 3.06 CONCRETE PLACEMENT

- A. Before placing concrete, inspect and complete formwork installation, steel reinforcement, and items to be embedded or cast-in.
- B. Remove snow, ice, or frost from subbase surface and steel reinforcement before placing concrete. Do not place concrete on frozen surfaces.
- C. Moisten subbase to provide a uniform dampened condition at time concrete is placed. Do not place concrete around manholes or other structures until they are at required finish elevation and alignment.
- D. Comply with ACI 301 requirements for measuring, mixing, transporting, and placing concrete.
- E. Do not add water to concrete during delivery or at Project site. Do not add water to fresh concrete after testing.

- F. Deposit and spread concrete in a continuous operation between transverse joints. Do not push or drag concrete into place or use vibrators to move concrete into place.
- G. Consolidate concrete according to ACI 301 by mechanical vibrating equipment supplemented by hand spading, rodding, or tamping.
- H. Screed paving surface with a straightedge and strike off.
- I. Commence initial floating using bull floats or darbies to impart an open-textured and uniform surface plane before excess moisture or bleed water appears on the surface. Do not further disturb concrete surfaces before beginning finishing operations or spreading surface treatments.
- J. Curbs and Gutters: Use design mixture for automatic machine placement. Produce curbs and gutters to required cross section, lines, grades, finish, and jointing.
- K. Slip-Form Paving: Use design mixture for automatic machine placement. Produce paving to required thickness, lines, grades, finish, and jointing.
  - 1. Compact subbase and prepare subgrade of sufficient width to prevent displacement of slip-form paving machine during operations.
- L. Cold-Weather Placement: Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing, or low temperatures. Comply with ACI 306.1 and the following:
  - 1. When air temperature has fallen to or is expected to fall below 40 deg F, uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F and not more than 80 deg F at point of placement.
  - 2. Do not use frozen materials or materials containing ice or snow.
  - 3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in design mixtures.
- M. Hot-Weather Placement: Comply with ACI 301 and as follows when hot-weather conditions exist:
  - 1. Cool ingredients before mixing to maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated in total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
  - 2. Cover steel reinforcement with water-soaked burlap so steel temperature will not exceed ambient air temperature immediately before embedding in concrete.
  - 3. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.

### 3.07 FLOAT FINISHING

- A. General: Do not add water to concrete surfaces during finishing operations.
- B. Float Finish: Begin the second floating operation when bleed-water sheen has disappeared and concrete surface has stiffened sufficiently to permit operations. Float surface with power-driven floats or by hand floating if area is small or inaccessible to power units. Finish surfaces to true planes. Cut down high spots and fill low spots. Refloat surface immediately to uniform granular texture.
  - 1. Burlap Finish: Drag a seamless strip of damp burlap across float-finished concrete, perpendicular to line of traffic, to provide a uniform, gritty texture.

2. Medium-to-Fine-Textured Broom Finish: Draw a soft-bristle broom across float-finished concrete surface perpendicular to line of traffic to provide a uniform, fine-line texture.
3. Medium-to-Coarse-Textured Broom Finish: Provide a coarse finish by striating float-finished concrete surface 1/16 to 1/8 inch deep with a stiff-bristled broom, perpendicular to line of traffic.

### 3.08 CONCRETE PROTECTION AND CURING

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.
- B. Comply with ACI 306.1 for cold-weather protection.
- C. Evaporation Retarder: Apply evaporation retarder to concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete but before float finishing.
- D. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.
- E. Curing Methods: Cure concrete by moisture curing, moisture-retaining-cover curing, curing compound or a combination of these as follows:
  1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
    - a. Water.
    - b. Continuous water-fog spray.
    - c. Absorptive cover, water saturated and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.
  2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover, placed in widest practicable width, with sides and ends lapped at least 12 inches and sealed by waterproof tape or adhesive. Immediately repair any holes or tears occurring during installation or curing period using cover material and waterproof tape.
- F. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas that have been subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating, and repair damage during curing period.

### 3.09 PAVING TOLERANCES

- A. Comply with tolerances in Oklahoma Department of Transportation's 2009 Specifications and as follows:
  1. Elevation: 1/2 inch.
  2. Thickness: Plus 3/8 inch, minus 1/4 inch.
  3. Surface: Gap below 10-foot unleveled straightedge not to exceed 1/4 inch.
  4. Alignment of tie-bar end relative to line perpendicular to paving edge: 1/2 inch per 12 inches of tie bar.
  5. Lateral Alignment and Spacing of Dowels: 1 inch.
  6. Vertical alignment of dowels: 1/4 inch.
  7. Joint Spacing: 3 inches.
  8. Contraction Joint Depth: Plus 1/4 inch, no minus.
  9. Joint Width: Plus 1/8 inch, no minus.

## 3.10 PAVEMENT MARKING

- A. Allow concrete paving to cure for a minimum of 28 days and be dry before starting pavement marking.
- B. Sweep and clean surface to eliminate loose material and dust.
- C. Apply paint with mechanical equipment to produce markings of dimensions indicated with uniform, straight edges. Apply at manufacturer's recommended rates to provide a minimum wet film thickness of 15 mils.

## 3.11 FIELD QUALITY CONTROL

- A. Engage a qualified testing agency to perform tests and inspections.
- B. Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:
  - 1. Testing Frequency:
    - a. Obtain at least one composite sample for each 100 cu.yd. or fraction thereof of each concrete mixture placed each day.
    - b. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
- C. Slump: ASTM C 143; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
- D. Air Content: ASTM C 231, pressure method; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
- E. Concrete Temperature: ASTM C 1064; one test hourly when air temperature is 40 deg F and below and when it is 80 deg F and above, and one test for each composite sample.
- F. Compression Test Specimens: ASTM C 31; cast and laboratory cure one set of three standard cylinder specimens for each composite sample.
- G. Compressive-Strength Tests: ASTM C 39; test one specimen at seven days and two specimens at 28 days.
  - 1. A compressive-strength test shall be the average compressive strength from two specimens obtained from same composite sample and tested at 28 days.
- H. Strength of each concrete mixture will be satisfactory if average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.
- I. Test results shall be reported in writing to Engineer, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.
- J. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Engineer but will not be used as sole basis for approval or rejection of concrete.
- K. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Engineer.
- L. Concrete paving will be considered defective if it does not pass tests and inspections.

- M. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
- N. Prepare test and inspection reports.

### 3.12 ENGINEER'S ACCEPTANCE OF PAVEMENT

- A. Pavement slabs with unsound concrete, uncontrolled cracking, malfunctioning sawed joints, spalling, honeycombing, surface irregularities, insufficient thickness, or other deficiencies associated with poor quality pavements may be rejected by Engineer.
- B. Pavement rejected by Engineer shall be removed and replaced at no additional cost to Owner.
- C. When replacing rejected slabs, remove a width of at least one lane and a length of at least 15 ft. If the removal is within 15 ft of any transverse joint, remove the slab to the joint.
- D. If a deficient unit does not warrant removal, as directed by Engineer, the Owner will not pay for the deficient unit.

### 3.13 REPAIRS AND PROTECTION

- A. Remove and replace concrete paving that is broken, damaged, or defective or that does not comply with requirements in this Section. Remove work in complete sections from joint to joint unless otherwise approved by Engineer.
- B. Protect concrete paving from damage. Exclude traffic from paving for at least 14 days after placement. When construction traffic is permitted, maintain paving as clean as possible by removing surface stains and spillage of materials as they occur.
- C. Maintain concrete paving free of stains, discoloration, dirt, and other foreign material. Sweep paving not more than two days before date scheduled for Substantial Completion inspections.

END OF SECTION 32 1300

SECTION 32 1373

CONCRETE PAVING JOINT SEALANTS

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 CONCRETE PAVING JOINT SEALANTS 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 CONCRETE PAVING JOINT SEALANTS shall be included in the bid prices for the work.

1.03. SECTION INCLUDES

- A. Cold-applied joint sealants
- B. Hot-applied joint sealants

1.04. RELATED SECTIONS

- A. 32 13 00 Rigid Paving

1.05. DEFINITIONS

- A. AHJ – Authority Having Jurisdiction
  - 1. City of Tahlequah

1.06. ACTION SUBMITTALS

- A. Product Data: Joint-Sealants.

1.07. INFORMATIONAL SUBMITTALS

- A. Product Certificates: For each type of joint sealant and accessory, from manufacturer.
- B. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for joint sealants.

1.08. DELIVERY, STORAGE, AND HANDLING

1.09. QUALITY ASSURANCE

- A. Source Limitations: Obtain each type of joint sealant from single source from single manufacturer.
- 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. PROJECT CONDITIONS

- A. Do not proceed with installation of joint sealants under the following conditions:
  - 1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F.
  - 2. When joint substrates are wet.
  - 3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.

4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates

PART 2 PRODUCTS

2.01. ADOPTED PRODUCT REQUIREMENTS

- A. All materials and products shall comply with the Oklahoma Department of Transportation's 2009 Specifications.

2.02. MATERIALS

- A. Compatibility: Provide joint sealants, backing materials, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer based on testing and field experience.
- B. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

2.03. COLD-APPLIED JOINT SEALANTS

- A. Single-Component, Nonsag, Silicone Joint Sealant for Concrete: ASTM D 5893, Type NS.
- B. Single-Component, Self-Leveling, Silicone Joint Sealant for Concrete: ASTM D 5893, Type SL.
- C. Multicomponent, Pourable, Traffic-Grade, Urethane Joint Sealant for Concrete: ASTM C 920, Type M, Grade P, Class 25, for Use T.

2.04. HOT-APPLIED JOINT SEALANTS

- A. Hot-Applied, Single-Component Joint Sealant for Concrete: ASTM D 3406.
- B. Hot-Applied, Single-Component Joint Sealant for Concrete and Asphalt: ASTM D 6690, Types I, II, and III.

2.05. JOINT-SEALANT BACKER MATERIALS

- A. General: Provide joint-sealant backer materials that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by joint-sealant manufacturer based on field experience and laboratory testing.
- B. Round Backer Rods for Cold- and Hot-Applied Joint Sealants: ASTM D 5249, Type 1, of diameter and density required to control sealant depth and prevent bottom-side adhesion of sealant.
- C. Round Backer Rods for Cold-Applied Joint Sealants: ASTM D 5249, Type 3, of diameter and density required to control joint-sealant depth and prevent bottom-side adhesion of sealant.
- D. Backer Strips for Cold- and Hot-Applied Joint Sealants: ASTM D 5249; Type 2; of thickness and width required to control joint-sealant depth, prevent bottom-side adhesion of sealant, and fill remainder of joint opening under sealant.

2.06. PRIMERS

- A. Primers: Product recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

PART 3 EXECUTION

3.01. EXAMINATION

- A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.



3.02. PREPARATION

- A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions.
- B. Joint Priming: Prime joint substrates where indicated or where recommended in writing by joint-sealant manufacturer, based on preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

3.03. INSTALLATION OF JOINT SEALANTS

- A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated unless more stringent requirements apply.
- B. Joint-Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.
- C. Install joint-sealant backings of kind indicated to support joint sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
  - 1. Do not leave gaps between ends of joint-sealant backings.
  - 2. Do not stretch, twist, puncture, or tear joint-sealant backings.
  - 3. Remove absorbent joint-sealant backings that have become wet before sealant application and replace them with dry materials.
- D. Install joint sealants using proven techniques that comply with the following and at the same time backings are installed:
  - 1. Place joint sealants so they directly contact and fully wet joint substrates.
  - 2. Completely fill recesses in each joint configuration.
  - 3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.
- E. Tooling of Non-sag Joint Sealants: Immediately after joint-sealant application and before skinning or curing begins, tool sealants according to the following requirements to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint:
  - 1. Remove excess joint sealant from surfaces adjacent to joints.
  - 2. Use tooling agents that are approved in writing by joint-sealant manufacturer and that do not discolor sealants or adjacent surfaces.
- F. Provide joint configuration to comply with joint-sealant manufacturer's written instructions unless otherwise indicated.

3.04. CLEANING

- A. Clean off excess joint sealant or sealant smears adjacent to joints as the Work progresses, by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.05. PROTECTION

- A. Protect joint sealants, during and after curing period, from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately and replace with joint sealant so installations in repaired areas are indistinguishable from the original work.

3.06. PAVEMENT JOINT SEALANT SCHEDULE

- A. Joint-Sealant Application: Joints within cement concrete pavement.
  - 1. Joint Location:
    - a. Expansion and isolation joints in cast-in-place concrete pavement.
    - b. Contraction joints in cast-in-place concrete slabs.
    - c. Other joints as indicated.
  - 2. Silicone Joint Sealant for Concrete: Single component, non-sag; Single component, self-leveling.
  - 3. Urethane Joint Sealant for Concrete: Multicomponent, pourable, traffic-grade.
  - 4. Hot-Applied Joint Sealant for Concrete: Single component.
- B. Joint-Sealant Application: Joints between cement concrete and asphalt pavement.
  - 1. Joint Location:
    - a. Joints between concrete and asphalt pavement.
    - b. Joints between concrete curbs and asphalt pavement.
    - c. Other joints as indicated.
  - 2. Hot-Applied Joint Sealant for Concrete and Asphalt: Single component.

END OF SECTION 32 1373

## SECTION 32 1613

## CURBS AND GUTTERS

## 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 CURBS AND GUTTERS 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 CURBS AND GUTTERS shall be included in the bid prices for the work.

## 1.03 SECTION INCLUDES

- A. Cast-In-Place Concrete Curb and Gutters

## 1.04 RELATED SECTIONS

- A. 31 2300 Excavation and Fill
- B. 31 2500 Erosion and Sedimentation Controls
- C. 32 1300 Rigid Paving
- D. 32 1373 Concrete Paving Joint Sealants

## 1.05 DEFINITIONS

- A. AHJ – Authority Having Jurisdiction
  - 1. City of Tahlequah

## 1.06 ACTION SUBMITTALS

- A. Design Mixtures: For each concrete paving mixture. Include alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

## 1.07 INFORMATIONAL SUBMITTALS

- A. Material Certificates: For the following, from manufacturer:
  - 1. Cementitious materials.
  - 2. Steel reinforcement and reinforcement accessories.
  - 3. Applied finish materials.
  - 4. Bonding agent or epoxy adhesive.
  - 5. Joint fillers.
- B. Material Test Reports: For each of the following:
  - 1. Aggregates. Include service-record data indicating absence of deleterious expansion of concrete due to alkali-aggregate reactivity.

## 1.08 QUALITY ASSURANCE

- A. Ready-Mix-Concrete Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94 requirements for production facilities and equipment.

1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities" (Quality Control Manual - Section 3, "Plant Certification Checklist").
  - B. Concrete Testing Service: Engage a qualified testing agency to perform material evaluation tests and to design concrete mixtures.
  - C. ACI Publications: Comply with ACI 301 unless otherwise indicated.
  - D. 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.
    2. Review methods and procedures related to concrete paving, including but not limited to, the following:
      - a. Concrete mixture design.
      - b. Quality control of concrete materials and concrete paving construction practices.
    3. Require representatives of each entity directly concerned with concrete paving to attend, including the following:
      - a. Contractor's superintendent.
      - b. Independent testing agency responsible for concrete design mixtures.
      - c. Ready-mix concrete manufacturer.
      - d. Concrete paving subcontractor.
  - E. 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.
- 1.09 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 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.

## 1.12 PROJECT CONDITIONS

## A. TRAFFIC

1. A Work Zone Permit must be obtained 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.

## PART 2 PRODUCTS

## 2.01 ADOPTED PRODUCT REQUIREMENTS

- A. All materials and products shall comply with the Oklahoma Department of Transportation's 2009 Specifications.

## 2.02 CONCRETE

- A. Class A PC Concrete (4,000 psi at 28 days, air entrained) shall be used for concrete curbs and gutters.

## 2.03 FORMS

- A. Form Materials: Plywood, metal, metal-framed plywood, or other approved panel-type materials to provide full-depth, continuous, straight, and smooth exposed surfaces.
- B. Use flexible or uniformly curved forms for curves with a radius of 100 feet or less. Do not use notched and bent forms.
- C. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and that will not impair subsequent treatments of concrete surfaces.

## 2.04 STEEL REINFORCEMENT

## A. Bar Steel Reinforcement – Billet Steel

1. Provide plain or deformed billet steel bars for concrete reinforcement and dowels in accordance with AASHTO M 31, Grade 60, except provide deformed billet steel bars for bent tie bars used in concrete paving in accordance with AASHTO M 31, Grade 40.

## B. Welded Steel Wire Fabric

1. Provide cold drawn steel wire fabric for concrete reinforcement in accordance with AASHTO M 55 or AASHTO M 221.
2. Provide reinforcing fabric in flat sheets or rolls. Straighten bent or distorted materials before use. Ensure the fabric is free of excessive rust, scale, or coating that may impair the concrete bond.

- C. Cold Drawn Steel Wire
  - 1. Provide cold drawn steel wire, in accordance with AASHTO M 32, for spiral ties and other reinforcing shown on the Plans as "W" (Wire) sizes.
- D. Epoxy Coated Reinforcing Bars
  - 1. Provide epoxy coated (an electro-statically applied organic coating) reinforcing bars and epoxy coating material in accordance with AASHTO M 285, except the following:
    - a. Provide reinforcing steel bars in accordance with Bar Steel Reinforcement – Billet Steel.
    - b. Provide finished epoxy coating in a color and tone that easily gives visual indications of damage or corrosion staining.
- E. Tie Bars
  - 1. ASTM A 615, Grade 60, deformed.
- F. Hook Bolts
  - 1. ASTM A 307, Grade A, internally and externally threaded. Design hook-bolt joint assembly to hold coupling against paving form and in position during concreting operations, and to permit removal without damage to concrete or hook bolt.
- G. Bar Supports
  - 1. Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars, welded wire reinforcement, and dowels in place. Manufacture bar supports according to CRSI's "Manual of Standard Practice" from steel wire, plastic, or precast concrete of greater compressive strength than concrete specified, and as follows:
    - a. Equip wire bar supports with sand plates or horizontal runners where base material will not support chair legs.
    - b. For epoxy-coated reinforcement, use epoxy-coated or other dielectric-polymer-coated wire bar supports.

## 2.05 CURING MATERIALS

- A. Absorptive Cover: AASHTO M 182, Class 3, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. dry or cotton mats.
- B. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.
- C. Water: Potable.
- D. Evaporation Retarder: Waterborne, monomolecular, film forming, manufactured for application to fresh concrete.
- E. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, dissipating.
- F. White, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 2, Class B, dissipating.

## PART 3 EXECUTION

### 3.01 ADOPTED PLACEMENT REQUIREMENTS

- A. The placement of CONCRETE CURBS AND GUTTERS shall comply with the Oklahoma Department of Transportation's 2009 Specifications.

### 3.02 EARTHWORK AND BASE COURSE

- A. Perform earthwork according to 31 2300 Excavation and Fill.
- B. Provide base course according to 32 1100 Base Courses.

## 3.03 JOINTS

- A. Expansion Joints - Set 1/2 inch expansion joints at maximum 100 ft spacing using 1/2 inch by 4-inch pre-molded expansion joint material.
- B. Contraction Joints – Set contraction joints at 15 ft to 20 ft spacing.
- C. Fill all joints to surface with silicone sealant.

## 3.04 TOLERANCES

- A. Comply with tolerances in Oklahoma Department of Transportation's 2009 Specifications and as follows:
  - 1. Elevation: 3/4 inch.
  - 2. Thickness: Plus 3/8 inch, minus 1/4 inch.
  - 3. Surface: Gap below 10-foot unleveled straightedge not to exceed 1/2 inch.
  - 4. Joint Spacing: 3 inches.
  - 5. Contraction Joint Depth: Plus 1/4 inch, no minus.
  - 6. Joint Width: Plus 1/8 inch, no minus.

## 3.05 FIELD QUALITY CONTROL

- A. Engage a qualified testing agency to perform tests and inspections.
- B. Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:
  - 1. Testing Frequency: Obtain at least one composite sample for each 100 cu.yd. or fraction thereof of each concrete mixture placed each day.
    - a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
- C. Slump: ASTM C 143; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
- D. Air Content: ASTM C 231, pressure method; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
- E. Concrete Temperature: ASTM C 1064; one test hourly when air temperature is 40 deg F and below and when it is 80 deg F and above, and one test for each composite sample.
- F. Compression Test Specimens: ASTM C 31; cast and laboratory cure one set of three standard cylinder specimens for each composite sample.
- G. Compressive-Strength Tests: ASTM C 39; test one specimen at seven days and two specimens at 28 days.
  - 1. A compressive-strength test shall be the average compressive strength from two specimens obtained from same composite sample and tested at 28 days.
- H. Strength of each concrete mixture will be satisfactory if average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.
- I. Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.

- J. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.
- K. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect.
- L. Concrete paving will be considered defective if it does not pass tests and inspections.
- M. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
- N. Prepare test and inspection reports.

3.06 REPAIRS AND PROTECTION

- A. Remove and replace concrete paving that is broken, damaged, or defective or that does not comply with requirements in this Section. Remove work in complete sections from joint to joint unless otherwise approved by Architect.
- B. Protect concrete paving from damage. Exclude traffic from paving for at least 14 days after placement. When construction traffic is permitted, maintain paving as clean as possible by removing surface stains and spillage of materials as they occur.
- C. Maintain concrete paving free of stains, discoloration, dirt, and other foreign material. Sweep paving not more than two days before date scheduled for Substantial Completion inspections.

END OF SECTION 32 1613



## SECTION 33 1000

### WATER 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 WATER 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 WATER UTILITIES shall be included in the bid prices for the work.

##### 1.03 SECTION INCLUDES

- A. Water Utilities Distribution Piping
- B. Water Distribution Equipment
- C. Disinfection of Water Utility Distribution

##### 1.04 RELATED SECTIONS

- A. 31 2300 Excavation and Fill
- B. 31 2500 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. Valves
  - 3. Fire Hydrants
  - 4. Fittings
  - 5. Steel Casing
  - 6. Mechanical Joint Restraints
  - 7. Meters
  - 8. Tracer Wire
  - 9. Manholes, Vaults, and Covers

- 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 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. 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.
- 1.10 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.
- 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 CONDITIONS

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 ADOPTED PRODUCT REQUIREMENTS

- A. All materials and products shall comply with the current edition of the AHJ's Standard Specifications for Construction of Public Improvements.
- B. All materials and products shall comply with the Oklahoma Administrative Code, Title 252, Chapter 625 titled "Public Water Supply Construction Standards".

2.02 PIPE

- A. Ductile Iron Pipe
  1. All pipe shall conform to ANSI Specification A21.51; AWWA Specification C 151, and cement lining in accordance with ANSI Specification A21.4 and AWWA Specification C104. Pipe shall be pressure rated at 350 psi with surge allowance of 100 psi, with pipe thickness to conform with depth of cover and laying conditions.
- B. PVC Pressure Pipe
  1. Materials used to produce the pipe, couplings, and fittings shall be manufactured in accordance with ASTM D-2241, ASTM D-3139, Commercial Standard CS 256, and approved by the National Sanitation Foundation (NSF). The pipe shall be made from clean, virgin, class 12454-B PVC compound conforming to ASTM Resin Specifications D-1784 Type 1, Grade 1. Standard joint length shall be twenty (20) feet. The pipe shall have a minimum Standard Dimension Ratio (SDR) of 21 for class 200 psi. The pipe shall be marked continuously along the length with: Manufacturer's name, nominal size, class pressure rating, PVC 1120, NSF, and identification code. Pipe certification sheets shall be submitted by the manufacturer to show compliance with these specifications as requested by the Engineer.

## 2.03 FITTINGS

- A. Fittings for all pipe 4" or larger shall be standard mechanical joint ductile iron unless otherwise indicated on the plans or noted by details. Ductile Iron Fittings shall conform to ANSI Specifications A21.10 and A21.11 and AWWA Specification C110.
- B. Fittings shall be manufactured in accordance with ANSI Specification A21.4 and AWWA Specification C104 and shall be furnished with a complete set of joint materials for each socket opening.

## 2.04 JOINTS

- A. Mechanical joints shall conform to and be tested in accordance with ANSI Specification A21.11 and AWWA Specification C111.
- B. Restrained joints, when necessitated by the conditions of construction as determined
- C. by the Engineer, shall be used with or without thrust blocking for pipe joints adjacent to fittings, bends and terminal points as well as fitting joints or where utilized in ANSI Specification A21.10 and with A21.11. Joint restraints at Fire Hydrants shall conform to ASTM A307. Specified restraints shall be MIDCO's PERMA-GRIP Mechanical restrained Fittings for Class 200, SDR-21 PVC pipe or Model 1300 Uniflange Pipe restraints by Standard International and MEGALUG joint restraint by EBAA Iron Sales.
- D. Flanged joints shall be used if indicated and shall conform to ANSI Specification A21.15 and AWWA Specification C115 for 125 pounds flange with appropriate bolts per standard ASA specifications for each flange size.

## 2.05 PVC PIPE COUPLINGS

- A. Couplings including bell ends, shall be Ring-Tite, Bell Ring, or Push Joint connected, with fittings furnished by the pipe manufacturer and certified to be suitable for use with the pipe furnished. They shall have a minimum pressure rating of 200 psi and be constructed with deep sockets.

## 2.06 GATE VALVES

- A. Specified gate valves shall be manufactured by AVK. All Gate Valves shall conform to, and be tested in accordance with, the AWWA Standard for Resilient Seated Gate Valves, for water and sewage systems, ANSI/AWWA Specification C509. Valves shall be bubble tight from either direction at a rated design working pressure of 200 psi. Valves shall have a single disc gate with synthetic rubber seat bonded or mechanically attached to the disc; a non-rising stem with 2" AWWA operating nut; opening counter clockwise with "O" ring stern seals. Valve interiors shall have a corrosion resistant coating acceptable for potable water and end connection to fit the pipe or connection to which it is attached. Valves installed with stems placed at depths greater than 36-inches shall have extensions attached to the operating nut as part of the valve component. Each valve shall have the maker's name or initials, pressure rating and year of manufacture cast on the body and shall be furnished complete with set of joint materials for each socket.

## 2.07 TAPPING SLEEVES & VALVES

- A. Tapping sleeves and valves shall be furnished and installed in sizes indicated on connections to existing lines. Tapping sleeves manufactured by SMITH BLAIR or FORD are acceptable. The valves shall be Flange by Mechanical Joint Resilient Seat conforming with applicable provisions of AWWA C509.

## 2.08 VALVE BOXES

- A. Valve boxes shall be of the cast iron extension type with screw or slide adjustment and flared base. The minimum thickness of the metal shall be 3/16 inch. The word WATER shall be cast in the cover. The boxes shall be of such length as will be adapted to the depth of cover over the pipe at the valve location, with bottom section, extension pieces, and

top section as needed. All installed valve boxes shall have a minimum 24"x 24" x 6" thick concrete pad set in place around the valve box for location and protection of the box.

#### 2.09 VALVE & LINE MARKERS

- A. Identification markers shall be of metal fabrication with baked enamel finish noting the OWNER, and type of facility identified. Marker must be at least 80 square inches in area and shall have attachments to be firmly secured to a galvanized rod or post five (5) feet in length for erection at the location needed.

#### 2.10 STEEL PIPE CASING

- A. All steel pipe casing shall be new or used smooth walled, welding steel pipe. The pipe shall be straight, round, and sound with no dents or splits and shall have a standard wall thickness as noted:
  - 1. 18" Pipe ..... 0.375" Minimum Thickness
  - 2. 12" Pipe ..... 0.330" Minimum Thickness
  - 3. 10" Pipe ..... 0.307" Minimum Thickness
  - 4. 8" Pipe ..... 0.277" Minimum Thickness
- B. Pipe shall be delivered in lengths that will best fit the crossings as noted in the plans with a minimum number of joints to be welded. Pipe shall be subject to adequate inspection before, during, and after unloading of pipe at the job site and owner reserves the right to reject any and all pipe not in satisfactory conformance with this specification.
- C. Spacers used between casing and pipe shall be as shown on the plans or as manufactured by RACI Spacers, Inc., Tulsa; M-2 THINsulator by T. D. Williamson, Inc., Tulsa; or APS Casing Spacers by Advance Prod. & Systems, Inc., Lafayette, La.

#### 2.11 FIRE & FLUSHING HYDRANTS

- A. Fire Hydrants shall be AVK and shall conform to and be tested in accordance with the AWWA Standard for Dry-Barrel Fire Hydrants, AWWA C502. Fire Hydrants shall have a 5½-inch compression main valve; 6-inch inlet connection; mechanical joint hub; bury length as specified on the plans; two 2½-inch hose nozzles with TAHLEQUAH (e.g. Mueller 301 threads are Tahlequah threads) THREADS; one 4½-inch pumper nozzle with National Standard threads (CHECK WITH FIRE DEPARTMENT); and Safety Red finish paint above ground line. Flushing Hydrant shall have a 2¼-inch main valve opening with one 2½-inch hose nozzle with TAHLEQUAH THREADS and Safety Red finish paint above ground line. All other specifications shall meet the model requirements and sizes including a 10-year guarantee.

#### 2.12 AIR RELEASE VALVES

- A. Air Release Valves shall be installed at the locations shown on the plans, or as directed by the Engineer. Valve shall be a heavy-duty air release type for 150 psi working pressure, tested to 300 psi, size shown on plans. Body, cover, and baffle shall be cast iron. All internal parts to be stainless steel and/or bronze, and the inside valve coated with rust inhibitor as manufactured by Val-Matic, or an approved equal. Tapping saddle shall be CLOW, twin seal brass saddle and corporation stop with IP threads on outlet piping connection. Valve and piping connection shall be offset from the main line and properly supported to avoid stresses on piping connections. The valve discharge will have open end piping extended with a screened downward facing elbow. Valve to be place in a 24"-meter box and lid with keyed locking mechanism and lettering as approved by the Engineer. Use tapping sleeve Spec.

2.13 TRACER WIRE

- A. 12-gauge tracer wire for the location of PVC water lines shall be required in all trenched areas of construction. The wire shall be attached to the water line and shall be brought to the surface and attached at all valve and meter boxes and any other appurtenance where the wire can be accessed.

2.14 CAST-IN-PLACE CONCRETE

- A. Concrete used for capping channel crossings, road crossings, and thrust blocking shall use as and included by reference herein ACI 301 Concrete Standard Specifications for Concrete for Building in its entirety. All concrete shall be mixed and proportioned as a six sack per yard mix to give good workability with a maximum slump of 4-inches. Concrete shall show a compressive strength of 3500 psi at 28 days when tested. All crossing pours shall be vibrated to reduce voids, honeycombing, or defects. Concrete shall not be placed when the outside air temperature is 40° F or under and falling, except with the approval of the Engineer. All concrete will be placed against undisturbed earth or compacted bedding with all exposed concrete leveled and broomed to achieve a smooth brushed finish and all blocking placed so that pipe and fittings will be accessible for repair or Polyethylene wrapped. Concrete thrust blocking for all pipe fittings shall be provided to sufficiently support the fitting from movement.

PART 3 - EXECUTION

3.01 ADOPTED PLACEMENT REQUIREMENTS

- A. The installation of WATER UTILITIES shall comply with the current edition of the AHJ's Standard Specifications for Construction of Public Improvements.

3.02 PROTECTION OF SERVICE & LATERAL LINES

- A. The location of utility service lines and sewer system lateral lines serving individual properties or other utilities mayor may not be shown on the plans. The CONTRACTOR shall assume that such service lines exist whether or not they are shown on the plans, and it shall be the responsibility of the Contractor to make any necessary changes in the line and/or grade of such services, or to secure the necessary changes therein to be made by the particular utility company involved or other owner thereof. Contractor shall pay the cost of all such revisions whether performed by the Contractor, the utility company, or other owner. In the event of interruption of a utility service as a result of accidental breakage, the Contractor shall promptly notify the owner of the utility, and shall repair or have repaired, in the same manner as necessary changes above provided for, and the Contractor shall do all things necessary to see the restoration of services as promptly as may be reasonably done.

3.03 GENERAL INSTALLATION DETAILS

- A. All material for the project shall be transported, delivered, and stored in a manner to prevent damage to the materials. All damaged, broken or otherwise defective materials will be rejected. Store lubricants, gaskets, jointing materials, and other packaged materials in a dry, protected area in which the manufacturer's name and all other applicable data is plainly marked and visible.
- B. Pipe shall be delivered to the job site by means which will adequately support it, and not subject it to undue stresses. The load shall be so supported that bottom rows of pipe are not damaged by crushing. Pipe shall be stored and protected and shall not be strung along the line of trenching more than two days prior to placing. The trench wall shall be straight with a minimum trench width of eight (8) inches or three (3) times the pipe diameter, whichever is greater, at the grade line with the upper portion of the trench sloped to prevent cave-in or collapse of the trench. The bottom of the trench shall be finished to

provide a uniform bearing for the pipe. Changes in grade in the trench bottom shall be made as shown on the drawings so the pipe will rest on the trench bottom. Where smaller radius of curvature than that recommended by the pipe manufacturer is required to fit the trench bottom, suitable elbows shall be used. Concrete thrust blocking shall be installed at all points of lateral thrust such as tees, elbows, etc., unless restraining connections are used as approved by the Water Department Superintendent. The pipe is to be laid in a trench having a six (6) inch bed of select material prepared before the pipe is lowered into the trench. Backfilling shall be carefully placed to avoid dropping rocks or large clods on the pipe. All backfill within eight (8) inches of the edges of the pipe shall contain no stones. Underground crossover piping shall provide a minimum clearance of twenty-four (24) inches between bottom of existing pipe and top of new pipe unless conditions restrict such clearance.

1. Sand, pea gravel, or crushed stone shall be used as bedding around the pipe, (6) inches below, and twelve (12) inches over the pipe as standard trench bedding. All pipe installed shall have a minimum cover over the top of the pipe of thirty-six (36) inches except where otherwise specified or approved by the Engineer. Where ledge or solid rock is encountered at this depth the pipe may be raised to a minimum depth of thirty (30) inches cover over the top of pipe.
- C. The Contractor shall replace all street and paved surfaces as soon as possible after the pipe has been backfilled. Concrete, asphalt and gravel streets, parking lots, and driveways shall be cut in straight lines a minimum of twelve (12) inches on undisturbed soil from the excavated area and replaced with concrete or material in kind to a minimum thickness of eight (8) inches for streets and six (6) inches for driveways and parking lots. Any pavement or other surfaces of streets, roads, driveways, or walks which are removed or damaged whether or not within the trench or excavated limits shall be replaced or repaired to its original or better condition. Backfill above the specified pipe embedment will require compaction to 95% standard density under these surfaces. All other compaction will be of a character that will be reasonable free from settlement. Wherever trenches have not been properly filled or where settlement has occurred at any time prior to final acceptance of the entire work covered by this contract, to the extent that the top of the backfill is below the original ground surface, such trenches shall be refilled and backfill surface compacted and smoothed to conform to the elevation of the adjacent ground surface.
- D. Trench backfill shall proceed immediately behind the pipe laying to avoid leaving open ditches overnight. Any excavation which remains open overnight shall be properly barricaded and lighted to avoid any injury to persons or property. When work is stopped at night or for any other reason, water tight plugs shall be used to prevent excavated material, water, and small animals from entering the pipe.
- E. Where the Contractor encounters water or the trench soil becomes mucky or in such condition that the bedding cannot be graded properly or support the pipe, then the Contractor shall excavate below the sub-grade sufficiently to allow for a gravel sub-grade bedding to be placed. Pumps shall be installed and operated to allow the water level to be drawn down below the bottom of the pipe. The Contractor shall install trench bracing where protection of his employees and the work is necessary and required by safety codes.

### 3.04 FIELD QUALITY CONTROL

#### A. FLUSHING

1. Waterlines shall be flushed clean prior to start of pressure testing or disinfection processes. The waterlines will be flushed again after disinfection of the lines to rid the lines of excessive chlorinated water. The duration of flushing shall be



adequate to accomplish successful cleaning and removal of excessive chlorine in the lines. The engineer has the authority to require additional flushing of the line to accomplish cleaning or removal of excessive chlorine.

**B. HYDROSTATIC PRESSURE TESTS**

1. All pipelines shall be tested by means of hydrostatic pressure of not less than the pressure rating of the pipe. If test plugs are used, they shall be furnished and installed by the Contractor at his own expense, together with all necessary anchors, braces and other devices necessary to withstand the hydrostatic pressure on such plug or plugs without placing any hydraulic thrust on the pipe line or any part thereof. The Contractor shall be solely responsible for any and all damage to the pipe line and public and private property which might be caused by the failure of such test plugs or supports incidental thereto. The allowable leakage is 10 gallons per inch of pipe diameter per mile of pipe per 24 hours.
2. After the section of line to be tested has been filled with water, the specified test pressure shall be applied by means of a force pump of such design and capacity that such pressure can be applied and maintained for the duration of the test period, which shall be not less than two (2) hours for 24" and smaller pipe; and not less than six (6) hours for 30" and larger diameter pipe.
3. All water supplied to the line after the initial filling thereof shall be metered by means of a tested water meter approved by the Engineer.
4. Any and all leaks on the line or lines constructed under this contract, which appear during the specified hydrostatic test or at any subsequent time before final acceptance of the whole works, shall be located and repaired by and at the expense of the Contractor. All installed pipe shall be listed for leakage in accordance with AWWA Standard Specifications.

**C. DISINFECTION**

1. Upon completion of all construction activities, the Contractor shall disinfect all water mains with a chlorine solution having an active available chlorine concentration of 100 parts per million, maintaining the pipe full of solution and under normal pressure for 24 hours. The residual chlorine solution at the end of the 24-hour disinfecting period shall not be less than 10 ppm. Upon completion, the water mains shall be flushed until the residual chlorine is not greater than 0.4 parts per million. The method of disinfecting the mains shall comply with Oklahoma Department of Environmental Quality Standards. Disinfection must be in accordance with AWWA Standard Specifications and require obtaining safe bacteriological samples on 2 consecutive days before placing the waterline into service. A set of samples shall be collected every 1,200 feet along new waterlines.

**D. GUARANTEE**

1. CONTRACTOR shall guarantee all materials and appurtenances furnished and work performed for a period of one (1) year from the date of substantial completion. CONTRACTOR warrants and guarantees for a period of one (1) year from the date of substantial completion of the system that the completed system is free from all defects due to faulty materials or workmanship and the CONTRACTOR shall promptly make such corrections as may be necessary by reason of such defects, including the repairs of any damage to other parts of the system resulting from such defects or workmanship. The TPWA will give notice of observed defects with reasonable promptness. In the event the Contractor

should fail to make such corrections, the TPWA may do so and charge the Owner/Contractor the costs thereby incurred.

END OF SECTION 33 10 00

## 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 CONDITIONS

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 REQUIREMENTS

- 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-638 (7 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 ( $\pm$ ) 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 ( $2 \frac{1}{3}$ ). 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 ( $3 \frac{1}{2}$  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 CONDITIONS

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 red brass or 80-10-10 bronze, ASTM B-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 CONDITIONS

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 CONDITIONS

##### 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
3/4 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



## **SECTION 33 4613**

### **FOUNDATION DRAINAGE SYSTEM**

#### **PART 1 - GENERAL**

##### **1.1 SUMMARY**

- A. Work required for this section includes foundation drainage system including supplementary items necessary to complete their installation.

##### **1.2 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.
- 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. Show details and installation drawings for interface with drainage pipe system.
- C. Samples:
  - 1. Geotextile Filter Fabric: Two 12 inch squares.
  - 2. Perforated drain pipe:
    - a. Pipe: 12" inch long piece.
    - b. Fittings: One of each.

##### **1.3 COORDINATION**

- A. Coordinate and schedule sequencing with materials trades for concrete walls, foundations, concrete finishing, waterproofing, excavation, and backfilling.

#### **PART 2 - PRODUCTS**

##### **2.1 MATERIALS**

- A. Molded-Sheet Drainage Panels: Refer to Division 07 waterproofing section.
- B. Filter Fabric: Woven or nonwoven geotextile filter fabric of polypropylene or polyester fibers, or combination of both. Flow rates range from 110 to 330 gpm per sq. ft. when tested according to ASTM D 4491.
- C. Perforated Drainage Pipe: ASTM D 2729 Polyvinyl Chloride nominal 4 inch, bell-and-spigot pipe including fittings, cleanouts, etc.

- D. Impervious Fill: Clay, gravel and sand mixture.
- E. Drainage Fill: Washed, evenly graded mixture of crushed stone, or crushed or uncrushed gravel, ASTM D 448, coarse aggregate, Size 57, with 100 percent passing 1-1/2 inch sieve and not more than 5 percent passing No. 8 sieve.

### **PART 3 - EXECUTION**

#### **3.1 EXAMINATION**

- A. Acceptance of Surfaces and Conditions: Examine substrates 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.

#### **3.2 INSTALLATION, GENERAL**

- A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:
  - 1. Respective manufacturer/fabricator's written installation instructions.
  - 2. Accepted submittals.
  - 3. Contract Documents.

#### **3.3 PREPARATION**

- A. General: Comply with manufacturer's instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.

#### **3.4 INSTALLATION, FOUNDATION DRAINAGE SYSTEM**

- A. Molded-Sheet Drainage Panels: Refer to Division 07 waterproofing section.
- B. Bottom Impervious Fill:
  - 1. Place impervious fill material on subgrade adjacent to bottom of footing after concrete footings have been cured and forms removed.
  - 2. Place and compact impervious fill not less than 6 inches deep and 12 inches wide.
- C. Filter Fabric:
  - 1. Cut fabric roll to proper width prior to installation.
  - 2. Include sufficient width to conform to trench perimeter and for minimum six inch top overlap.
  - 3. Lap upstream roll over downstream roll minimum of two feet, to form shingled effect.
  - 4. Ensure fabric continuity as fabric conforms to excavation surface during drainage fill placement and compaction.
  - 5. Following drainage fill placement, fold fabric over aggregate to form longitudinal lap.

6. Place backfill soil over lap at sufficient intervals to maintain lap during subsequent backfilling.
7. Exercise care during fabric installation to prevent natural or fill soils from intermixing with drainage aggregate.

D. Drainage Fill:

1. Place supporting layer of drainage fill over compacted subgrade to compacted depth of not less than 4 inches.
2. After installing drainage piping, add drainage fill to width of at least 6 inches on side away from wall and to top of pipe to perform tests.
3. After satisfactory testing, cover piping to width of at least 6 inches on side away from footing and above top of pipe at least 12 inches.
4. Place drainage fill in layers not exceeding 3 inches in loose depth; compact each layer placed.

E. Drain Pipe: Comply with ASTM D 2321 and as follows:

1. Excavate to proper depths, profiles and lines required for proper drainage.
2. Provide minimum slope of 1 percent (1:100) unless otherwise indicated. Slope to drain.
3. Lay drain pipe solidly bedded in filtering material with bells facing upslope and spigot end inserted fully into adjacent bell.
4. Provide full bearing for each pipe section throughout its length to true grades and alignment, and continuous slope in direction of flow.
5. Lay perforated pipe with perforations down and joints tightly closed in accordance with pipe manufacturer's recommendations.
6. Provide fittings and couplings as required.
7. Joint PVC pipe and fittings according to ASTM D 3034 with elastomeric seal gaskets according to ASTM D 2321.
8. Joint perforated, PVC pipe and fittings according to ASTM D 2729, with loose, bell-and-spigot joints.
9. Provide riser extensions and clean-outs at grade at approximately 100 feet on center. Locate at beginning of pipe run and changes in direction.
10. Set top of clean-outs 1 inch above grade and secure in 12 inch square by 4 inch deep concrete anchor.
11. Extend piping and connect to building storm drainage system or building sump pumps.

### 3.5 FIELD QUALITY CONTROL

- A. Testing: After installing drainage fill to top of pipe, test drain piping with water to ensure free flow before backfilling. Remove obstructions, replace damaged components, and repeat test until results are satisfactory.

### 3.6 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