CITY OF HASTINGS
HASTINGS, NEBRASKA

ADDENDUM NO. 2
8/12/25

WEC UNIT 1 FLY ASH SILO
MECHANICAL CONSTRUCTION
WHELAN ENERGY CENTER, UNIT 1

Contract No. HU 2025-72

- Revised section 4.5.1 of technical specs. Scope of work table was incorrect. Revised Section 4 – Technical Specifications is attached.
- Drawing numbers in section 4.2 were corrected per Addendum 1.

CITY OF HASTINGS

By Brandon Miller

Title Mechanical Engineer

The undersigned bidder hereby certifies that the revision set forth in this addendum have been incorporated in their bid and are a part of the contract documents.

Signed _____

Title _____

Firm _____

Date _____

ALL ISSUED ADDENDUM(S) MUST BE ACKNOWLEDGED
& RETURNED WITH YOUR BID DOCUMENTS

SECTION 4 – Technical Specifications

4.1 Structural Steel:

4.1.1 Scope of Supply:

Contractor shall be responsible for supplying and installing structural steel as indicated on Olsson drawing S100 as auxiliary steel #1, auxiliary steel #2 including infilling existing hole in existing platform grating, and auxiliary steel #3 including platform steel, new grating, ladder, and all hardware. All new structural steel shall meet the following specifications:

Table 1 – General Information		
General		
1	Application	Carbon steel structural steel
2	Installation Requirements	In accordance with the specifications and drawings See General Notes on Olsson Drawing S001
Codes and Standards		
3	Structural steel	Fabricated and erected in accordance to the latest edition of AISC 303 “Code of Standard Practice for Steel Building and Bridges”
4	Welding	All welding shall be performed by Certified/Qualified welders and shall conform to the latest edition of AWS D1.1 “Structural Welding Code – Steel”
Materials		
5	W / WT Shapes	ASMT A992
6	M and S Shapes	ASTM A36
7	HP Shapes	ASTM A572, Grade 50
8	Plates	ASTM A572, Grade 50
9	Angles	ASTM A572, Grade 50
10	C and MC Shapes	ASTM A992
11	HSS Square and Rectangular Tubes	ASTM A500, Grade C, Fy = 50 ksi
12	HSS Rounds	ASTM A500, Grade C, Fy = 50 ksi
13	Pipes	ASTM A53, Grade B, Fy = 35 ksi
14	Anchor Rods	ASTM A1554, Grade 55 with Supplement S1
15	High Strength Bolts	ASTM F3125, Grade 325, Type 1, UON ASTM F3125, Grade 490, Type 1
16	Washers for Hight Strength Bolts	ASTM F436
17	Direct-Tension Indicating Washers	ASTM F959
18	Heavy Hex Nuts	ASTM F563

19	Stick Electrodes	AWS Class E70XX AWS Class E6010 or E6011 (Galv. Surfaces)
Surface Finish		
20	Surface Prep	Surface shall be cleaned in accordance with SSPC-6, Commercial Blast Cleaning
21	Finish	Hot Dip Galvanizing per ASTM 123. Bolts shall be Galvanized by Mechanical Deposit according to ASTM B695, Class 55, Type 1

4.2 Demolition of Existing:

4.2.1 General:

Demolition of existing piping and equipment will be needed to route new pipe provided by UCC. This demolition work will have to be done during the fall outage period since the existing sluicing system will remain in operation until outage. LOTO of existing system will be performed by City of Hastings prior to beginning of demolition work. Care should be taken to prevent damage to parts of plant and equipment that are staying in service.

4.2.2 Equipment to be Demolished:

The following equipment and piping are to be demolished:

- Existing plant ash sluice piping between TP-1, TP-2, and TP-3.
- Elbow at TP-4 to be replaced with new tee.
- Valve ASB-1059 in ash line from Air Heater to be saved and relocated per UCC drawings.
- Demolish all equipment, piping, valves, and hardware necessary for the routing of new piping, valves, and fittings. All other equipment to remain and be Abandoned in Place.

4.2.3 Reference Drawings:

The following drawings show equipment and piping is to be demolished:

- PT-333-01 – Demolition Plan
- PT-333-02 – ASB System Demolition Plan

4.3 Equipment Installation:

4.3.1 General:

Equipment to be installed on the silo, that is provided by UCC and not installed by Silo Erection Contractor, can be installed ahead of outage once the silo has been erected. Erection procedures shall be in accordance with the recommendations of the equipment manufacturers. Equipment shall be checked prior to its installation to ensure that it is in conformance with the manufacturer's drawings. Any discrepancies shall be reported to the Purchaser. If the equipment to be erected by the Contractor is shipped unassembled, the complete assembly of such equipment shall be part of the work included under these specifications. Setting and all other erection work for this equipment shall be performed under this section.

4.3.2 Equipment to be installed:

The equipment to be installed under this contract includes but is not limited to:

- TCH-001 – Telescopic Spout
- FAN-002 – Telescopic Spout Vent Fan and Motor
- FAN-003 – Silo Vent Fan and Motor
- VNT-001 – Ventilation Louver
- VNT-002 – Ventilation Louver
- FLT-001 – Filter Separator including filter cages & filter bags
- VSL-002 – Transfer Hopper
- ME-001 – Mechanical Exhauster A including enclosures
- ME-002 – Mechanical Exhauster B
- FAN-004 – Exhauster Enclosure Vent Fan A
- FAN-005 – Exhauster Enclosure Vent Fan B
- Outlet Plenum and Manhole on Silo Roof
- Bin Outlet Hopper, Fluidizing air system including Fluidizing Elements and Diffuser Stones
- Access Ladder and Platform from Silo Roof to Filter Separator

Installation shall include all accessories and hardware associated with this equipment.

4.3.3 Location Tolerances:

All equipment shall be located within 1/8" of the dimensioned locations indicated on the drawings.

4.3.4 Leveling and Grouting:

The metal bases of all equipment installed under these specifications shall be grouted in place in accordance with the project drawings, equipment manufacturer's instructions and recommendations when available.

Prior to placing of grout, each base shall be set in place over its anchor bolts and shall be carefully aligned in proper position and then brought to accurate level, preferably by means of leveling screws with nuts above and below temporary lugs attached to the edges of the base. Steel shims may be used for leveling small bases, if permission is given by the Purchaser. Such shims shall be of a type that cannot be easily or accidentally dislodged. The use of wood blocking or wood wedges to hold the base in position will not be permitted.

4.3.5 Equipment Checkout:

All equipment shall be cleaned. Rotating machinery shall be lubricated and checked for freedom of movement by hand if possible, and all prerequisite operating conditions shall be established before the application of motive power. Equipment subject to pressure shall be checked for leakage.

4.3.6 Defects:

All defects in erection shall be corrected to the satisfaction of the purchaser. The dismantling and reassembly of Supplier-furnished equipment to remove defective parts, replace parts, or make adjustments shall be included as a part of the work under these specifications.

4.4 Piping Supply:

4.4.1 Piping Scope of Supply:

Scope of supply shall include all piping marked as “GC” or “by others” on UCC drawings. This includes the piping, valves, and fittings from the compressed air tie-in to the purchaser supplied air receiver and from the air receiver to valves, fluidizing system, and filter separator as indicated on the UCC drawings. All piping 2” and smaller shall be field routed. All piping, valves, and fittings shall be compatible with existing plant piping as shown in section 4.5.3.

All other piping shown on UCC drawings is supplied by UCC from tie-in points indicated to

4.4.2 Piping Isometric, Plan, and Section Drawings:

All piping 2” and smaller shall be field routed by the contractor. This includes the Compressed Air (CAA – service air and CAB – instrument air) system piping from existing plant piping to equipment at the fly ash silo.

All UCC piping shall be routed per UCC piping drawings C-55650-05-001 through -008.

4.4.3. Existing Plant Materials:

Existing plant piping materials are shown by system code on the pipeline listing, drawing no. PT-333-05.

4.4.4 Piping Codes and Standards:

Work performed under these specifications shall be done in accordance with the following codes and standards. Unless otherwise specified, the applicable governing edition and addenda to be used for all references to codes or standards specified herein shall be interpreted to be the jurisdictionally approved edition and addenda. If a code or standard is not jurisdictionally mandated, then the current edition and addenda in effect at the date of this document shall apply. These references shall govern the work except where they conflict with the Purchaser’s specifications. In case of conflict, the latter shall govern to the extent of such difference:

Work	**In Accordance With**
Materials for piping and application of piping materials	The most current edition of the ASME Code for Pressure Piping, B31.1, Power Piping, including all addenda thereto
Sizes, schedule numbers, and dimensions of carbon steel and alloy steel pipe, and stainless steel pipe schedules not covered by ANSI B36.19M	ASME B36.10M
Wall thickness tolerances for carbon steel and alloy steel pipe	ASTM A530
Butt weld fitting manufacturing standard	ASME B16.9 and ASME B16.28

Work	In Accordance With
Socket-weld and threaded forged steel fittings manufacturing standard and minimum pressure class ratings	ASME B16.11
Carbon steel flanged fittings	ASME B16.5
Welding adapters	Paragraph 104.3 of ANSI/ASME B31.1
Socket weld fittings for use with stainless steel tubing	ASME B16.11
Braze joint fittings for use with copper tubing	ASME B16.22
Steel flange construction requirements	ASME B16.5
Compressed fiber gaskets and rubber gaskets	ASME B16.21
Ring joint gaskets	ASME B16.20
Flange bolting requirements - alloy steel bolting	ASME B16.5
Flange bolting requirements - carbon steel bolting	ASME B16.1
Carbon steel bolting dimensional standards	ANSI B18.2.1 and ANSI/ASME B18.2.2

4.4.5 <u>Piping Materials:</u>

All pipe shall be in accordance with the applicable codes and standards as designated in this section and the attachments thereto. Contractor shall submit from material supplier factory tests showing conformance to specified standards. Material substitutions shall not be made without written approval by the purchaser. The following materials shall be used:

Component	Material
Steel pipe	
Carbon steel	CAA-A system: ASTM A53 GR B
Carbon steel flange material standards, ANSI Pressure Classes 150 and 300	ASTM A181/A181M or ASTM A105/A105M
Carbon steel flange material standards, ANSI Pressure Class 600 and higher	ASTM A105/A105M
Carbon and alloy steel butt weld fitting material standards	ASTM A234/A234M
Carbon steel bolting materials	ASTM A307 Grade B, ASTM A563 Grade A Heavy Hex Nuts

Component	Material
Alloy steel bolting materials	ASTM A193 Grade B7, ASTM A194 Grade 2H Heavy Hex Nuts

4.4.6 Steel Pipe:

Steel piping shall be provided per the standards in sections 4.4.5.

4.4.7 Valves:

Valves shall be provided per the standards in sections 4.5.4, and the pipeline list PT-333-05. Airline isolation valves shall be ball valves.

4.4.8 Pipe Fittings:

Contractor shall supply all fittings to provide a complete installation. Unless otherwise indicated on the attachment(s), steel fittings used shall be socket welded fittings and threaded steel fittings as specified in the drawings. Forged steel fittings shall be used for socket-welded and threaded connections. Socket-welded and threaded fittings shall conform to the applicable standards listed in 4.4.4. Metal thicknesses of fittings shall be adequate to provide actual bursting strengths equal to or greater than those of the pipe with which they are to be used. Minimum pressure class rating of socket-welded and threaded fittings shall be in accordance with the applicable standard listed in 4.4.4.

4.4.9 Piping Flanges:

Flanges shall conform to applicable standards indicated in 4.4.4. Unless otherwise specified, flanges shall be as follows:

For the case where the Contractor determines flanges to be furnished based on attached drawings or based on the Contractor's overall design, flanges mating with flanges on piping, valves, and equipment shall be of sizes, drillings, and facings that match all connecting flanges. Flange class ratings shall be adequate to meet the design pressure and temperature specified in the attachment(s) for the piping with which they are used. Flange materials shall be equivalent to the pipe with which they are used.

4.4.10 Gaskets:

Gaskets shall be furnished as indicated on the attachment(s). Gaskets shall be red rubber (SBR) or neoprene. Unless otherwise specified full face type gaskets shall be used with flat face flanges and raised face ring type gaskets shall be used with raised face flanges. Gaskets containing asbestos are not acceptable.

4.4.11 Flange Bolting:

Flange bolting shall be provided by UCC with all UCC supplied flanges.

Alloy steel bolting shall be used for joining all steel flanges having a design pressure rating of Class 150 or greater, except steel slip-on flanges.

Carbon steel bolting shall be used for joining all other flanges including steel slip-on flanges.

Bolting for bolt diameters 1-3/4 inches (45 mm) and larger shall consist of threaded studs and two nuts. Bolting for bolt diameters less than 1-3/4 inches (45 mm) may be threaded studs and nuts or bolts and nuts. Bolts and nuts shall be heavy hexagonal heads conforming to the standards listed in 4.4.5.

4.4.12 Unions:

All piping unions shall be of the ground joint type constructed of materials equivalent in alloy composition and strength to other fittings in the piping systems in which they are installed. Union pressure classes and end connections shall be the same as the fittings in the piping systems in which they are installed.

4.5 Piping Erection:

4.5.1 Piping Erection Scope of Work:

The work shall include erection of all piping, fittings, valves, supports, and piping specialties, as called for on the drawings and specifications, and by the codes and standards. This includes all materials furnished by the conveyor supplier and those furnished by The Contractor. The Contractor shall furnish all required materials and perform all related work for completion of the work included under these specifications unless specifically stated that item is Purchaser supplied.

Scope of Work	**Scope of Work for this package includes the following items:**		
System Name	**System Code**	**Category ***	**Material Supply**
Ash Conveyor Piping	ASB	2	By Purchaser
Service Air Piping	CAA	2	By Contractor
Vent Piping	ASB	2	By Purchaser
*Categories are as follows: 1. Hot (300°F and above operating temperature) piping system. 2. Cold (below 300°F operating temperature) piping system.			
The systems listed above include the following:			
Above grade piping	Yes		
Below grade piping	No		
Scope of Work includes the following services and materials:			
Routing of miscellaneous 2 inch (50 mm) and smaller pipe, fittings, and valves	Yes (Field routed by Contractor. Purchaser to approve of routing. Suggested routing and tie-in points shown on drawings)		
Pressure testing of piping erected under these specifications	Yes-Pneumatic Leak Test		
Hydrostatic testing of the following piping systems erected by others:			
Furnish water for hydrotest	N/A		
Furnish chemicals for treatment of hydrotest water	No		
Furnish and install piping insulation and lagging	Yes		

Provide penetrations of structures for piping	Yes

4.5.2 Piping Erection Codes and Standards:

Work performed under these specifications shall be done in accordance with the following codes and standards. Unless otherwise specified, the applicable governing edition and addenda to be used for all references to codes or standards specified herein shall be interpreted to be the jurisdictionally approved edition and addenda. If a code or standard is not jurisdictionally mandated, then the current edition and addenda in effect at the date of this document shall apply. These references shall govern the work except where they conflict with the Purchaser's specifications. In case of conflict, the latter shall govern to the extent of such difference:

Work	In Accordance With
Piping Erection	ASME B31.1 Code for Pressure Piping ASME Boiler and Pressure Vessel Code

4.5.3 Piping Erection Execution:

All piping, valves, and fittings shall be erected in accordance with the requirements of this section and notes contained on UCC drawings C-55650-05-001 and -002. Any piping installation not specified herein shall be done in accordance with good engineering practice.

The drawings indicate the dimensions of the major lines. These dimensions are subject to change to accommodate the equipment, valves, and fittings actually furnished and the variations in equipment as actually installed. If the equipment, valves, fittings, and other components of the piping systems actually furnished differ in dimensions from those indicated, the piping systems shall be altered as required to accommodate these changes. If, due to some unforeseen circumstance, the installation of the piping as indicated would result in an interference, the modifications or corrections required to install the piping free from interferences shall be made.

A field check of all connections to equipment and existing pipe, valves, or fittings for location, size, butt weld end preparation or flange drilling and facing shall be made prior to erecting interconnecting piping.

Allowances in fit-up and modifications to piping spools shall be made as required prior to completion of field welds and hoisting pipe spools into place as applicable.

Pipe, fittings, valves, and accessories shall be handled in a manner that will ensure installation in a sound, undamaged condition. Equipment, tools, and methods used in unloading, reloading, hauling, and laying pipe and fittings shall be such that the pipe and fittings are not damaged.

Particular care shall be taken to prevent damage to protective coatings. Slings shall be nonabrasive and located between the ends of each pipe section when lifting. Bare wire rope slings or the use of hooks to lift pipe will not be permitted.

4.5.4 Welding:

Field welding shall be in accordance with the requirements of the General Welding Section 4.7 of this specification. All piping welds and piping support welds will be visually inspected for cracks, undercutting, lack of fusion, incomplete penetration (if possible), surface porosity.

4.5.5 Piping Routing:

Piping routing and tie-in points shall be done according to the provided drawings. Special attention shall be given to securing a neat appearance. All piping shall be installed perpendicular or parallel to the major equipment, building structure, and floor levels except in special cases consented to by the Purchaser.
Pipe routing shall allow unobstructed maintenance of existing plant equipment, including maintenance pull spaces shown on the drawings. Pipe shall not interfere with operation of existing plant equipment including overhead cranes and access doors.

Valves shall be installed in such a manner that they can be operated from the main operating floors or platforms without the use of ladders or special operating devices where able.

Sketches of the proposed routing of all piping not located on the drawings shall be submitted to the Purchaser. The Purchaser's acceptance of all routings shall be obtained before the piping is erected. Approximate tie-in points are shown on the drawings but final location should be determined during routing of pipe.

4.5.6 Piping in Existing Areas:

Before installation of piping in existing areas, the routings of new piping to be installed shall be walked down to verify that the piping, insulation, and supports can be installed as designed without interference. If the piping as designed would interfere with existing facilities, the pipe routing shall be reviewed with the Purchaser and shall then be altered or existing piping shall be relocated. All pipe routings shall be subject to acceptance by the Purchaser.

4.5.7 Thermal Expansion:

All piping shall be installed so that excessive or destructive expansion forces will not exist either in the cold condition or under conditions of maximum temperature.

4.5.8 Piping Supports:

All Pipe supports shall be installed by Contractor per the project drawings where specified. Pipe supports or hangers shall be provided and installed for all field routed piping. In all cases Contractor shall provide support to limit unsupported lengths of pipe to that suggested in ASME B31.1 Table 121.5. Support materials shall be installed level and square to piping and existing structure to be attached to. The use of standard support assemblies is allowed and recommended. Pipe supports shall not allow for excessive sag in piping or create excessive deformation due to misalignment.

Welding of pipe supports to structural steel forming a part of the building supporting structure shall be in accordance with the following. Welds shall run parallel with the length of the beam and all welding of lugs or attachments shall be staggered on the sides, with cooling allowed between subsequent weld bead deposits. Loaded beams shall be unloaded or properly shored prior to field welding if 10 percent or more of the flange width or web depth should be heated to over 500° F (260° C) at any one time.

Pipe supports shall utilize standard support materials when possible. Support designs shall minimize required field welding. "Bolt-on" materials such as beam clamps, pipe clamps, and threaded hanger rods are encouraged.

4.5.9 Cutting and Drilling Structures:

All necessary drilling, cutting, and patching of structures required for proper installation of piping or bolts shall be done, but only as indicated on the drawings, specified herein, or with the consent of the Purchaser. Any penetrations provided by others are shown on the drawings.

Holes cut in walls and roofs shall be complete with sleeves, collars, panel edge closures, reinforcing, flashing, and other accessories in accordance with the details indicated on the drawings. Hole size shall be drilled large enough to allow for expected expansion and contraction.

Field cut holes through walls or roof shall be done with proper cutting equipment, leaving a clean finished edge. Burning or other nonexact methods shall not be used.

Holes shall not be cut in structural steel. Wherever possible, clamps shall be used for attaching erection rigging. Lugs may be welded to structural steel only with the consent of the Purchaser. Upon completion of the work, the lugs shall be removed and the surfaces ground smooth.

Holes cut in grating or floor plate shall be banded and reinforced in accordance with the details indicated on the drawings, if details are provided. If no details are indicated on the drawings, holes cut in floor grating shall be banded with 1/4 inch (6 mm) steel bands or standard weight steel pipe welded to the main carrying bars. The bands shall extend the full depth of the grating and shall project 4 inches (100 mm) above the top of the grating.

If normal grating support is removed by the cutting of holes, the Contractor shall add miscellaneous angles or other steel as required to properly support the grating.

All openings in concrete shall be made by core drilling, saws, or similar clean cutting equipment.

All field cut holes and sleeves shall have adequate provisions to allow for insulation and expansion of piping as required.

Field cut holes through walls or roof shall be performed with proper cutting equipment, leaving a clean finished edge. All holes in walls or roofs shall be complete with sleeves, collars, panel edge closures, reinforcing, flashing, and seals.

4.5.10 Equipment Connections:

When attaching piping to equipment connections, special care shall be taken so that excessive stresses are not transmitted to, and imposed upon, such connections.

In the case of flanged connections, the piping shall be installed and supported so that accurate matching of bolt holes and uniform contact over the entire flange area are obtained prior to the installation of any flange bolts. Bolts shall be carefully tightened to uniformly compress the gaskets and minimize flange stress.

Fit-up of the flanges to equipment connections may be checked after the bolting has been installed at the request of the Project Field Manager. Such bolting shall be removed and replaced and new gaskets installed if requested by the Purchaser.

Final alignment checks and manufacturer representative's acceptance of connection alignment shall only be performed with all travel stops in place and all temporary supports removed. Making up of the welded joints on the conveyor system shall be done in strict accordance with the equipment manufacturer's requirements. It shall be the Contractor's responsibility to determine the manufacturer's requirements from the provided drawings.

After startup, if the connecting piping is found to be exerting excessive strains on the equipment, the piping shall be altered by adjusting the piping supports, cutting and rewelding joints, and removing sections of piping, all as necessary to eliminate the excessive strains.

4.5.11 Valve Installation:

Excessive piping strains and bending moments on valves shall be avoided. Excessive strains and moments will result in distorted valve seats. Valve should be checked for any debris that may prevent operation prior to final installation.

4.5.12 Making Flanged Connections:

The faces of all flanges and gaskets shall be wiped clean when making up flanged joints. The contact faces of all flanges shall meet squarely, and particular care shall be exercised in pulling up flanged joints to prevent overstressing of flanges or flange bolting.

The threads of all bolting shall be painted with a suitable thread lubricant before the joint is made. The lubricant shall be suitable for the operating temperatures involved.

4.5.13 Miscellaneous Small Connections:

All openings for vents, drains, instruments, and other similar connections made after erection of the piping systems shall be drilled. No burning of such openings will be permitted. Connections shall be made in accordance with the details indicated on the drawings. Any burrs remaining on the inside wall of the pipe after drilling shall be removed.

4.5.14 Damage to Machined Surfaces:

Special measures shall be taken to avoid damage to machined surfaces such as flange facings or pipe ends that have been prepared for welding. Any damage to welding ends shall be repaired prior to butting up for welding. If a flange facing is marred, scratched, or damaged to such an extent that, in the opinion of the Purchaser, the flange will be a cause for leakage, such flange shall be repaired or replaced.

When welding to equipment that is in the assembled condition, separate ground leads shall be attached to the equipment, pipes, or components to prevent stray welding currents from arcing the internals of the equipment. Wherever possible, the ground lead shall be 2/0 cable or larger directly and mechanically connected adjacent to the welding area and returned directly to the welding power source.

4.5.15 Penetration Seals:

Penetration seals shall be furnished and installed on piping that passes through walls and floors where indicated on the drawings.

Seals shall be designed for any expected axial and lateral movements.

For penetrations through corrugated steel building panels utilize the following:

Sealing method shall utilize EPDM rubber flashing boot with formable metal strip for molding to existing panel profile. DEKS Dektite roof flashing components or approved equal shall be utilized for wall penetrations though steel building panels. EPDM flashing boot shall be correct size for piping and shall provide tight fit around pipe diameter. Silicone shall be applied at the pipe and the building panel interface according to the manufacturer's recommendations.

For penetrations through concrete or masonry walls utilize the following:

Hole shall be core drilled slightly larger than pipe diameter to allow for pipe movement. Gaps shall be sealed with expanding insulation.

Seals shall be installed and sealed in accordance with the manufacturer's installation instructions.

4.5.15 Pressure Testing:

Contractor will be responsible for the tests listed below of newly installed piping.

Compressed air lines will be subjected to an In-Service Leak Test (ISLT) according to the following.
Cycle: Pressurize the entire pipe to the rated pressure five (5) times, holding at rated pressure for five (5) minutes and at zero (0) pressure for five (5) minutes during each cycle. This requirement for cycling is in addition to ASME B31.1 requirements.

Hold: Pressurize the entire pipe to the specified test pressure and hold at this pressure for two (2) hours.

Test: Reduce pressure to specified design pressure and walk down the entire system to check for leaks. A liquid with foaming agent applied to all joints may be used to aid in leak determination. In the event of repair needed all liquid shall be cleaned prior to beginning repair work.

Repair: If any leaks are found, they shall be repaired per manufacturer's recommendations and the entire process specified above shall be repeated until the entire system is demonstrated to be leak free.

Water and air lines shall be pneumatically pressure tested for leaks. Contractor shall install blind flange at either end with airline connection to one of the flanges to allow for pressurization. Tests shall not commence until pressure is established at or above the prescribed test pressure and the pressurizing source has been disconnected from the system. The pressure decay shall be zero for a period of 10 minutes. Should pressure decay occur, the test pressure shall be reduced to design pressure and the system checked for leaks. The test shall be repeated after the system defects have been repaired. A liquid with foaming agent applied to all joints may be used to aid in leak determination. In the event of repair needed all liquid shall be cleaned prior to beginning repair work.

4.5.16 Cleaning of Pipe:

The inside and outside surfaces of all pipe, tubing, valves, and fittings shall be cleaned of all dirt, sand, loose mill scale, and other foreign materials immediately after removal from storage

and before erection. All lines shall be thoroughly flushed or blown before being placed in service. All compressed air lines shall be air blown.

4.5.17 Final Adjustment:

After a period of initial operation, all flange bolting shall be checked for tightness, and all hangers readjusted.

4.6 Welding:

4.6.1 General Welding Requirements:

Unless otherwise specified, the applicable governing edition and addenda to be used for all references to codes or standards specified herein shall be interpreted to be the jurisdictionally approved edition and addenda. If a code or standard is not jurisdictionally mandated, then the current edition and addenda in effect at the time of (contract or specification) approval shall govern.

For the purposes of this contract the following codes shall apply:
ASME B31.1
ASME Boiler and Pressure Vessel Code
MSS SP-58 for pipe support welding

All piping under this contract shall fall under the P-1 classification.

Where requirements of a referenced code or standard differ the more stringent or restrictive requirements shall apply.

Any request for deviation from specified requirements shall be submitted in writing and shall include the proposed deviation, rationale for the deviation, any technical data supporting the deviation, and historical experience supporting the deviation.

4.6.2 Welding Processes:

Unless otherwise specified, only shielded metal arc welding (SMAW), gas metal arc welding (GMAW), flux cored arc welding (FCAW), submerged arc welding (SAW), plasma arc welding (PAW), stud welding, and gas tungsten arc welding (GTAW) processes shall be permitted. Other welding processes may be used, provided the governing code or standard permits it and written approval has been granted by the Purchaser.

4.6.3 Welding Procedure Qualification:

Welding procedures shall be prepared and qualified in accordance with ASME Section IX except as modified by ASME B31.1.

Welding Procedure Specifications (WPS) and applicable Procedure Qualification Records (PQRs) shall be submitted for review by the Purchaser prior to start of fabrication. Submittal of welding procedures and applicable PQRs shall apply to all Contractors and subcontractors. Contractors shall review the documents in accordance with the applicable code and specification requirements and shall accept all of their subcontractors' welding procedures and applicable PQRs prior to submitting accepted documents to the B&V Materials Applications Section.

Due to the number of different nickel alloys within a nickel alloy P-number or S-number, WPSs for welding P-number or S-number 41 through 49, nickel alloy materials should identify the base materials by the Unified Numbering System (UNS) to aid in the proper application of the WPS, e.g., P45 (UNS N08367). As an alternative to identifying the UNS number on the WPS, the UNS number of the base material from the WPS may be cross referenced to the WPS by other means.

Standard Welding Procedure Specifications (SWPSs) produced by the American Welding Society (AWS) may be used when permitted by the jurisdictional code. Any supplemental requirements mandated by the jurisdictional code shall be met.

4.6.4 Welder/Welding Operator Performance Qualification:

Welders and welding operators shall be qualified in accordance with ASME Section IX except as modified by ASME B31.1. The welder and welding operator qualification records shall be available at the shop facility or construction site and shall be made available for review when requested and prior to start of work.

Each manufacturer or contractor is responsible for the qualification of welders or welding operators. Field welder or welding operator performance qualification testing shall be performed under the full supervision and control of the manufacturer or contractor at the project site or approved offsite testing facility prior to start of work.

4.6.5 United Association (UA) Welder Qualification:

Welders qualified and certified in accordance with the United Association (UA) Welder Qualification Program may be permitted to perform welding at the project construction site without further testing, provided the following requirements are met:

The UA Welder Qualification Program has been approved by state authorities and clients. Documentation of the UA Welder Qualification Program acceptance by the state jurisdiction and client shall be submitted to B&V Materials Applications Section and the Purchaser prior to permitting implementation of the program.

The UA Welder Qualification Program shall not be accepted for ASME Section I, boiler proper and ASME B31.1, boiler external piping. This program is applicable only for ASME B31.1, nonboiler external piping.

Project construction site personnel shall be provided with the applicable UA Welder Performance Qualification Test Record and the UA Welder's Record of Continuity as specified by ASME B31.1, Paragraph 127.5.3 (B).

If the provided documentation is acceptable, project construction site personnel shall prepare and sign a welder performance qualification record accepting responsibility for the ability of the welder in accordance with ASME B31.1, Paragraph 127.6.

4.6.6 Weld End Preparation:

Pipe ends for socket-weld connections shall be reamed to full inside diameter to remove all burrs and obstructions and to ensure proper assembly in accordance with ASME B31.1, Paragraph 127.3(E).

When weld joint details are specified by design documents, they shall be prepared in accordance with design documents.

4.6.7 Filler Materials:

Welding filler metal shall comply with the requirements of the referenced code and any modified requirements specified herein. The filler metal shall be as specified in the applicable WPS.

Unless otherwise specified, the welding filler metal shall have a chemical composition as similar as possible to the base materials to be welded. The finished weld as deposited, or after postweld heat treatment (PWHT) when required, shall be at least equal to the base metal as to strength, ductility, notch toughness, corrosion-erosion resistance, or other physical or thermal properties.

Unless otherwise approved in writing, the GTAW process shall require the addition of filler metal.

Unless otherwise specified, the use of the -G electrode/wire classification is prohibited.

SAW multipass weld deposits shall use an essentially neutral flux. Alloy, semiactive, or active fluxes shall not be used except as specified otherwise. Fluxes that compensate for losses of alloying elements are permitted. Active flux may be used for single pass welding of carbon steels, provided the weld deposit thickness is approximately 1/4 inch (6 mm) maximum each side for a double-V-groove joint design or approximately 1/4 inch (6 mm) one side for a single-V-groove joint design. The joint thickness shall not exceed 1/2 inch (13 mm) nominal.

The SAW process shall not use recrushed slag.

SMAW low-hydrogen type electrodes, including stainless steel and nickel and nickel alloy electrodes, shall be purchased in hermetically sealed or vacuum packed containers only.

4.6.8 <u>Filler Material Control:</u>

Storage, handling, and drying of SMAW electrodes and SAW flux shall, as a minimum, be in accordance with the manufacturers' recommendations. In addition, SMAW low-hydrogen type carbon and low alloy steel electrodes shall be stored in ovens at 250° F (120° C) minimum after the hermetically sealed or vacuum packed container is opened. Bare rod in straight lengths shall be individually flag tagged, stamped, or otherwise identified with the AWS classification or product classification. Each spool of solid or cored rod shall be tagged, labeled, or otherwise identified with the AWS classification or product classification. SMAW low-hydrogen type covered electrodes shall only be reconditioned one time. Any SMAW low-hydrogen type electrodes that have been wet or have damaged coatings shall not be used. Any welding filler metals or fluxes not readily identifiable shall not be used.

4.7 Fabrication Controls:

4.7.1 Welding Preheat and Interpass Temperature:

The preheat and interpass temperature requirements are essential variables and shall be in accordance with the referenced code and as specified herein. The WPS for the material being welded shall specify the minimum preheat and maximum interpass temperature requirements. The thickness used to determine preheat requirements shall be the thickness of the thickest part at the point of welding. Preheating shall be applied prior to any welding or thermal removal process.

Preheat and interpass temperatures shall be monitored and checked by temperature indicating crayons, thermocouples, surface contact pyrometers or thermometers, or other suitable methods.

Preheating shall be performed using electric resistance, induction heating, or oxyfuel heating methods that will provide uniform heating over the complete weld or thermal removal process area.
Preheat of pressure retaining components for carbon steel P-number 1 or S-number 1 materials shall be 175° F (79° C) when the material specified carbon content is in excess of 0.30 percent and the nominal thickness at the joint is in excess of 1 inch (25 mm). In addition, 200° F (93° C) minimum preheat is required for nominal thickness over 1.25 inches (32 mm), regardless of carbon content. A minimum preheat temperature of 50° F (10° C) is required for all other carbon steel P-number 1 or S-number 1 materials.

4.7.2 Miscellaneous Fabrication Control Requirements:

Welding shall not be performed when surfaces of the parts to be welded are wet. The parts to be welded shall be protected from deleterious contamination and from rain, snow, and excessive wind during welding.

Prior to welding, the weld preparation and adjacent base material surfaces shall be cleaned and kept free from paint, oil, grease, dirt, scale, rust, and other foreign materials.

The weld end preparation on carbon and low alloy steel materials that will be stored for extended periods of time may consist of coating with deoxaluminate or an equivalent protective material. This coating may be welded through if applied within the manufacturer's maximum weldable limit of 1.25 mils. Complete removal of the coating is neither required nor prohibited, unless signs of rust or other foreign materials such as oil, grease, dirt, or excessive coating are apparent, in which case these areas shall be cleaned.

Acceptable cleaning solvents include new or redistilled acetone (acetone reclaimed by other methods shall not be used), alcohol (ethyl, methanol, or isopropanol), methyl ethyl ketone, or toluene (toluol). Halogenated cleaning solvents shall not be used for cleaning or degreasing.

All groove butt joints shall be complete joint penetration unless specified otherwise by design documents or the applicable code.

Complete penetration joints welded from both sides shall have the root of the first layer or pass chipped, gouged, ground, or machined to sound metal prior to welding from the second side.

Welded joints shall be made by completing each weld layer before succeeding weld layers are deposited. Partial fill passes are permitted to correct localized underfill conditions and for the purpose of maintaining alignment. Block welding is prohibited.

As-welded surfaces are permitted; however, the surfaces of welds shall be uniform in width and size throughout their full length. The cover pass shall be free from coarse ripples, grooves, overlaps, abrupt ridges, and valleys. The surface condition of the finished welds shall be suitable for the proper interpretation of nondestructive examination. If the surface of the weld requires grinding to meet the above criteria, care shall be taken to avoid reducing the weld or base material below the minimum required thickness.

All socket welds shall be welded using only the GTAW or SMAW welding processes and shall meet the following requirements:

A minimum of two weld layers is required for pipe or tube over 1/2 inch (13 mm) nominal pipe size. Either GTAW or manual SMAW processes may be used.

For pipe or tube 1/2 inch (13 mm) or less in nominal pipe size, the GTAW process should be used and a single weld layer is permitted. The SMAW process may be used provided a minimum of two weld layers is deposited.

Welding slag and spatter shall be removed from all welds.

A gas or gas mixture used for shielding shall be welding grade or shall meet Specification SFA-5.32 and have a dew point of -40° F (-40° C) or lower.

Fabricators and Contractors shall check for residual magnetism at each end of the machined field pipe weld bevels. Weld bevels containing residual magnetism greater than 5 gauss shall be demagnetized.

Arc strikes outside of the area of permanent welds should be avoided on any base metal. Cracks or blemishes caused by arc strikes shall be ground to a smooth contour and checked to ensure soundness.

Peening is prohibited. The use of power tools for slag removal is not considered peening.

The application of heat to correct weld distortion and dimensional deviation without prior written approval from the Purchaser is prohibited.

Temporary attachments to pressure boundary components should be avoided and only used when absolutely necessary. When required, clamps, welded clips, tack welds, or other appropriate means shall be used to properly align the joint for welding. Welded attachments used for fit-up shall be compatible with the base material and shall be welded with a qualified welding procedure. Attachments shall not be knocked off base material. The attachments shall be removed by suitable methods, such as grinding, machining, or sawing, followed by grinding flush with the base material. When thermal cutting is used to remove attachments, approximately 3/16 inch of material shall be left for final removal by grinding. The ground area shall then be visually examined for defects. The area from which attachments have been removed shall be examined as required by the governing code or specification. Any defects found shall be repaired.

All defects in welds or base materials shall be removed and repaired in accordance with the referenced code.

Welding machine ground leads and clamps shall be located to avoid passing welding current through equipment, snubbers, bearings, or any other items where transfer of electrical current may result in damage to equipment.

A complete repair procedure for repairs that are documented as the basis of a nonconformance report shall be submitted to the Purchaser for review and approval in writing prior to performing the repair. If repair by welding is required, the applicable WPSs and supporting PQRs shall be submitted with the repair procedure. All nonconformance report dispositions shall comply with applicable code requirements.

4.7.3 Nondestructive Examination (NDE):

The Contractor shall conduct visual inspection of all piping and pipe support welds for cracks, undercutting, lack of fusion, incomplete penetration (if possible), surface porosity. If deemed necessary the Contractor shall hire an independent contractor to handle all of NDE tests and associated cost. Repair of defective welds and reexamination shall be at the Contractor's expense. Weld acceptance standards shall be in accordance with applicable codes and design specifications. If an individual interpretation is in question, the final authority shall be the responsibility of the Purchaser

NDE shall be performed in accordance with written procedures that are prepared in accordance with the referenced code and as specified herein.

NDE personnel performing NDE other than visual shall be qualified and certified for the applicable NDE method. Personnel shall meet written practice ASNT SNT-TC-1A, unless permitted otherwise by the referencing code. NDE personnel qualification records shall be made available for review when requested.

Personnel performing or supervising the visual examination of welds, including ASME Boiler and Pressure Vessel components, shall be qualified as a Certified Welding Inspector (CWI) in accordance with the American Welding Society AWS QC 1 or previously approved equivalent program. Visual inspectors' qualifications and certificates shall be submitted for review and verification.

All welds shall receive 100 percent visual examination. Visual weld examination acceptance criteria and other NDE acceptance criteria shall be in accordance with applicable referenced codes and design documents. Records of these examinations shall be documented.

4.7.4 Records:

Records of inspections, NDE, impact testing, hardness testing, PWHT charts or records, base material test reports, filler material test reports, radiographic film with applicable reader sheets, deviation requests including resolution documentation, nonconformance reports, and other records, as required, shall be retained by the Contractor for 5 years after completion of the work. Records shall be submitted to the Purchaser.

Quality records, including applicable Data Report Forms generated by a manufacturer or assembler in accordance with an approved Quality Control System and applicable Certificates of Authorization from the ASME Boiler & Pressure Vessel Code, shall be provided in accordance with the approved contract or purchase order. Quality records shall be legible, appropriately completed, and sufficiently detailed to permit traceability to the item or activity involved.

4.8 Grouting:

Table 1 – General		
General		
1	Application	Grout placed under baseplates, soleplates, and skids for equipment and structures. Equipment grouting shall be performed in accordance with the materials and procedures specified by the equipment supplier in their installation/instruction manual. When the equipment supplier does not specify the requirements for equipment grouting, equipment grouting shall comply with the requirements of this specification and the grout manufacturer's installation procedures and requirements.
Codes and Standards		
2	Cementitious Grout	ASTM C1107
3	Fluid grout test for cementitious grout	ASTM C939
4	Flowable grout test for cementitious grout	ASTM C1437
5	Compressive strength test method for cementitious grout	ASTM C109 as modified by ASTM C1107
6	Compressive strength test method for epoxy grout	ASTM C579, test method B

Table 2 - Products		
Requirements and Performance		
1	**General Purpose Non-shrink Cementitious Grout**	
2	Minimum Requirements	ASTM C1107
3	Temperature Range	Between 50° F (10° C) and 90° F (32° C).
4	Minimum Compressive strength at 28 days	5000 psi (35 MPa)
5	Working times at a flowable consistency	30 minutes
6	Bleeding	None at manufacturer's maximum recommended water content.
7	Approved Products	Master Builders "MasterFlow 100 or 555" L & M "Duragrout" Dayton Superior 1107 Advantage Unisorb "V-1" Non-shrink Euclid "NS" Grout Five Star Products "Five Star Grout"
8	**Precision Non-shrinking Cementitious Grout**	
9	Minimum Requirements	ASTM C1107
10	Temperature Range	Between 45° F (7° C) and 90° F (32° C).
11	Minimum Compressive strength at 28 days	5000 psi
12	Working time at a flowable consistency	30 minutes
13	Bleeding	None at manufacturer's maximum recommended water content.

14	Approved Products	Master Builders "MasterFlow 928,555, or 4316 Grout" Five Star Products "Five Star Fluid Grout 100" Five Star Products “Five Star Grout” L & M "Crystex" Unisorb "V-1 Non-shrink" Euclid "Hi-Flow" CGM Pro Grout 100

Table 3 - Execution		
General		
1	Surface preparation, mixing, placing, finishing, and curing	In accordance with Grout Manufacturer’s Instructions.
2	Anchor bolt protection	In accordance with Grout Manufacturer’s Instructions.
3	Installation of shims/wedges and leveling devices	In accordance with Grout Manufacturer’s Instructions.
Additional Requirements		
4	Surface preparation of concrete	Remove laitance, expose sound surface mortar, and provide an exposed aggregate surface. Remove oil, grease, curing compound, or other foreign materials. Use of a chemical surface retarder to expose aggregate immediately after placing and finishing concrete is permitted on new installations, unless the grout manufacturer requires a mechanical means of roughening.
5	Installation methods	Sufficient to provide complete, void free filling of all space beneath the baseplate
6	Forms	Enclose the base and contain flowable grout mixtures.
7	Spacing between the form and base	Sufficient to permit manipulation of the grout and not less than 0.75 inches.
8	Form height	Top higher than the bottom of base.
9	Anchor bolt sleeves	Remove closed cell foam and all water prior to grouting operations.
10	Alignment and Level	
11	Pre-placement verification	By Purchaser.
12	Control	Three-point control.
13	Leveling method	Leveling screws or steel shims/wedges.
14	Leveling screw nut	Locate above and below temporary lugs attached to the base.
15	Steel Shims/Wedges	Prevent steel shims/wedges from being dislodged during grout placement.
16	Steel Shim/Wedge Grout Encapsulation	2 inch (50 mm) minimum Steel shims/wedges shall be a minimum of 2 inches (50 mm) from the edge of the baseplate or skid frame.
17	Wood Shims/Wedges	Prohibited.
18	Finishing	
19	Grout Protection	Protect from disturbance until a stiff set is obtained.

20	Edges of grout (grout shoulders)	Remove forms and excess grout. Width of grout shoulders should not exceed 3 inches (75 mm). Avoid large areas of unconfined grout.
21	Grout Edge Bevel	Approximately 45 degrees from bottom of base
22	Exposed Edges and Adjacent Surfaces	Clean to remove all grout. 90° edges should have a 45° chamfer. The chamfer may be cut into the grout before final set (cementitious grout only) or built into the formwork (epoxy grout).
Applications		
23	General Purpose Non-Shrinking Cementitious Grout	Pipe Supports Instrument Stands Stairs Light structural columns Tank Bases (required grout flow less than 2 ft)
24	Precision Non-Shrinking Cementitious Grout	Heavy structural columns Fans Pumps Compressors Tank Bases (required grout flow more than 2 ft)

4.9 Post-Installed Anchorage to Concrete (Structural):

General		
1	Application	Anchorage to hardened concrete using Mechanical (Expansion) or Adhesive Anchors for specific uses as indicated below.
2	Structural anchors shall be suitable for cracked concrete	Yes
3	Seismic Design Category	A
4	Furnish and Install	Anchors, compatible nuts and washers, adhesives
5	Installation Requirements	In accordance with Manufacturer's Printed Installation Instructions (MPII) and ICC-ES Evaluation Reports. Reinforcing shall not be cut during anchor installation without approval by Purchaser.
Codes and Standards		
6	Concrete Design Code	ACI 318-14, Chapter 17
7	Acceptance Criteria basis for ICC Evaluation Reports – Mechanical Anchors	ICC-ES AC193
8	Acceptance Criteria basis for ICC Evaluation Reports– Adhesive Anchors	ICC-ES AC308
Requirements and Performance		
9	**Mechanical (Expansion) Anchors**	
10	Usage	Structural elements. Guardrails. Fire Protection components including pipe hangers Suspended or horizontal pipe or cable tray supports where the tributary load to the support exceeds 400 pounds (180 kg).
11	Type	Wedge Anchor
12	Compliance with ICC Evaluation Report	Required
13	Anchor Selection based on Exposure Conditions	
14	Interior, Dry	Hilti Kwik-Bolt TZ, Carbon steel with electroplated zinc coating (ICC ESR-1917)
15	Interior, Damp or Wet. Exterior.	Hilti Kwik-Bolt TZ, Type 304 Stainless Steel body, nut, and washer, Type 316 Stainless steel sleeve (ICC ESR-1917)
16	Saltwater exposure. High corrosion locations.	Not Applicable
17	Alternate manufacturers. See Note 2.	ITW Red Head, DeWalt, Simpson Strong-Tie
18	**Mechanical (Expansion) Anchors**	
19	Usage	Mechanical and electrical equipment weighing over 400 pounds (180 kg). Bottom supported pipe or cable tray supports where the tributary load to the support exceeds 400 pounds (180 kg).
20	Type	Wedge Anchor
21	Compliance with ICC Evaluation Report	Not required

22	Anchor Selection based on Exposure Conditions	
23	Interior, Dry	Hilti Kwik-Bolt TZ, Carbon steel with electroplated zinc coating
24	Interior, Damp or Wet. Exterior.	Hilti Kwik-Bolt TZ, Type 304 Stainless Steel body, nut, and washer, Type 316 Stainless steel sleeve
25	Saltwater exposure. High corrosion locations.	Not Applicable
26	Alternate manufacturers. See Note 2.	ITW Red Head, DeWalt, Simpson Strong-Tie
27	**Adhesive Anchors**	
28	Usage	Structural elements. Guardrails. Fire Protection components including pipe hangers except adhesive anchors shall not be used in an upwardly inclined installation. Suspended, horizontal, or bottom supported pipe or cable tray supports where the tributary load to the support exceeds 400 pounds (180 kg). Mechanical and electrical equipment weighing over 400 pounds (180 kg).
29	Compliance with ICC Evaluation Report	Required
30	Anchor Selection based on Exposure Conditions	
31	Interior, Dry	ASTM F1554 Threaded Rod, Grade 36 unless otherwise noted on drawings. Hot dipped galvanized.
32	Interior, Damp or Wet. Exterior.	ASTM F1554 Threaded Rod, Grade 36 unless otherwise noted on drawings. Hot dipped galvanized.
33	Saltwater exposure. High corrosion locations.	Not Applicable
34	Adhesive	Hilti HY-200 (ICC ESR-3187)
35	Alternate manufacturers. See Note 2.	ITW Red Head, DeWalt, Simpson Strong-Tie
36	Minimum Age of Concrete Prior to Anchor Installation	21 days
37	Concrete Temperature Range at time of Installation	14 F (-10 C) to 104 F (40 C)
38	In-Service Concrete Temperature Limits	Maximum short-term temperature 176 F (80 C), maximum long term temperature 110 F (43 C)
39	Moisture Condition at time of installation	Dry Concrete
40	Type of Lightweight Concrete	Not Applicable
41	Hole Drilling and Preparation	Hammer drill only. Clean hole with steel brushes and compressed air.
42	Installer Certification Requirements for Horizontal or Upwardly Inclined Anchors	ACI/CRSI Adhesive Anchor Installation Program
Inspection		
43	Building Code Required Special Inspection per IBC Chapter 17.	Not Required
44	Inspection of Mechanical Anchors as specified in Note 3, shall be performed by	Purchaser
45	Inspection of Adhesive Anchors as specified in Note 4, shall be performed by	Purchaser

Notes	
	1. Not Used. 2. Pre-approval by Purchaser required prior to use of product from alternate manufacturer. Alternate product shall provide comparable performance to specified anchor. Vendor data sheets and ICC-ES Evaluation Report required with submittal. Purchaser reserves the right to reject an alternate product or manufacturer, even if listed herein. 3. Mechanical (Expansion) Anchors Inspections. Perform the following inspections during initial installation of each type and size for each installer followed by 5% of remaining anchors: Verify horizontal and vertical location of anchor(s). Verify diameter and depth of drilled hole, compliance with drill bit requirements. Verify hole is clean, dry, and free of debris. Verify installer has cleaned holes using clean, oil-free compressed air, a wire brush and then compressed air again. Verify anchors are free of oil, dirt, loose rust, loose dry mortar, or damage. Verify anchor embedment and tightening torque. Verify installation in accordance with manufacturer's printed installation instructions. 4. Adhesive Anchor Inspections. Perform the following inspections during initial installation of each type and size for each installer followed by 5% of remaining anchors, except for anchors installed horizontally or upwardly inclined which shall be 100% inspected: Verify horizontal and vertical location of anchor(s). Verify diameter and depth of drilled hole, compliance with drill bit requirements. Verify hole is clean, dry, and free of debris. Verify installer has cleaned holes using clean, oil-free compressed air, a wire brush and then compressed air again. Verify anchors are free of oil, dirt, loose rust, loose dry mortar, or damage. Verify application of adhesive to bottom of hole and during withdrawal. Verify insertion of anchor to proper depth with proper length extending out of hole. Verify proper coating of anchor by noting extrusion of adhesive from hole and twisting to coat entire anchor. Verify installation in accordance with manufacturer's printed installation instructions.

4.10 Post-Installed Anchorage to Concrete (Non-Structural):

General		
1	Application	Anchorage of the following to hardened concrete using Mechanical (Expansion) or Adhesive Anchors: Architectural components Suspended, horizontal, or bottom supported pipe or cable tray supports where the tributary load to the support is 400 pounds (180 kg) or less with the exception of fire protection components including pipe hangers. Mechanical and electrical equipment weighing 400 pounds (180 kg) or less.
2	Furnish and Install	Anchors, compatible nuts and washers, adhesives
3	Installation Requirements	In accordance with Manufacturer's Printed Installation Instructions (MPII). Reinforcing shall not be cut during anchor installation without approval by Purchaser.
Requirements and Performance		
4	**Mechanical (Expansion) Anchors**	
5	Type	Sleeve or Drop-in anchor. See Note 1.
6	Anchor Selection based on Exposure Conditions	
7	Interior, Dry Interior, Damp or Wet. Exterior	Hilti HLC Sleeve Anchor, carbon steel with zinc plated coating; Hilti HDI/HDI-L Drop-in Anchor, carbon steel with zinc plated coating ITW Red Head Dynabolt sleeve anchor, carbon steel with zinc plated coating; ITW Red Head Multi-Set II drop-in anchor, carbon steel with zinc plated coating DeWalt Lok-Bolt AS sleeve anchor, carbon steel with zinc plated coating; DeWalt Steel Dropin anchor, carbon steel with zinc plated coating Simpson Strong-Tie Sleeve-All sleeve anchor, carbon steel with zinc plated coating; Simpson Strong-Tie Drop-in Anchor, carbon steel with zinc plated coating
8	Saltwater exposure. High corrosion locations.	Not Applicable
9	Alternate manufacturers	See Note 2.
10	**Adhesive Anchors**	
11	Type	Threaded Rod
12	Anchor Selection based on Exposure Conditions	
13	Interior, Dry	ASTM F1554 Threaded Rod, Grade 36 unless otherwise noted on drawings. Hot dipped galvanized.
14	Interior, Damp or Wet Exterior	ASTM F1554 Threaded Rod, Grade 36 unless otherwise noted on drawings. Hot-dip galvanized.

15	Saltwater exposure. High corrosion locations.	Not Applicable
16	Adhesive	Hilti HY-200
17	Alternate manufacturers. See Note 2.	ITW Red Head, DeWalt, Simpson Strong-Tie
18	Type	Internally Threaded Insert. Use only where specifically noted on drawings.
19	Anchor Selection based on Exposure Conditions	
20	Interior, Dry	Hilti HIS-N Carbon Steel with electroplated zinc coating
21	Interior, Damp or Wet Exterior	Hilti HIS-RN 316 SS Stainless Steel
22	Saltwater exposure. High corrosion locations.	Not Applicable
23	Adhesive	Hilti HY-200
24	Alternate manufacturers	See Note 2
Notes		
	1. Structural mechanical anchors specified in 4.9 may be substituted for non-structural mechanical anchors specified herein. 2. Pre-approval by Purchaser required prior to use of product from alternate manufacturer. Alternate product shall provide comparable performance to specified anchor. Vendor data sheets required with submittal. Purchaser reserves the right to reject an alternate product or manufacturer, even if listed herein.	

4.11 Insulation:

4.11.1 Piping Insulation and Jacketing:

Piping insulation and jacketing shall be furnished for the piping as indicated on the UCC piping drawings C-55650-05-001 through -008. The following pipe shall be insulated:

- Ash conveyor piping from outside wall of precipitator building to filter separator (dwg no. C-55650-05-003 and -004)
- Suction piping between filter separator and mechanical exhausters (dwg no. C-55650-05-004)
- Discharge piping from mechanical exhausters to the flue gas duct (dwg no. C-55650-05-006).
- All compressed air piping outside of precipitator building to silo.

General Requirements	
Maximum surface temperature allowable for personnel protection	150° F (66° C)
Material Types	
Piping insulation materials shall be	1-1/2” diameter Mineral fiber with a nominal density of 8 lbs/ cu ft
Material Requirements	
Where mineral fiber blanket is furnished, it shall be provided	Without facings **or** With woven wire mesh facing on one side **or** With woven wire mesh facing on both sides **or** With expanded metal lath facing on one side **or** With expanded metal lath facing on both sides
Jacketing	Embossed aluminum with a minimum thickness of 0.016 inch
Method of securing insulation to equipment shall be	Steel bands **or** Welded studs **or** Impaling pins and speed washers **or** Steel bands, welded studs, or impaling pins and speed washers, as determined for each application
Jacketing for elbows shall be	Preformed aluminum elbows **or** Field fabricated from aluminum sheet **or** Preformed aluminum elbows or field fabricated from aluminum sheet
A moisture barrier is required for jacketing for these systems or areas	All outdoor installations
Moisture barrier shall be	3 mil (76 micron) polysurlyn moisture barrier factory heat laminated to the interior surface **or** 1.5 mil (0.040 mm) polyethylene and 40 pound basis weight (65.2 grams per square meter) kraft paper
Neoprene washers are required on screws for the listed jacketing	All outdoor installations

4.12 Field Applied Protective Coatings:

Table 1 - General		
General		
1	Application	Field coatings
Codes and Standards		
2	Code compliance	Use the jurisdictionally approved code editions and addenda for all codes. Use the most recent edition and addenda in effect at the date of this document if none are jurisdictionally mandated.
3	Fabrication details, surface finish requirements, and proper design considerations for tanks and vessels to be lined for immersion service	NACE SP0178
4	Mineral and Slag Abrasives	SSPC-AB 1
5	Cleanliness of Recycled Ferrous Metallic Abrasives	SSPC-AB 2
6	Newly Manufactured or Remanufactured Steel Abrasives	SSPC-AB 3
7	Solvent cleaning	SSPC-SP 1
8	Hand tool cleaning	SSPC-SP 2
9	Power tool cleaning	SSPC-SP 3
10	White metal blast cleaning	SSPC-SP 5 / NACE No. 1
11	Near white blast cleaning	SSPC-SP 10 / NACE No. 2
12	Commercial blast cleaning	SSPC-SP 6 / NACE No. 3
13	Brush-off blast cleaning	SSPC-SP 7 / NACE No. 4
14	Power tool cleaning to bare metal	SSPC-SP 11
15	Surface Preparation and Cleaning of Steel and Other Hard Materials by High- and Ultra-High Pressure Water Jetting Prior to Recoating	SSPC-SP 12
16	Brush Off Blast Cleaning of Coated and Uncoated Galvanized Steel, Stainless Steels and Non-Ferrous Metals	SSPC-SP 16
17	Shop, field, and maintenance painting of steel	SSPC-PA 1
18	A guide to safety in paint application	SSPC-PA Guide 3
19	Standard procedure for evaluating painting contractors	SSPC-QP 1
20	Visual standard for abrasive blast cleaned steel	SSPC-VIS 1
21	Visual standard for power and hand tool cleaned surfaces	SSPC-VIS 3
22	Dehumidification and Temperature Control	SSPC-TR 3 / NACE 9A192
23	Surface Preparation of Soluble Salt Contaminated Steel Substrates	NACE 6G186

24	Handling and storage	Abide by all EPA, OSHA, and state regulations regarding storage, handling, and use of flammable and combustible liquids

Table 2 - Products		
Materials		
1	Coating Materials	Use new and undamaged materials. Deliver to the job in original, unopened containers, with labels intact.
2	Material handling	Maintain within the temperature range required by the coating manufacturer during transportation, storage, mixing and application. Store appropriately to ensure proper quality when used. Do NOT add any adulterant, unauthorized thinner, or other material not included in the coating formulation to the coating for any purpose.
3	Air quality regulation	Ensure all coatings conform to the air quality regulations applicable at the location of use. Do NOT use coating materials that cannot be guaranteed by the manufacturer to conform to the regulations, whether or not specified by product designation.
4	Multiple coatings	For successive field coats, use coatings produced by the same manufacturer. Cause no wrinkling, lifting, or other damage when applying first field coating over underlying shop coats
5	Tinting	Use factory tinted coatings
Material Safety		
6	Employees who will be using chemicals (solvents, cleaners, lubricants, coatings, linings, etc.)	Knowledgeable and skilled in the proper use of and the hazards associated with these chemicals in accordance with SDSs
Testing Requirements		
7	Indicating moisture in concrete by the plastic sheet method	ASTM D4263
8	Indicating oil or water in compressed air	ASTM D4285
9	Measurement of wet film thickness by notch gauges	ASTM D4414
10	Field measurement of surface profile of blast cleaned steel	ASTM D4417
11	Pull-off strength of coatings using portable adhesion testers	ASTM D4541
12	Measurement of dry paint thickness with magnetic gauges	SSPC-PA 2
13	Discontinuity (Holiday) testing of new protective coatings on conductive substrates	NACE SP0188
14	Guide for Illumination of Industrial Painting Projects	SSPC Guide No. 12

15	Field Methods for Retrieval and Analysis of Soluble Salts	SSPC-TG 15
Quality Assurance		
16	Coating system submittal	Provided manufacturers standard data sheets. Develop and submit a separate submittal for each variation or change in coating system or surface coated.
17	Certification	Review and approve of, in writing, the coating manufacturer's recommendations for intended service. Submit, in writing, any variations from these specifications or the coating manufacturers published recommendations. Any variations must be approved.
18	Color cards	Use owner provided color codes or owner chosen colors
19	Submittal approval	Submittals must be approved prior to the commencement of work

Table 3 - Execution		
General		
1	Manufacturer's recommendations	Meet or exceed the coating manufacturer's minimum recommendations for cleaning, surface preparation, and coating application. Comply with the manufacturer's minimum recommendations even if they exceed the specified requirements.
2	Coating inspector	Assign an experienced coating inspector to supervise the entire process to ensure that all procedures meet or exceed the specifications or the coating manufacturer's recommendations. A third party lining inspector may be provided to ensure compliance with this specification.

3	Items not to be coated Unless otherwise noted	Metal wall panels and flashings (exterior). Glass and glazing. Acoustical ceiling. Aluminum surfaces. Brass and Bronze. Quarry tile, ceramic tile, or ceramic granular flooring. Resilient floor coverings. Hardware. Floor plates. Embedments (galvanized). Grating. Galvanized ductwork, dampers, and fan boxes. Light fixtures, except supports. Electrical conductors, insulated or uninsulated. Electrical conduits, wireways, and junction boxes. Cable trays and supports. Chromium plated metals. Gauges. Rotating shafts and couplings. Rubber belts, skirting, gaskets, and idler disks.
4	Coating plant equipment	Coat all exposed surfaces of the equipment as directed on the Coating System Data Sheets. The remainder of the plant equipment will be coated under separate specifications.
5	Coating applicators	Employ supervisors and workers qualified by commercial experience installing the types of materials specified.
Surface Preparation		
6	Surface preparation specification	These surface preparation requirements are a minimum. Where the requirements published in the coating manufacturer's data sheets exceed the limits specified, use the data sheets as the minimum requirement.
7	Surfaces to be coated	Clean and dry all surfaces before coating. Completely remove Oil and grease using techniques described in SSPC-SP 1 before mechanical cleaning is started. Meet the recommendations of the coating manufacturer for surface preparation. Ensure surfaces are free of cracks, pits, projections, or other imperfections that would interfere with the formation of a smooth, unbroken coating film.

8	Previously coated surfaces For touchup or repair	Dull the gloss on previously coated surfaces if necessary for proper adhesion of topcoats. Clean as recommended by the coating manufacturer. Feather the edges of the repaired area by sanding or wire brushing to produce a smooth transition that will not be noticeable after the coating is applied. Completely remove all coatings made brittle or otherwise damaged by heat of welding. All repairs must be in accordance with the original manufacturer's recommendations for repair
9	Abrasive blasting	Verify the quality of compressed air in accordance with ASTM D4285 prior to abrasive blasting. Carry out the test at the beginning of each shift and witnessed by the coating inspector.
10	**Ferrous Metal Surfaces**	
11	Ferrous metal surface preparation	Prepare for coating by using one or more of the following cleaning procedures: solvents (SSPC-SP1); hand tools (SSPC-SP2); power tools (SSPC-SP3 or -SP11); abrasive blasting (SSPC-SP5, -SP6, -SP7, or -SP10); or water jetting (-SP12). Completely remove oil and grease in accordance with SSPC-SP1 before beginning any other cleaning.
12	Welds on ferrous metal surfaces	Scrape and grind the surfaces of welds as necessary to remove all slag and weld spatter. Unless specified otherwise in the Coating System Data Sheets, grind welds smooth and free of all defects in accordance with NACE Standard SP0178, Appendix C, Designation E on all ferrous metal surfaces.
13	Ferrous metal surface blasting	Remove all blasting residue, waste, and accumulation before coating application
14	Ferrous metal surface coating	Coat or line cleaned surfaces with coating, primer, or touchup within 6 hours of cleaning, or before rust bloom occurs. Do NOT allow blast cleaned surfaces to stand overnight before coating.
Coating Work		
15	**Mixing and Thinning**	
16	Coating storage and use	Keep coating containers tightly closed except while coating is being withdrawn. Mix coatings thoroughly each time any is withdrawn from the container.
17	Factory mixing	Use coatings factory mixed to proper consistency and viscosity for hot weather application with thinning and thinners recommended by the manufacturer for ambient temperatures

18	Thinning	Thin only as necessary to obtain recommended coverage at lower application temperatures. Do NOT reduce the wet film thickness of applied coating, by addition of coating thinner or otherwise, below the thickness recommended by the coating manufacturer. Conduct thinning in compliance with all applicable air quality regulations.
19	Coating pigmentation	Maintain uniform suspension of coating pigments during application. Jobsite tinting is NOT permitted.
20	**Coating Application**	
21	General coating	Apply coating in a neat manner producing an even film of uniform and proper thickness, with finished surfaces free of runs, sags, ridges, laps, and brush marks. Do not apply coating at a rate of coverage greater than the maximum rate recommended by the coating manufacturer. Apply coating materials in accordance with the manufacturer's recommendations by competent and experienced applicators. Protect freshly coated surfaces from dust and other contaminants.
22	Ventilation	Provide ventilation adequate to remove all particulates and solvent vapors. Where natural ventilation is inadequate, employ a mechanical ventilation system. Provide a clean air supply during all phases of coating operations.
23	Failed coatings	Will not be accepted. Remove entirely down to the substrate and recoat the surface. Failures include but are not limited to, checking, cracking, teardrops, fat edges, fisheyes, or delamination.
24	Protection of surfaces	Use proper dropcloths, masking tapes, and other protective measures throughout the work to protect surfaces from accidental spraying, splattering, or spilling of coatings. Correct and repair damage resulting from coating operations. Immediately remove coatings deposited on surfaces not currently being coated.
25	Hardware, components, and fittings	Remove and reinstall, or provide adequate in-place protection for, valve and equipment identification tags, gauges, installed hardware, accessories, lighting and electrical components, factory finished materials, plumbing fixtures and fittings, and other materials that may become splattered or damaged by coating materials

26	**Environmental Conditions**	
27	Weather and debris	Do not apply coatings during wet, damp, or foggy weather, or when windblown dust, dirt, debris, or insects will collect on freshly applied coating except under environmentally controlled conditions
28	Low temperatures	Do NOT apply coatings at temperatures less than the minimum temperature recommended by the coating manufacturer
29	High temperatures	Do NOT apply coatings at temperatures or greater than the maximum temperature recommended by the coating manufacturer. During periods of elevated ambient temperatures, ensure that proper application is performed including adherence to all re-coat window requirements. Keep the surface temperature during application below 100°F by shading the application area from direct sunlight, applying coating in the evening or at night, and ventilating the area to reduce the humidity and temperature.
30	Humidity	Do NOT install coating or lining material if substrate temperature is within 5° F of the dewpoint temperature or if the relative humidity is greater than 85%. Do NOT apply coatings to metal surfaces where conditions are likely to cause condensation, regardless of the air temperature. Do NOT apply coatings when the relative humidity is greater than the maximum or less than the minimum values recommended by the coating manufacturer.
31	Temporary enclosures	Provide where necessary. Maintain the temperature within acceptable temperature limits during surface preparation and coating application activities and until the coating has fully cured. Maintain the relative humidity within acceptable temperature limits during surface preparation and coating application activities and until the coating has fully cured.
Field Quality Control		
32	Required testing and inspection	Visual inspection, surface profile, wet and dry film thickness, spark testing, and adhesion testing
33	Visual inspection	Visually inspect the surface of the protective coatings
34	Film thickness	Verify the coating film thickness by measuring the film thickness of each coat as it is applied and the dry film thickness of the entire system. Measured dry film thickness in accordance with SSPC-PA 2. Measured wet film thickness using a gauge that will measure the wet film thickness with an accuracy of ±0.5 mil in accordance with ASTM D4414.

35	Holiday testing	Where specified on the Coating System Data Sheets (CSDS), holiday test coatings using an acceptable electrical spark tester set at the recommended voltage. Thin films may be tested with the low voltage sponge test procedure. Observe the spark testing and verify the testing equipment is working properly before starting the spark testing of the coating. Use an electrode with continuous movement and that will proceed in a systematic manner to cover 100% of the coated surface in one pass only. Ensure the electrode maintains continuous contact with the coated surface. Conduct holiday testing for coatings on metal in accordance with NACE SP0188. Mark and repair all detected holidays and pinholes Perform repairs in accordance with the coating manufacturer's published recommendations.
36	**Coating Adhesion**	
37	Coating adhesion testing	Where coated surfaces contain visible defects that could adversely affect the adhesive or cohesive properties of the film, conduct an adhesion test to validate the integrity of the coating system. Visible defects in the film that require performance of an adhesion test include; overspray, cratering, runs or sags, solvent blistering, dirt or debris in the film, flaking, lifting or cracking. Allow the coated test area to cure completely according to the coating manufacturer's published recommendations prior to performing the adhesion test. Perform a minimum of one adhesion test in accordance with ASTM D4541 for steel substrates and SSPC-SP 13 for concrete substrates. The resultant coating adhesion strength must meet or exceed the minimum value specified in the coating manufacturer's published literature or, for concrete, exceed the minimum surface tensile strength of the substrate.

38	Coating adhesion failure	If the surface tested fails to comply with the minimum specified adhesion strength, expand adhesion testing to adjacent surfaces until sound coating, meeting or exceeding the minimum adhesion strength value specified in the coating manufacturer's published literature, is obtained. Remove coating materials, down to the substrate, from surfaces that exhibit adhesion values less than the specified minimum and replace. Remove coating by mechanical means, such as hand/power tool and/or abrasive blasting. Reapply the coating in accordance with the applicable coating system data sheet. Treat interfaces and tie-ins between the previously coated surfaces and surfaces that have been replaced in compliance with recommendations stated in the coating manufacturer's published literature.

Datasheets

39	**Description**	**Approved Products** **Manufacturer: First Coat, Second Coat**	**Dry Film Thickness (First Coat/Second Coat)**
40	Outdoor Structural Steel	Sherwin Williams: Kem Bond HS, Industrial Enamel VOC Carboline: Carbozinc 859, Carbothane 133 LH International: Interzinc 315, Interthane 870 Jotun: Barrier Plus, Hardtop XP PPG: Amercoat 68HS, Sigmacover 550H	1st Coat - 3.0-4.0 2nd Coat – 3.4-5.0
41	Hot Dipped Galvanized Steel	Carboline: Carboguard 60, Carbothane 134 HG International: Interseal 670HS, Interthane 990 Jotun: Penguard Universal, Hardtop XP PPG: Amerlock 2, Pitthane Ultra Sherwin Williams: Macropoxy 646, Acrolon 7300 Tnemec: Series 27, Series 1095	1st Coat - 3.0-4.0 2nd Coat – 2.0-3.0
42	Carbon Steel Pipe (no insulation <200 °F)	Carboline: Carboguard 893 SG, Carbothane 133 LH International: Interseal 475HS, Interthane 870 Jotun: Penguard Universal, Hardtop XP PPG: Amerlock 2/400, Sigmadur 550 H Sherwin Williams: Macropoxy 646, Acrolon 7300 Tnemec: Series 61, Series 290	1st Coat - 4.0-6.0 2nd Coat – 3.0-4.0
43	Carbon Steel Pipe (no insulation >200 °F)	Carboline: Carbozinc 11 Series, Thermaline 4000 AL International: Interzinc 22, Intertherm 50 PPG: Dimecote 9, Hi-Temp 1000	1st Coat - 2.0-3.0 2nd Coat – 1.0-2.0
44	Carbon Steel Pipe (under insulation <350 °F)	Carboline: Thermaline 450 EP, Thermaline 450 EP International: Interbond 2340UPC, Interbond 2340UPC Jotun: Jotatemp 250, Jotatemp 250 PPG: Hi-Temp 900, Hi-Temp 900 Sherwin Williams: Cor-Cote HT, Cor-Cote HT	1st Coat - 4.0-6.0 2nd Coat – 4.0-6.0
45	Carbon Steel Pipe (under insulation >350 °F)	Carboline: Carbocoat 153 International: Interprime 198 Jotun: Pilot QD Primer Tnemec: Series 10	1st Coat - 2.0-3.0