

JEA BRANDY BRANCH GENERATING STATION WAREHOUSE BUILDING

General Construction Technical Specification

410518.70.0100

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Black & Veatch Corporation (Engineer)
Florida Registration No. 00008132
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01100 – General Requirements and Scope of Work

01100.1 Overall Project Description

The JEA Brandy Branch Generating Station is located in Baldwin, Florida. JEA plans to construct a Warehouse Building with a footprint of approximately 100 ft x 125 ft.

01100.2 Technical Scope of Work

Contractor shall design, furnish and erect the Warehouse Building in accordance with the layout shown on the included plans and to meet the below requirements supplementing the specifications found in this Construction Specification document.

- Design, Furnish and Erection of a Pre-Engineered Metal Warehouse Building with an approximate floor area of 125 ft x 100 ft and a 22 ft eve height
 - Construction of the building should be per the Pre-Engineered Metal Building (PEMB) Specification in this document and the included Black & Veatch drawings.
 - Construction of the building shall meet the 2023 Florida Building Code (8th Edition) and local jurisdictional code requirements.
 - Building should be designed to meet the wind loading as detailed in the D100 technical supplemental, Factory Mutual (FM) material and design requirements, and should have FEMA 361 rated windows and doors.
 - Fire Suppression System within the PEMB Warehouse in accordance with FM Global and Florida Building Code requirements.
 - Includes providing associated fire projection system permits and coordinating required inspection and testing with local authorities having jurisdiction.
 - Includes a new full fire alarm system, which is in accordance and compliant with FM Global Property Loss Prevention Data Sheet 5-40, Fire Alarm Systems
 - The new local fire control panel will have three alarms that shall be hardwired back to the existing Main Fire Control Panel and shall be able to interface with the existing Main Fire Control Panel.
 - Design and Installation of Building Grounding and Lightning Protection systems.
 - Design and installation of building electrical systems to include 200A, 480V, 3-phase, 3W panelboard, 480 to 208Y/120V stepdown transformer and 208Y/120V panelboard (minimum 42 circuit), building lighting and building receptacles.
 - Building should be of clear-span/open-bay design with no interior columns.
 - (2) 18 ft high x 14 ft wide Overhead Motorized Roll-Up Doors, located on ends of the building.
 - Roll-up doors to be installed in line to allow drive-through of the building
 - Hose Bibb (service water) connections to be provided adjacent to each of the overhead doors
 - FM Global Compliant for fire and natural disasters
- Installation of the Warehouse Building Foundation.
 - Includes Overhead Door concrete approach slabs and personnel door stoop foundations.
 - Foundation requirements are to be coordinated with Black & Veatch who will provide final design of the building foundation. The basis of bid should be based on installation of a 12-inch thick slab with a 2'-6" by 4 foot wide thickened edge, reinforced with #6 rebar at 12 inches each way top and bottom.
- Erosion and Sedimentation Control of the Contractor's work area including development of a project specific Stormwater Pollution Prevention Plan.
 - Contractor is required to submit for Construction NPDES permit and maintain appropriate associated records on site.

- Earthwork required to established warehouse pad and road grades including associated grading of the stormwater management system additions/modifications
- Asphalt Paved Access Road to and from the warehouse building, and connecting to the existing Plant loop road.
- Power feed from the nearby existing 480v Panel Board to the PEMB Warehouse 480V panelboard via underground conduit(s).
- Route underground fire water piping from the existing Fire Water Loop to the PEMB Warehouse Sprinkler System.
- Turnout upgrade and associated culvert extension of one of the existing plant loop road intersections as depicted on the plans.
- Route underground service water piping to the new PEMB for hose bibs.

All work necessary to furnish and erect equipment as indicated on the Contract Drawings and as specified herein shall be provided by the Contractor. The Scope of Work specified herein includes the materials and services required to furnish and erect the systems included but is not limited to the following:

- Contractor shall provide all craft labor, tools, special tools, machine work, equipment, and vehicles to perform all phases of the Work.
- Contractor shall be responsible for the procurement of all bulk materials (permanent or temporary) needed for the proper erection of systems and components of the Work.
- Contractor to provide and/or install all items listed in section 01100.1 per the Contract Drawings and all relevant technical specifications included in this Construction Specifications
- Installation of all concrete foundations as shown on the Contract Drawings.
- Furnish, fabrication, and installation of all necessary piping, fittings, valves, and appurtenances for the systems as shown on the Contract Drawings. Contractor shall install pipe racks, piping supports and appurtenances per the Contract Drawings.
- Contractor shall supply all materials necessary to fabricate pipe racks and pipe supports as detailed on the Contract Drawings. Pipe supports welded directly to piping shall be coated same as attached piping. Pipe supports not directly welded to the piping shall be hot dip galvanized.
- All piping shall be per ASME B31.1. All welds shall be inspected per ASME B31.1 Table 136.4.
- It shall be the responsibility of Contractor to disconnect/reinstall/replace any piping, structure, wiring, conduit, instrumentation, insulation, lagging, or related items which were removed by Contractor to aid him in his work; however, Contractor shall not de-energize/energize any station electrical or mechanical system. This shall be done in accordance with Owner Lockout/Tagout procedures and coordinated through the Owner Operations personnel.
- The Contractor shall provide all materials and services to furnish and erect a complete system, unless noted otherwise. Omission by Engineer of specific equipment and services shall not relieve the Contractor of his responsibility to provide all materials and services to furnish and erect a complete and operational system as specified herein.
- Where provision of specific equipment, materials, and services are specified herein, the Contractor shall provide the equipment, materials and services as specified unless otherwise noted or approved by the Owner.

- The Contractor shall furnish all materials, supplies, management resources, labor, and services. The activities shall be accomplished without disturbing or damaging adjacent facilities, utilities or equipment, and structures that are to be preserved.
- Contractor shall obtain all local, state, federal, or other permits required to complete work.

Contractor understands that the work will be performed in an operating power plant. Work shall be performed in required sequence coordinated with plant operations to minimize operational impact.

Where the term "Contractor" is used herein, it shall refer to the Prime Contractor and/or the Prime Contractor's subsupplier(s) and/or the Prime Contractor's Contractor(s). Where the term "Owner" is used herein, it shall refer to the Owner (JEA) and the Owner's representative(s).

In the event of technical conflicts, errors, or discrepancies, the detailed technical specifications, including this Section 01100 and all higher numbered sections, take precedence over Section 01400, Technical Supplemental Specifications.

01100.2.2 As-Built Drawings

Contractor shall provide as-built drawings of the locations and elevations of equipment, utilities, structures and fixtures. As-built drawings shall be clear and legible and "red-lined" on the most recent drawing revision. PDF and CAD As-built drawings shall be submitted to the Owner within 14 days of completion of construction. As-built markups requiring clarification shall be resolved within 7 days of the Owner's request for clarification.

Contractor shall perform an As-Built Survey of the topographic features and stormwater management system of the Contractor's Scope of Work area. The As-Built survey shall be performed by a Florida Registered Land Surveyor (RLS) and the Survey Map shall contain the Surveyor's as-built certification in accordance with Florida Administrative Code Chapter 62-330.310(1).

01100.3 Scope of Work Clarifications

01100.3.1 General

Any costs for soil remediation, soil improvements, removal of unknown abnormal underground obstructions or contaminated soil shall be considered additional work and shall not be included in the initial Contract scope of work or pricing. The Contractor shall assume that on-site material is suitable for general fill.

Normal construction surveys for laying out and controlling the work shall be included in the Contractor's scope of work. Utility locates (i.e. ground penetrating radar (GPR), hydro excavation, soft dig, etc.) dewatering and shoring of excavation works shall be the responsibility of the Contractor.

01100.3.2 Safety, Health, and Accident Prevention

Contractor shall take all precautions to protect the safety of its employees and others on the site. Work safety requirements shall comply with OSHA and Owner's Safe Work Practices.

01100.3.3 Lines and Grades

Basic horizontal and vertical control points exist on site as indicated on the design drawings. These points shall be used as datum for work under this Contract; however, Contractor shall verify that these control points are correct.

Work shall be done to the lines, grades, and elevations indicated on the design drawings. Contractor shall provide suitable equipment and competent workmen who shall locate and lay out the work.

Work done without being properly located may be ordered removed and replaced at Contractor's expense.

01100.3.4 Preservation of Monuments, Stakes, and Existing Monitoring Wells

Contractor shall carefully preserve monuments, benchmarks, reference points, stakes, and existing monitoring wells. Contractor will be charged with the expense of replacement of such items destroyed and shall be responsible for mistakes or loss of time that may be caused. Permanent monuments or benchmarks subject to removal or being disturbed shall be protected until they can be properly referenced for relocation. Contractor shall furnish materials and assistance for the proper replacement of such monuments or bench marks.

01100.3.5 Final Grading

At the completion of the Work, holes, ruts, settlements, and depressions resulting from the work shall be filled and graded to match elevations of adjacent surfaces, and areas disturbed by the work shall be restored to their original condition to the maximum extent practicable and as reasonably acceptable to Owner.

01100.3.6 Utility Conflicts

Contractor is responsible for providing the materials and labor required to resolve conflicts between the structures being installed by Contractor and the existing underground utilities and structures.

01100.3.7 Dewatering

If any dewatering is required to support the construction activities within the Contractor's Scope of Work, it shall be the responsibility of the Contractor and shall be performed in accordance with applicable permits, laws, and regulations. Dewatering shall be required for all Work which requires excavation below the groundwater table unless otherwise stated. The Contractor shall furnish all supervision, labor, materials, tools, and equipment required to install, operate, monitor, and maintain dewatering systems in accordance with the design drawings and permit requirements.

The dewatering systems shall be installed, operated, monitored, and maintained in accordance with the requirements of these specifications, the design drawings, the Saint Johns River Water Management District (SJRWMD), FDEP, the State of Florida, Duval County, and other applicable codes and standards. A detailed dewatering plan including identification of where, when, and how dewatering will be performed, calculation of expected dewatering flow, treatment of discharge flow, and demonstration of insignificant impacts to wetlands and offsite water table shall be provided by the Contractor to the Owner. Contractor shall acquire necessary permits.

01100.4 Division of Responsibility

The Division of Responsibility Matrix defining the Contractor's scope of supply and the Owner's scope of supply is included at the end of this section and supplements responsibility definition provided throughout the Contract Documents.

Division of Responsibility Matrix				
Engineering, Procurement, and Construction Items	Contractor	By Others	Owner	Remarks
Engineering design	PEMB System		X	Contractor to provide engineering design of complete PEMB Building System including Electrical, Lighting, Ventilation and Fire Suppression System. Owner's Engineer to provide engineering design of PEMB Foundation, Roads, Grading and Drainage and Yard Utilities

Division of Responsibility Matrix				
Engineering, Procurement, and Construction Items	Contractor	By Others	Owner	Remarks
Certified as-built drawings	X			Drawings shall be certified by the Contractor shall be identified with "AS-BUILT" designation per the requirements of the State of Florida.
Construction specifications			X	
Site survey	X(1)		X(2)	(1)As required for construction. (2) Owner shall provide existing survey.
Site Security	X		X	Contractor is responsible for securing their work area
Construction power supply	X			Owner will provide location for construction power; Contractor will be required to distribute from that point.
Construction water supply	X			Owner will provide location for service water; Contractor will be required to distribute from that point.
Construction sewage and waste disposal services	X			
Construction telecommunications	X			
All construction craft and supervision	X			
Permanent wiring from OWNER's electrical system to PEMB Warehouse Building	X			
Supply, Fabricate and Install Fire Protection Piping	X			
Excavate for Underground Piping and Electrical Connections	X			
Make Tie-ins into Existing Plant Piping	X			Tie-in connections required for fire water and service water systems.
Install Foundations	X			
Supply and install electrical conduits and Duct Bank	X			
Cable Pulling	X			
Grounding connections to existing plant ground grid	X			
Lightning Protection	X			
Power Wiring	X			

Division of Responsibility Matrix				
Engineering, Procurement, and Construction Items	Contractor	By Others	Owner	Remarks
Installation of all Electrical Panels	X			
Piping Hydro-testing	X			Contractor responsible for water disposal in accordance with local jurisdictional requirements
Equipment Testing and Startup	X			
Install Interior and Exterior Lighting Fixtures and receptacles	X			All lighting fixtures to be LED
Sitework for stormwater runoff/drainage	X			
Equipment Testing and Startup	X			

01100.5 Drawings and Technical Attachments

01100.5.1 Contract Drawings

The following listed drawings provided separately shall be part of the Contract.

Drawing No. or Other Designation	Rev. No.	Title
410518-CGAU-S1000	0	Warehouse Addition - Site Plot Plan
410518-CSTF-S3000	2	Warehouse Addition - Grading, Paving and Yard Utilities
410518-CBAU-S5001	1	Warehouse Addition - Foundation Plan and Details
410518-CBAU-S5950	0	Warehouse Addition - Foundation General Notes, Legend and Typical Details
410518-DS-A4000	2	Warehouse Addition – Conceptual Floor Plan
410518-DS-A4001	0	Warehouse Addition – Conceptual Elevation
410518-DS-E2300	0	Warehouse Electrical Site Plan – Notes and Requirements

01100.5.2 Technical Attachments and Reference Drawings

The Technical Attachments for this project are as listed below.

Drawing No. or Other Designation	Rev. No.	Title
D010322-591L100-01	0	Utility Engineers – Site Underground Utilities – Overall Plan
D010322-591L100-04	4	Utility Engineers – Site Underground Utilities – Zone 4
D010322-591L100-07	0	Utility Engineers – Site Underground Utilities – Zone 7

Drawing No. or Other Designation	Rev. No.	Title
D010322-572M001-01	4	Utility Engineers – Piping & Instrumentation Diagram – Fire Protection
D010322-577M001-01	3	Utility Engineers – Piping & Instrumentation Diagram – Potable Water

01100.6 Schedule of Submittals

Item No.	Reference Document	Submittal Item	Submittal Dates			
			Calendar Days		Event	Due Date
Schedule of Submittals						
	01100	Scope of Work				
	01100	Concrete mix design proportions for all components by mass: <ul style="list-style-type: none">• Cement• Supplementary cement materials• Coarse aggregate• Fine aggregate• Admixtures• Water• Entrained air• Other components.	10	Before	Placement	
	01100	Field and Laboratory Cast-in-Place Concrete Test Reports	7	After	Test	
0601	02220	Earthwork				
0602	02220	CLSM mix design	7	Before	Placement	
0603	02220	Plasticity test results	1	After	Test	
0604	02220	Gradation test results	1	After	Test	
0605	02220	Maximum density test results	1	After	Test	
0606	02220	Field density and water content test results			Submit on the day performed	
0607	02220	CLSM compressive strength test results	1	After	Test	
	03210	Concrete Reinforcement				
0608	03210	Reinforcing steel material certification: Billet steel bars		Upon	Delivery	
0609	03210	Reinforcing steel material certification: Low alloy steel bars		Upon	Delivery	
0610	03210	Reinforcing steel material certification: Epoxy coatings		Upon	Delivery	
0611	03210	Tensile tests	14	After	Tests	
0612	03210	Chemical analysis of bars to be welded		Upon	Delivery	
0613	03210	Placing drawings and bar lists	14	After	Receipt of engineering drawings	

Item No.	Reference Document	Submittal Item	Submittal Dates			
			Calendar Days		Event	Due Date
	03316	<u>Concrete Supply</u>				
0615	03316	Copy of Cement Mill Test Report		With	Mix proportions and with each new shipment	
0616	03316	Copy of Supplementary Cementitious Materials (fly ash, ground granulated blast furnace slag, silica fume, or other) Report		With	Mix proportions and with each shipment	
0617	03316	Admixture vendor technical data sheets		With	Mix proportions	
0618	03316	Design mix characteristics: <ul style="list-style-type: none"> • Design Strength • Documentation of required average strength by either of the following methods: 1. Historical data method with standard deviation and test records or 2. Trial batch method with trial mix and test data used to determine strength and proportions • Initial Slump • Augmented slump (after addition of high range water reducers) • Temperature • Time initial set • Unit weight – plastic • Unit weight - after set 		With	Mix Proportions	
	05500	<u>Miscellaneous Metals</u>				
0622	05500	Structural Steel Fabrication and Erection Drawings	30	After	Effective Date	
	10210	<u>Louvers</u>				
0901	10210	Louvers sound level data	30	After	Effective Date	
0902	10210	Louvers shop drawings, arrangement drawings, certified performance curves, and dimension data	30	After	Effective Date	
0903	10210	Louvers coating data, fabrication schedule, quality assurance inspection and test plan	45	After	Effective Date	
	13120	<u>Pre-Engineered Metal Building</u>				
0904	13120	Pre-engineered metal building design conference with Purchaser	15	After	Effective Date	
0905	13120	Pre-engineered metal building certified building drawings, all miscellaneous framing details, foundation loads, and anchor bolt arrangements	30	After	Effective Date	

Item No.	Reference Document	Submittal Item	Submittal Dates			
			Calendar Days		Event	Due Date
0906	13120	Pre-engineered metal building certified building drawings indicating underground piping arrangement to termination point approximately five feet outside of building edge. Termination point will be provided at contract award.	30	After	Effective Date	
0907	13120	Pre-engineered metal building certified design calculations for structural framing, structural anchorage, and covering panels	30	After	Effective Date	
0908	13120	Pre-engineered metal building doors and hardware, model numbers, manufacturers, and catalog data	45	After	Effective Date	
0909	13120	Pre-engineered metal building windows and glazing types, manufacturers, and materials	45	After	Effective Date	
0909	13120	Pre-engineered metal building electrical equipment manufacturer data sheets and plans showing location of panelboards, lighting and receptacles and other electrical equipment being furnished and installed.	45	After	Effective Date	
0622	15264	Valve Data Sheets	45	After	Effective Date	
	15830	<u>HVAC Fans</u>				
0910	15830	Exhaust Ventilation Calculation	45	After	Effective Date	
0911	15830	Certified loads for design of supports	45	After	Effective Date	
0912	15830	Sound level data	45	After	Effective Date	
0913	15830	Certified performance curves	45	After	Effective Date	
0914	15830	Dimension data	45	After	Effective Date	
0915	15830	Arrangement drawings	45	After	Effective Date	
0916	15830	Electrical one-line and elementary drawings	45	After	Effective Date	
0917	15830	Coating data	45	After	Effective Date	
0918	15830	Point-to-point wiring diagrams	45	After	Effective Date	
	19000	<u>Quality System Requirements</u>				
06105	19000	Certification Letter or Certificate of Authorization (copy), if certified by a registered agency, e.g., ASME Certificate of Authorization, ISO Certificate	30	After	Effective Date	
06106	19000	Subsupplier listing	5	Before	Issue of Subsupplier Purchase Order	

Item No.	Reference Document	Submittal Item	Submittal Dates			
			Calendar Days		Event	Due Date
06107	19000	Notification of inspection/test (for Purchaser identified hold/witness points)	14	Before	Test/Inspection	
06108	19000	Quality Manual, uncontrolled copy	28	After	Effective Date	
06109	19000	Inspection and test plan with monthly inspection target dates	28	After	Effective Date and then monthly thereafter	
	E640	<u>Low Voltage Induction Motors</u>				
0961	E640	Motor dimensional drawings	60	After	Effective Date	
0962	E640	Motor nameplate data	60	After	Effective Date	
	Q301	<u>Manufacturer's Standard Coating</u>				
06118	Q301	Shop drawings that identify shop-applied coating systems	10	Before	Start of Fabrication	
06119	Q301	Manufacturer's product data sheets	30	After	Award	
	Q500	<u>Shop Drawings and Instruction Manuals</u>				
0701	Q500	For instruction manual submittal requirements, refer to Technical Supplemental Q501 and the commercial submittals section.		Upon	Shipment of Equipment	
	Q502	<u>Electrical Data</u>				
0500	Q502	Completed motor information sheets	45	After	Award	
0501	Q502	Completed electric actuator information sheet	45	After	Award	

01200 – Technical Specifications and Datasheets

01200.1 Datasheets

Equipment and materials shall be supplied per the following listed datasheets.

Tag No.	Title
02220	Earthwork and Trenching
03210	Concrete Reinforcement Datasheet
03311	Cast-in-Place Concrete Datasheet
03316	Concrete Supply Datasheet
03611	Grouting Datasheet
05500	Miscellaneous Metals Datasheet
08100	Hollow Metal Doors & Frames Datasheet
10210	Louvers Datasheet
11390	Sanitary Lift Station Datasheet
13120	Pre-Engineered Metal Building Datasheet
16120	AC Panelboards Datasheet
16502	Lighting for Pre-Engineered Buildings Datasheet
19000	Quality System Requirements

02220 – Earthwork and Trenching Datasheet

Table 1 – General		
General		
1	Application	Excavation, subgrade preparation and backfill Construction of fills and embankments, surfacing, and grading Disposal of debris
2	Execution Requirements	In accordance with site requirements
3		
Codes and Standards		
4	Classification of Soils	ASTM D2487
5	Description and Identification of Soils	ASTM D2488
6	Particle Size Analysis	ASTM D422
7	Compaction Tests	
8	Standard Proctor	ASTM D698
9	Modified Proctor	ASTM D1557
10	In Place Density and Unit Weight Tests	ASTM D1556
11	In Place Density and Water Content Tests	ASTM D6938
12	Maximum Index Density and Unit Weight Tests	ASTM D4253
13	Minimum Index Density and Unit Weight Tests	ASTM D4254
14	Liquid Limit, Plastic Limit, and Plasticity Index Tests	ASTM D4318
15	Earthworks and Construction Safety	OSHA 29CFR Part 1926, Subpart P, "Excavations"
16		

Table 2 – Products		
1	Concrete Aggregates used as Fill Material	ASTM C33 or Standard Specification for Road and Bridge Construction, Florida Department of Transportation (DOT)
2	Nuclear Surface Moisture-Density Gauge	Select from: Troxler Model 3430, 3440, 3450, 3451 Campbell Pacific Nuclear (CPN) Model MC-3 and MC-1
3		

Table 3 – Execution		
Requirements and Performance		
1	Materials, Compaction, and Testing Requirements	As specified in Schedule A
2		
Testing		
3	Laboratory Testing	Performed by an independent testing laboratory acceptable to the Purchaser
4	Field Sampling and Testing Qualifications	NICET Level II Construction Materials Testing
5	Field Sampling and Testing Technicians	Employed by an independent testing company acceptable to the Purchaser Provide assistance to field testing representative upon request
6	Field Sample Locations	Selected by the Site QA Manager Arrange so as to represent the average density over the depth of the layer Perform additional field control tests as directed by Site QA Manager
7	Definitions	
8	Maximum Dry Density	Per ASTM D698 or ASTM D1557
9	Optimum Moisture Content	Per ASTM D698 or ASTM D1557
10	Relative Density	Per ASTM D4254
11	Distribution of Test Results	Provide to Purchaser on the day the test is performed
12		
General		
13	Backfill, Fill and Earth Materials	Do not place during freezing weather unless acceptable to the Engineer
14	Erosion and Sediment Control Measures	Install prior to any clearing operations Maintain during the course of the project
15		
Site Preparation		
16	Schedule	Perform clearing operations before excavations, subgrade preparation, and fill construction
17	Previous construction	Strip subgrades of all concrete, asphalt, conduit, pipes and demolition or construction debris

18	Noncombustible Material Removal	Remove from the construction areas for disposal off-site In accordance with the requirements of the regulatory authorities having jurisdiction
19	Combustible Material Removal	Remove and dispose off-site; Burning is prohibited In accordance with the requirements of the regulatory authorities having jurisdiction
20		
Water Removal		
21	Diversion of Surface Water	Divert surface water to prevent entrance into the excavations
22	Dewatering	As specified herein
23	Requirements	Design and operate by a dewatering specialist Provide adequate dewatering to remove and dispose of all surface and ground water entering excavations Keep the excavations dry Lower the water level in advance of the excavation utilizing wells, well points, or similar methods
24	Engineering Review	Submit the proposed dewatering system to the Engineer for review
25	Control of Ground Water	Control ground water in a manner to preserve the strength of foundation soils, cause no instability of excavation slopes and no damage to existing structures
26	Water Level	Maintain the water level, as measured by piezometers, continuously about 12 inches below the prevailing excavation level, or within about 12 inches of impermeable strata
27	Well Screening	Install wells and well points with suitable screens and filters so that continuous pumping of fines does not occur
28	Water Pumped and Discharge	Pump only water that is clear and free of fines . Open pumping with sumps and ditches resulting in boils, loss of fines, softening of the ground, or instability of slopes, is NOT permitted Arrange discharge so samples can be collected
29	Maximum turbidity	29 NTU above background
30	Header Systems	Lay on top of the ground only if they do not obstruct plant operations, construction activity, or traffic
31	Discharge Routing	Route to existing drainage system after fines have been removed. Ensure plant drainage system is not overloaded

32	Dewatering Operation	Operate continuously, if necessary, to maintain the specified water level until construction is no longer affected by ground or surface water
33	Pipe and Conduit Cleaning	Keep pipe or conduit used for drainage purposes clean and free of sediment
34	Dewatering System Removal	Remove all temporary dewatering piping and equipment after work completion and before the Contractor demobilizes from the site
35	Permanent Plant and Site Drainage	Repair all damage to the permanent plant and site drainage caused by dewatering operations
36		
Excavated Materials		
37	Stockpiling	Stockpile excavated materials that meet the specified requirements for fills, embankments, and backfills
38	Clean soil or gravel	Stockpile for later use
39	Separation of Rock	Keep rock that cannot be handled and compacted as earth separate from other excavated materials and do not mix with backfill, fill, or embankment materials
40		
Roadway Roadbeds		
41	Construction	Includes excavation, subgrade preparation, and construction of fills and embankments
42	Excavation	Remove the overburden in excavated roadbed areas Shape the subgrade to line, grade, and cross section Remove soft, organic, and other unacceptable material from the subgrade and replace with material meeting structural fill requirements
43	Compaction	Compact the subgrade in accordance with Schedule A requirements
44	Subgrade Finish	Uniform surface to allow for proper drainage
45	Tolerance	Within 0.1 foot of the elevation indicated on the drawings
46	Ditches	Maintain ditches and drains along the subgrade for effective drainage Reshape and recompact the subgrade when ruts of 2 inches or more in depth are formed
47	Material Stockpile	Do not store or stockpile material on subgrades
48		
Fills and Embankments		
49	Compliance with Drawings	Construct fills and embankments to lines and grades indicated on the drawings

50	Subgrade Preparation	<p>Scarify, level, and roll</p> <p>Ensure the subgrade surface is well bonded to the previous layers of fill</p> <p>Areas identified as soft or excessively disturbed shall be removed and replaced with compacted soil</p> <p>Seal subgrade with a smooth drum roller when inclement weather is expected, then scarify prior to adding overlying lifts</p> <p>Standing water is not permitted</p> <p>Allow areas that have been exposed to heavy rain or standing water to dry to within 2 percent of optimum water content prior to adding overlying lifts</p>
51	Observation	<p>Witnessing and approval of subgrade by a qualified soil technician and construction management required prior to fill placement</p>
52	Material	
53	Source	<p>Use earth materials obtained from excavations for the construction of fills and embankments to the maximum extent available</p> <p>Obtain additional material from borrow pits or approved off-site sources</p>
54	Properties	<p>Use cohesive soils</p> <p>Excavated material that is noncohesive may be placed in fills and embankments provided it is thoroughly mixed with cohesive material and an acceptable cohesive mixture results</p> <p>Provide cohesive materials classified as Group _____ in ASTM D2487, Table 1, Soil Classification Chart</p> <p>Remove excess noncohesive material for disposal</p>
55	Borrow Areas	<p>Excavate material necessary to complete fills and embankments from off-site borrow areas and haul the fill or embankment to site; No borrow material will be available on the Owner's property and it must be furnished from an acceptable source</p>
56	Objectionable Material	<p>Keep rocks or stones larger than allowed in Schedule A, brush, stumps, logs, roots, debris, and organic or other objectionable materials out of the material deposited</p>

57	Contamination	<p>Use material obtained from offsite sources free of contamination</p> <p>Free of contamination shall be defined as having a constituent concentration less than the lowest "Soil Cleanup Target Level" for that constituent listed in FDEP, Chapter 62-777 (8/5/1999), Contaminant Cleanup Target Levels, Table II - Soil Cleanup Target Levels. Inorganics, if above the levels in FDEP Chapter 62-777, must be within normal background levels for the site area.</p> <p>Provide documentation proving the material is free of contamination</p>
58	Placement	<p>Scarify the top 1 inch of each lift to promote bonding between lifts</p> <p>Place materials in approximately horizontal layers</p> <p>Spread and level material deposited in piles or windrows prior to compaction</p>
59	Compaction	<p>Compact each layer thoroughly to meet the requirements specified in Schedule A</p> <p>Modify the compaction methods to attain the specified density if the material first fails to meet the density specified</p> <p>Recompact failed layers until they meet the specification requirements in Schedule A</p>
60	Water Content	<p>Add water to meet the moisture content required by Schedule A and work into each layer using harrow, disk, blade, or other acceptable equipment to provide a uniform moisture content</p> <p>Remove water to meet the moisture content required by Schedule A using mechanical means to work the soil or other acceptable methods and equipment to provide uniform moisture content.</p> <p>Use of chemical additives to reduce or modify the moisture content requires Owner approval.</p> <p>Alter compaction methods if the material fails to meet the specified density required</p>
61		
Additional Requirements for Structures		
62	Structure Excavation	
63	Compliance with Drawings	Complete the excavation for structures the designated lines and elevations
64	Undercutting	<p>Control machine excavation to prevent undercutting the subgrade elevations indicated on the drawings</p> <p>Do not undercut vertical faces of excavations to provide for extended footings</p>

65	Excavation Below Structures	
66	Structures supported on subgrade	<p>Replace material excavated below the bottom of concrete structures with concrete placed monolithically with the concrete above</p> <p>Rock fill or lean concrete may be used, if acceptable to the Engineer</p>
67	Structure Subgrade	
68	Compliance with Drawings	Ensure the finished elevation of stabilized structure subgrades is not above the subgrade elevations indicated on the drawings
69	Subgrade Requirements	<p>Ensure subgrades for structures are firm, dense, free from mud, and sufficiently stable to remain firm and intact</p> <p>Thoroughly compact subgrades to the specified density listed in Schedule A</p>
70	Structural Fill Replacement	Over-excavate structure subgrades that cannot achieve the required density and replace with structural fill as defined in Schedule A
71	Subgrade Stabilization	Stabilize subgrades that are otherwise solid, but mucky on top due to construction operations, by reinforcing them with one or more layers of crushed rock or gravel unless otherwise noted on the drawings
72	Structural Fill	
73	Applicability	Fill placed beneath structures
74	Materials	Meet the requirements provided in Schedule A
75	Compaction	Mechanically compact backfill in accordance with the requirements in Schedule A
76	Compaction beneath pipes, drives, roads, or other surface construction	Requires special care
77	Trenching Through Structural Fill	Place and compact structural fill to at least 12 inches above the top of the pipe elevation before the trench is excavated
78	Structure Backfill	
79	Material	Use backfill material composed of earth only and, to the extent possible, free of wood, grass, roots, broken concrete, stones, trash, or other debris
80	Moisture Content	<p>Use loose earth having a moisture content as specified in Schedule A in order to obtain the specified density of the compacted soil</p> <p>Work so the moisture content is distributed uniformly</p> <p>Uniformly distribute water added for correction of moisture content prior to compaction</p> <p>Use wet, not just damp, granular material when compacted</p>

81	Placement	Deposit backfill around and outside of structures in approximately horizontal layers
82	Compaction	Mechanically compact backfill in accordance with the requirements in Schedule A Inundation with water to compact structure backfill is prohibited
83	Rolling Compaction	Rolling compaction of structure backfill will be permitted provided the desired compaction is obtained and damage to the structure is prevented
84	Restriction	Depositing or compacting tamped, rolled, or otherwise mechanically compacted backfill in water is prohibited
85		
Pipe Trench Excavation		
86	General	Limit opening of trench in advance of pipe laying to no more than is necessary to expedite the work Open cut from the surface except where boring is required
87	Alignment and Grade	Fix and determine by means of batter boards and offset stakes, laser beam equipment, or surveying instruments, unless otherwise accepted
88	Trench Widths	Provide adequate working space and pipe clearance during installation Keep to a minimum to allow installation and compaction around the piping Limit width as specified below Where necessary to reduce earth load on trench banks to prevent sliding and caving, banks may be cut back on slopes that do not extend lower than 12 inches above the top of the pipe
89	Only one pipe in a trench, maximum trench width measured at the bottom of the pipe	
90	Pipe 48 inches (1,200 mm) outside diameter and smaller	Pipe outside diameter plus 24 inches
91	Multiple pipes in a common trench	
92	Maximum trench width	Based on the outside diameter of the outside pipes
93	Maximum clear distance between the trench wall and the adjacent pipe	
94	Pipe 48 inches (1,200 mm) outside diameter and smaller	Pipe outside diameter plus 24 inches

95	Trench width exceeding specified Trench Width limits	Take corrective measures as required by the loading conditions Measures may include: Use of a stronger pipe Special pipe embedment Concrete encasement. Submit corrective measures to the Engineer for engineering review prior to implementation
96	Trench Depth	Excavate to the depth required for the installation of embedment material or concrete for encasement below the underside of the pipe
97	Excavation in locations where operation may cause damage to trees, buildings, culverts, or other existing property, utilities, or structures above or below ground	Mechanical equipment prohibited Use hand excavating methods
98	Bell Holes	Provide adequate clearance for tools and methods used to install the pipe Prevent parts of any bell or coupling from being in contact with the trench bottom, walls, or embedment when the pipe is jointed
99		
Pipe Embedment		
100	Trench Subgrade	Firm, dense, free from mud, and sufficiently stable to remain firm and intact Stabilize subgrades that are otherwise solid, but mucky on top due to construction operations, by reinforcing them with one or more layers of crushed rock or gravel unless otherwise noted on the drawings
101	Maximum depth of mud or muck allowed to remain on stabilized trench bottom when pipe embedment material is placed	1/2 inch
102	Embedment Classes	Class A for all pipe materials unless noted otherwise on the drawings.
103	Placement below pipe	Spread embedment material on the trench bottom and grade the surface to provide a uniform and continuous support beneath the pipe at all points between bell holes or pipe joints
104	Compaction	Compact embedment material a minimum of 4 passes with a vibratory flat plate type compactor Adjust compactive effort and moisture content to provide a firm but slightly yielding support for the pipe Compact each layer uniformly
105	Pipe coatings	Ensure coatings are not damaged during placement and compaction

106		
Pipe Trench Backfill		
107	Material	Use either suitable job excavated material or material from offsite sources
108	Compaction	Compact trench backfill above the pipe embedment for the full depth of the trench above the embedment Use appropriate methods and equipment for the material being compacted Ensure no damaging shocks are transmitted to the pipe
109	Contamination	As specified herein for fills and embankments
110	Beneath established lawn areas	Finish the top portion of backfill with at least 6 inches of topsoil similar to the topsoil in adjoining lawn areas
111		
Ductbank Trenching		
112	Excavation	Excavate to lines indicated on the drawings or at other locations acceptable to the Engineer and to within 1/2 inch of the depth required Sufficient to permit the duct bank to rest on undisturbed earth or rock
113	Trench through backfill	Ensure the earth is well compacted before the duct bank is installed
114	Trench widths	Wide enough to provide ample room for workmen engaged in handling and installing the ducts
115	Trench sides	Where it is necessary to reduce the earth load on trench banks to prevent sliding or caving, trench banks may be cut back on slopes
116	Trench subgrade	Firm, dense, free from mud, and sufficiently stable to remain firm and intact
117	Backfill	As specified herein for fills and embankments
118		
Pavement Removal and Replacement for Trenching		

119	Cutting concrete and asphalt pavement	<p>No larger than necessary to provide adequate working space for proper installation of pipe ducts structures and appurtenances</p> <p>Start cutting with a concrete saw and provide a clean groove at least 1-1/2 inches deep along each side of the trench</p> <p>Ensure pavement cuts are straight or accurately marked curved lines parallel to the centerline of the trench</p> <p>Provide shoulder not less than 6 inches in width between the cut edge of the pavement and the top edge of the trench</p>
120	Associated excavation	<p>Excavate trench such that trench width at the bottom is not greater than at the top</p> <p>Undercutting of trenches is prohibited</p>
121	Drives, walks, curbs, or other surface construction	<p>If the trench parallels the length of concrete walks and is all or partially under the walk, remove and replace the entire walk</p> <p>Where the trench crosses drives, walks, curbs, or other surface construction, remove and replace the surface between existing joints or saw cuts</p>
122	Replacement surfacing	<p>Replace surfacing over backfilled trenches crossing surfaced areas</p> <p>Match the existing surfacing and finish flush with the adjoining surfaces</p> <p>Use base material for surfacing that matches the thickness and density of the material excavated</p>
123		
Additional Requirements for Fill Materials		
124	Applicability	Provide Compacted Rock Fill, Compacted Sand Fill, and Drainage Fills where indicated on the drawings
125	Compacted Rock Fill	
126	Material	<p>Consists of crushed rock</p> <p>Crushed concrete meeting gradation and requirements may be used with Engineer's approval</p>
127	Placement	Handle and place crushed rock in a manner that prevents segregation of sizes
128	Rock Moisture Content	The moisture content specified in Schedule A is required for fill material to achieve the compaction required
129	Compaction	Perform compaction with vibrating mechanical compactors in accordance with the requirements in Schedule A

	Fill Finishing	Where concrete is to be placed on the compacted rock fill, finish the fill with a thin layer of clean concrete sand to fill all voids and interstices to obtain the required subgrade elevation
130	Compacted Sand Fill	
131	Material	Use clean, natural sand
132	Subgrade	Place sand fills on undisturbed or compacted subgrade
133	Compaction	Compact using mechanical vibrators Compaction and moisture content must meet the requirements in Schedule A
134	Drainage Fills	Unwashed material is unacceptable
135	Sand Drainage Material	ASTM C33, clean concrete sand
136	Drainage Filter Material	Washed rock or crushed gravel
137	Compaction	Compact sand drainage fill and drainage filter material with a vibrating compactor Compaction and moisture content must meet the requirements in Schedule A
138	Controlled Low Strength Material (CLSM)	Provided in accordance with FDOT Specifications Item 121, "Excavatable Flowable Fill"
139		
Project Completion		
140	Maintenance and Restoration	
141	Erosion and Settlement	Repair fills, embankments, and backfills that settle or erode before final acceptance of the work Repair pavement, structures, and other facilities damaged by settlement or erosion Fill, compact, and grade the settled or eroded areas to conform to the elevation indicated on the drawings or to the elevation of the adjacent ground surface
142	Facilities Damage	Repair damaged facilities in a manner acceptable to the Purchaser
143	Earth Slope Maintenance	Maintain earth slopes of the roads and railroads to the lines and grades indicated on the drawings until the final acceptance of the work

144	Final Grading	<p>Grade all ground surface areas disturbed by construction activities after all construction work has been completed</p> <p>Finish the grading to the contours and elevations indicated on the drawings or, if not indicated, to match the contours and elevations of the original, undisturbed ground surface</p> <p>Provide smooth uniform surfaces with the final grading shall for effective drainage of the ground areas</p>
145	Disposal of Surplus Materials	<p>Spoil surplus earth and materials not suitable for the work on the site in a manner and location designated by the Owner</p> <p>Spoil material not suitable for work separately from surplus material</p> <p>Keep stockpiles of surplus material free from brush, trees, debris, or other organic or deleterious materials</p> <p>Offsite disposal may be used if allowed by the Site Construction Manager</p> <p>Deposit materials in the on-site disposal areas and level in 12 inch maximum layers</p> <p>Compact on-site material with at least three passes of a bulldozer</p> <p>Dispose of material in accordance with all federal, state, and local requirements pertaining to construction landfills</p>

Schedule A Materials, Compaction, and Testing Requirements										
Material	Plasticity Requirements	Gradation Requirements	Maximum Dry Density	Maximum Density Test Frequency	Required Field Density	Field Density Test	Field Density Test Frequency	Required Field Water Content	Field Water Content Test	Required Lift Thickness
Roadway and railroad roadbed	-	-	ASTM D1557, Method C	3 initial tests; further tests as directed	92% Max. Dry Density	ASTM D6938; ASTM D1556	One test per 500 sy (420 sm), or as required	-2% to +2% of optimum water content	ASTM D6938; ASTM D1556	8 inches (200 mm) depth
embankments	-	6 inch (150 mm) max; 3 inch (75 mm) max in upper 18 inches (460 mm)	ASTM D1557, Method C	3 initial tests, further tests as directed	95% Max. Dry Density	ASTM D6938; ASTM D1556	One test per 500 cy (380 cm), or as required	-2% to +2% of optimum water content	ASTM D6938; ASTM D1556	8 inches (200 mm) thick lift prior to compaction (loose lift)
Structure subgrade	-	-	ASTM D1557, Method C	1 initial test; further tests as directed	95% Max. Dry Density	ASTM D6938; ASTM D1556	One test per 1,000 sy (840 sm), or as required. Min one per foundation for foundations over 10 sy (8 sm)	-2% to +2% of optimum water content	ASTM D6938; ASTM D1556	8 inches (200 mm) depth
Structure backfill	Structure backfill placed against below grade walls shall be non-swelling material with a liquid limit (LL) less than 40 and a PI less than 15.	3 inch (75 mm) max ≤85 percent minus No. 200 (75 µm)	ASTM D1557, Method C	3 initial tests; further tests as directed	95% Max. Dry Density	ASTM D6938; ASTM D1556	One test per 200 cy (150 cm), or as required	-2% to +2% of optimum water content	ASTM D6938; ASTM D1556	8 inches (200 mm) thick lift prior to compaction (loose lift)

Schedule A Materials, Compaction, and Testing Requirements										
Material	Plasticity Requirements	Gradation Requirements	Maximum Dry Density	Maximum Density Test Frequency	Required Field Density	Field Density Test	Field Density Test Frequency	Required Field Water Content	Field Water Content Test	Required Lift Thickness
30 inch (750 mm) pipe or smaller Crushed rock or crushed gravel embedment	Non-plastic	Perform at least two gradation tests; at least 95% passing 1/2 inch (12.5 mm) sieve and not more than 5% passing No. 4 sieve (4.75 mm)	ASTM D4253 and ASTM D4254	2 initial tests; further tests as directed	70% Relative Density	ASTM D6938; ASTM D1556	One test per 100 feet (30 m) of trench for each lift	-	-	8 inches (200 mm) max
Sand embedment	Non-plastic	Perform at least two gradation tests; at least 95% passing No. 4 (4.75 mm) sieve and not more than 5% passing No. 100 sieve (150 µm)	ASTM D698, Method C	2 initial tests; further tests as directed	95% Max. Dry Density	ASTM D6938; ASTM D1556	One test per 100 feet (30 m) of trench for each lift	-	-	8 inches (200 mm) max
Trench backfill	LL < 40 PI < 15	3 inch (75mm) max particle size	ASTM D1557, Method C	2 initial tests; further tests as directed	90% Max Dry Density	ASTM D6938; ASTM D1556	One test per 100 feet (30 m) of trench for each lift	-2% to +2% of optimum water content	ASTM D6938; ASTM D1556	8 inches (200 mm) max
Trench backfill where trench crosses a roadway, permanent parking lots or other trench and facilities subject to damage by settlement	Non-plastic	3 inch (75mm) max particle size	ASTM D1557, Method C	2 initial tests; further tests as directed	95% Max Dry Density	ASTM D6938; ASTM D1556	One test per 100 feet (30 m) of trench for each lift	-2% to +2% of optimum water content	ASTM D6938; ASTM D1556	8 inches (200 mm) max

Schedule A Materials, Compaction, and Testing Requirements										
Material	Plasticity Requirements	Gradation Requirements	Maximum Dry Density	Maximum Density Test Frequency	Required Field Density	Field Density Test	Field Density Test Frequency	Required Field Water Content	Field Water Content Test	Required Lift Thickness
Compacted rock fill	Non-plastic	1-1/2 in. (38 mm) max. to crusher fines	ASTM D4253 and D4254	3 initial tests; further tests as directed	70% Relative Density	ASTM D6938; ASTM D1556	One test per 200 cy (150 cm), or as required	As required to achieve field density	ASTM D6938; ASTM D1556	8 inches (200 mm) thick lift prior to compaction (loose lift)
Compacted sand fill	Non-plastic	≥75% minus No. 4 (4.75 mm); ≤10% minus No. 200 (75 µm); ASTM C33 or Type ____ per Section ____ of ____ DOT	ASTM D1557, Method C	3 initial tests; further tests as directed	92% Max. Dry Density	ASTM D6938; ASTM D1556	One test per 200 cy (150 cm), or as required	-2% to +2% of optimum water content	ASTM D6938; ASTM D1556	8 inches (200 mm) thick lift prior to compaction (loose lift)
Sand drainage fill	Non-plastic	Uniformly graded from No. 4 (4.75 mm) to No. 100 (150 µm) sieve	ASTM D4253 and D4254	3 initial tests; further tests as directed	65% relative density	ASTM D6938; ASTM D1556	One test per 500 cy (380 cm), or as required	As required to achieve field density	ASTM D6938; ASTM D1556	4 inches (100 mm) compacted

03210 - Concrete Reinforcement Datasheet

Table 1 - General		
General		
1	Reinforcing Steel Sizes Indicated on Drawings	US Standard Units
2		
Codes and Standards		
3	Specification for Structural Concrete	ACI 301-10
4	Reinforcing Steel Detailing	ACI Manual SP 66
5	Concrete Building Code	ACI 318-19
6	Billet Steel	ASTM A615
7	Low Alloy Steel	ASTM A706
8	Epoxy Coating	ASTM D3963
9	Welded Wire Fabric	ASTM A1064
10		

Table 2 - Products		
Requirements and Performance		
1	Reinforcing Steel Materials	
2	Straight bars of all diameters and bent bars with a diameter less than 1-1/2 inches (38 mm)	Deformed billet steel bars, 60 ksi (420 MPa)
3	Lap Splices	
4	Maximum Bar Diameter for Lap Splices	1-3/8 inches (35 mm)
5	Horizontal reinforcing in vertical walls	Detail in accordance with top reinforcing requirements
6	In regions of maximum bending stress	Not permitted
7	Lap splice reductions due to staggered splice locations or excess reinforcement	Not permitted (unless indicated on the drawings)
8	Mechanical Splices	
9	Type	Metal Filled or Threaded Couplers
10	Metal Filled	Erico Products Cadweld
11	Threaded Coupler	LENTON Taper Threaded Couplers as Manufactured by ERICO

Table 2 - Products		
12	Alternate products	<p>Pre-approval by Purchaser required prior to use of product from alternate manufacturer</p> <p>Comparable performance to specified product required for alternate product</p> <p>Vendor data sheets required with submittal</p> <p>Purchaser reserves the right to reject an alternate product or manufacturer.</p>
13	Minimum Strength	125 Percent of reinforcement yield strength
14	Inspection procedures	In accordance with manufacturer's criteria. Provide to the Engineer for review.
15	Bar Supports	
16	Exposed	CRSI Class 1
17	Unexposed	CRSI Class 3
18	Reinforcing Spacing Limits	
19	Minimum clear distance between individual parallel bars in a horizontal layer. Also applies to the clear distance between a contact lap splice and adjacent splices or bars.	<p>4/3 times the maximum size of coarse aggregate</p> <p>One nominal bar diameter (use the diameter of the larger bar if the diameters are not equal)</p> <p>1 inch (25 mm) in beams</p> <p>1-1/2 inches (38 mm) in columns</p> <p>2 inches (50 mm) in other locations</p>
20	Minimum clear distance between longitudinal bars in columns, pedestals, struts and boundary elements	<p>Greatest of:</p> <p>1.5 inches</p> <p>1.5 nominal bar diameters</p> <p>4/3 times the maximum coarse aggregate size</p>
21	Minimum clear distance between layers for beam reinforcing placed in two or more layers	1 inch (25 mm) with upper layer bars placed directly above the lower layer bars
22	Minimum clear cover	Per specified Concrete Building Code
23	Welding of reinforcing steel	Prohibited. Remove unauthorized welds and replace the reinforcing steel
24	Welded chairs and supports	Permitted
25		
Testing and Inspection		
26	Tensile Tests	ASTM A615 and A706
27		
Drawings		

Table 2 - Products		
28	Placement Drawings	Detail support system for reinforcement Locate all control joints Designate a numbering system for each placement.
29	Bar List	Indicate grade of reinforcement
30	List on each bar list and placement drawing	Name of project Unit designation Contract title and number Name of the building or structure Concrete placement number Supplier's name
31		

Table 3 - Execution		
Delivery		
1	Shipping bundles	Ship all bundles required for one or more concrete placements per shipment. Tag with a sturdy, durable, weatherproof tag. Provide binding capable of safely holding the entire weight of the entire bundle Provide complete bundle-by-bundle inventory that duplicates the information listed on all the tags of all the bundles listed.
2	List on each delivery tag	Placement Number (according to Purchaser's designation) If bar is a dowel bar, the placement number is the first of the two placements. Bar Diameter Number of bars in bundle Position/Shape number Bar length Weight of bundle Graphical description of bar shape

03311 - Cast-in-Place Concrete Datasheet

Table 1 - General		
General		
1	Application	Onsite construction of concrete structures.
2		
Codes and Standards		
3	Structural concrete for buildings	ACI 301
4	Hot weather concreting	ACI 305R
5	Cold weather concreting	ACI 306R and ACI 301
6	Mass Concrete Thermal Control Plan	ACI 207.2R
7	Building code requirements for reinforced concrete	ACI 318
8	Recommended practice for concrete formwork	ACI 347R
9	Splices in reinforcing steel	ACI 318
10	Installation of structural steel and miscellaneous metals	AISC 303 Code of Standard Practice for Steel Buildings and Bridges
11	Tolerances for concrete work	ACI 117
12	Finishes and finishing	ACI 301
13	Sampling and Testing for Strength	ACI 318, Section 26.12
14		

Table 2 - Products		
Products and Materials		
1	Form coating	Nox-Crete Form Coating, L&M Debond, Richmond Clean Strip Ultra, Symons Magic Kote
2	Form ties	
3	Type	Removable end, permanently embedded body type In liquid retaining structures, provide integral water stops
4	Minimum distance of outer ends of the permanently embedded portion back from adjacent outer concrete faces.	1 inch
5	Acceptance by Owner	Required
6	Vapor retarder	ASTM E1745 Class A, 10 mil
7	Water stops	
8	PVC Type	

Table 2 - Products		
9	Construction joints	PVC ribbed or serrated, 6 inches by 3/8 inch, with "O" bulb closed center section Select from: Vinylex RB6-38 Greenstreak Style 705 J.P. Specialties Earth Shield PVC605 BoMetals Ribbed Center Bulb RCB-638
10	Expansion or isolation joints	PVC ribbed or serrated, 9 inches by 3/8 inch, with "O" bulb closed center section Select from: Vinylex RB9-38 Greenstreak Style 709 BoMetals Ribbed Center Bulb RCB-938
11	Hydrophilic Type	
12	Concrete joints and pipe penetrations in doubly reinforced secondary containment concrete walls and slabs 8 inch or greater thickness	Expanding preformed rubber strip, expansion pressure greater than or equal to 100 psi CETCO Akwastop Adeka Ultra Seal MC-2010MN (for pipe diameters greater than 24") Adeka Ultra Seal MC-2005T (for pipe diameters less than 24")
13	Concrete joints and pipe penetrations in secondary containment concrete walls and slabs 8 inch or less thickness	Expanding preformed rubber strip, expansion pressure less than 100 psi Adeka Ultra Seal KBA-1510FP
14	Concrete curbs, 8 inches minimum thickness	Bentonite/butyl rubber strip, expansion pressure less than 100 psi Select from: CETCO Waterstop RX-102 Sika Hydrotite CJ 1020
15	Expansion joint material	ASTM D1752, Type 1 sponge rubber or closed cell PVC or polyethylene foam
16	Polyurethane sealant	ASTM C920, Type M, Grade P, Class 25, Use T
17	Expansion joint shear bar	ASTM A36 smooth round bar; galvanized or epoxy coated
18	Expansion cap	Sika Speed Dowel for Construction Joints, Meadow Burke Plastic Dowel Cap, or approved equal
19	Finishing aid	SikaFilm or approved equal
20	Membrane curing compound and floor sealer	ASTM C1315, Type 1, Class A, acrylic copolymer, with a minimum 25 percent solids, nonyellowing, maximum moisture loss 0.40 kg/m ² in 72 hours
21	Membrane curing compound, dissipating type, where specified herein or indicated on the drawings	ASTM C309, Type 1, Class A, maximum moisture loss 0.55 kg/m ² in 72 hours

Table 2 - Products		
22	Epoxy bonding adhesive for joints between existing and new concrete	ASTM C881, Types I and V, moisture insensitive, 100 percent solids Select from: Sika Sikadur 32 Hi-Mod BASF MasterEmaco ADH 326 Euclid Chemical Duralprep A.C.
23	Acrylic bonding adhesive for joints between existing and new concrete	ASTM C1042, Type 2 ASTM C1059, Type 2 Select from: Dayton Superior Acrylic Bonding Agent J40 Spec Chem Strong Bond Acrylic Bonding Agent
24	Reinforcing adhesive	Hilti HIT-HY 200
25	Anchor rods and sleeves	As specified in Section 05500 Miscellaneous Metals.
26		

Table 3 - Execution		
Steel Reinforcement		
1	Placement	Accurately position and secure in place with wire ties or suitable clips Prohibit contact between bare metal supports and forms for exposed concrete surfaces Where reinforcements in beams are placed in two or more layers, place the bars in the upper layer directly above the bars in the lower layer
2	Minimum clear distance between: individual parallel bars in a horizontal layer contact lap splice and adjacent splices or bars	Greatest of: 4/3 times the maximum size of coarse aggregate One nominal bar diameter (use the diameter of the larger bar if the diameters are not equal) 1 inch in beams, 1-1/2 inches in columns, or 2 inches in other locations
3	Minimum clear distance between longitudinal bars in columns, pedestals, struts and boundary elements	Greatest of: 1.5 inches 1.5 nominal bar diameters 4/3 times the maximum coarse aggregate size
4	Minimum clear distance between layers for reinforcement in beams placed in two or more layers	1 inch
5	Splices	
6	Permitted splice type for bars with a nominal diameter less than 1-1/2 inches	Lap splice or mechanical splice
7	Permitted splice type for bars with a nominal diameter greater than or equal to 1-1/2 inches	Mechanical splice

Table 3 - Execution		
8	Lap splice length of horizontal reinforcement placed in vertical wall sections	In accordance with top reinforcement requirements
9	Lap splice length	Sufficient to permit all bars to be spliced at the splice location with no reduction in splice length due to staggered splice locations or excess reinforcement unless otherwise indicated on the drawings.
10	Splices in regions of maximum bending stress.	Prohibited
11	Mechanical splices shall develop	125 percent of yield strength of spliced bars
12	Welded splices	Prohibited unless directed by the Engineer
13	Field bending or straightening of reinforcement partially embedded in hardened concrete	Requires approval of the Engineer
14	Installation in Hardened Concrete	
15	Cutting of reinforcing during boring, drilling, sawing or other activities	Prohibited without the Owner's consent If reinforcement is encountered while drilling, stop drilling and contact the Owner
16	Anchorage method	Specified reinforcing adhesive
17	Installation methods	In accordance with manufacturer's installation instructions
18	Hole depth	Sufficient to develop the tensile strength of the reinforcing bar as recommended in the manufacturer's literature
19		
Formwork		
20	Design and construction	Maintain position, shape, and alignment during and after placement of concrete
21	Earth forms for foundations completely below grade	Acceptable when soil conditions are suitable Where concrete protection for reinforcement is indicated as less than 3 inches, increase the gross dimensions of the concrete so as to provide for 3 inches of protections against the earth form Remove loose dirt prior to placing concrete
22	Suspended members supported by concrete columns or piers	Form to allow the column or pier forms to be removed without disturbing the supports for the suspended members
23	Vertical surfaces of footings extended above finished grade	Formed

Table 3 - Execution		
24	Form Ties	<p>Provide sufficient strength, stiffness, and rigidity to support and maintain the form in proper position and alignment without the use of auxiliary spreaders</p> <p>Construct permanently embedded portions of form ties that are not provided with threaded ends to allow the removable ends to be broken off by twisting without chipping or spalling the concrete surface</p> <p>Uniformly space at exposed surfaces</p>
25	Chamfer strips at edges and corners	
26	Size	3/4 inch by 3/4 inch unless indicated otherwise on the drawings
27	Equipment bases	Provide at all vertical and horizontal corners unless indicated otherwise on the drawings.
28	Omit	At edges designated on the drawings to receive special treatment
29	Formwork removal	<p>Formwork may be removed in accordance with Lines 30-35 below.</p> <p>The Supplier is responsible for limiting any applied loadings to uncured concrete or reinforcing the shoring/formwork as necessary to support the load</p> <p>Ensure no damage to concrete and no excessive deflection or distortion of members due either to the removal of forms or to loss of support</p> <p>Reshores for horizontal members shall be installed the same day that the supporting formwork was removed. Reshoring shall be adequate to carry any additional construction loads applied after the reshores are installed</p> <p>For determining the strength of concrete for the removal of forms, cylinders shall be made and cured on site in conditions no better than those of the actual structure. The cylinders shall be cast per ASTM C31 and tested per ASTM C39</p> <p>Removal times for vertical forms that support formwork for horizontal members are the same removal times as the horizontal members</p> <p>When forms are removed before the specified curing is completed, take measures to immediately continue curing</p> <p>When forms are removed in cold weather conditions, adequate thermal protection for the concrete shall be provided.</p>
30	Minimum Concrete Strength or Time required for Form Removal (assumes normal weight concrete without retarding agents)	
31	Vertical formwork	75 percent of the specified 28 day compressive strength as determined by cylinder break data

Table 3 - Execution		
32	Wall formwork (subject to wind load)	75 percent of the specified 28 day compressive strength as determined by cylinder break data
33	Supporting formwork for horizontal members for installation of reshores	75 percent of the specified 28 day compressive strength as determined by cylinder break data
34	Reshores	Specified 28 day compressive strength as determined by cylinder break data
35	Mass concrete	75 percent of the specified 28 day compressive strength as determined by cylinder break data
36		
Embedments and Accessories		
37	Anchor rods	Secure anchor rod in its proper position with nuts Anchor rods may not be repaired, replaced, or field modified without the approval of the Owner. If anchor rods become damaged the contractor shall submit a formal repair plan to the Owner for review and approval as noted in Section 05500 Miscellaneous Metals.
38	Welding of embedments to structural reinforcement	Prohibited
39	Anchor rod sleeves, handrail sleeves, and similar openings in concrete susceptible to filling with water and freezing	Fill open sleeves and other openings with closed cell PVC expansion joint filler for protection until grouting Cut out upper neck of plastic anchor rod sleeves and fill the annular space with closed cell PVC expansion joint filler or other means acceptable to the Engineer
40	After concrete placement	Clean exposed surfaces of embedments of all concrete spatter and other foreign substances
41	Water stops	Use PVC Type unless noted otherwise Insure water stops are clean and free from coatings that weaken the bond with concrete
42	PVC water stops	Continuous throughout the length of the joint Intersections made using factory prefabricated crosses, tees, and ells Performance of splices equal to that of the continuous material and be made in strict conformance with the recommendations of the water stop manufacturer
43	Hydrophilic water stops	Install as recommended by water stop manufacturer
44	Vapor retarder	Place between soil and cast-in-place concrete where indicated on the drawings Install in accordance with ASTM E1643
45		
Placement		
46	Adjustments	May be made for weather or placement conditions Acceptance of Site Construction Manager required

Table 3 - Execution		
47	Minimum advance notice to Owner of times and locations of Concrete Placement	24 hours
48	Limits of each concrete pour	Defined by construction joints indicated on the drawings
49	Preparation	
50	Subgrade preparation	Moisten with water prior to concrete placement Insure there are no puddles or wet, soft, unstable or muddy areas when the concrete is placed
51	Concrete placed against rock or existing concrete	Remove loose pieces of rock removed and clean exposed surface with a high-pressure hose before concrete is placed Clean surfaces encrusted with dried mortar or concrete from previous placement operations before placing new concrete
52	Condition of space receiving concrete	Clean and clear of debris and standing water
53	Acceptance of the entire installation by the Site Construction Manager or designee before concrete is placed	Required
54	Bonding to Hardened Concrete	
55	Cleaning of hardened surface	Remove all laitance and foreign substances Wash with clean water Achieve saturated-surface-dry condition by soaking with potable water for 8 to 24 hours before the fresh concrete is placed Remove excess water from the surface receiving concrete prior to placement
56	Surface roughness	Select either Method 1 or Method 2
57	Method 1	At the time of the initial concrete placement, apply a retarding agent to the fresh concrete After hardening, pressure wash the concrete to remove laitance and expose the aggregate
58	Method 2	Roughen the concrete at the time of initial concrete placement or by mechanical means after the concrete has hardened Expose the aggregate and insure roughened surface has an open pore structure
59	Roughness of hardened concrete upon which fresh concrete will be placed	Approximately 1/4 inch amplitude
60	Surface bonding treatments	Select either Method 1 or Method 2

Table 3 - Execution		
61	Method 1	Deposit a 2 inches thick mortar puddle on hardened concrete in wall and column forms immediately before placing fresh concrete Mortar puddle to be the specified concrete mix, at the same water content, with the coarse aggregate omitted.
62	Method 2	Use the specified epoxy or acrylic bonding adhesive Install epoxy or acrylic bonding adhesive in accordance with the manufacturer's instructions Place concrete before the adhesive sets
63	Conveyance and Distribution	Convey concrete to the placement location by methods that prevent separation or loss of the ingredients
64	Depositing Concrete	
65	Deposited layers	Horizontal
66	Maximum depth of layer	24 inches
67	Condition of each layer of concrete when succeeding layers are placed	Plastic. See Note 1 Prepare concrete that is no longer plastic as specified for Bonding to Hardened Concrete and slush with mortar puddle Acceptance of preparation of the in-place concrete by Purchaser required before successive layer of concrete is placed
68	Maximum distance deposited concrete may be moved laterally in the forms	5 feet
69	Underwater concrete placement	
70	Placement method	Tremie system or other method acceptable to the Engineer
71	Provide placement plan covering the number of tremie pipes, locations, and rate of placement to the Engineer prior to beginning placement activities	Required
72	Tremie pipes size	Between 8 and 10 inches in diameter or as required to prevent aggregate blockage within the pipe during concrete placement
73	Minimum head of concrete above the tremie pipe mouth	3 foot
74	Consolidation	
75	Method	Compact concrete using mechanical immersion type vibrating equipment
76	Mechanical vibrators	
77	Minimum vibration rate	9,000 cycles per minute when immersed in the concrete
78	Minimum motor size	1-1/2 hp

Table 3 - Execution		
79	Acceptance by the Site Construction Manager or designee of number and type of vibrators	Required
80	Hot Weather Requirements	
81	Maximum temperature that does not require special procedures to keep the concrete as cool as possible during placement and curing	90° F
82	Cold Weather Requirements	
83	Minimum concrete temperatures immediately after placement and maintained throughout the curing period when the average of the highest and lowest temperature during the period from midnight to midnight is expected to be less than 40° F for more than 3 successive days,	
84	Sections less than 12 inches in the least dimension	55° F
85	Sections 12 inches to 36 inches in the least dimension	50° F
86	Sections 36 inches to 72 inches in the least dimension	45° F
87	Sections greater than 72 inches in the least dimension	40° F
88	Maximum time interval for measuring concrete temperature during the protection period	12 hours
89	Placement on frozen ground	Prohibited If the subgrade is frozen, remove before concrete is placed If freezing weather is expected, protect the subgrade receiving concrete from freezing
90	Mass Concrete	
91	Applicability	Structures indicated on the drawings as mass concrete

Table 3 - Execution		
92	Thermal Control Plan	<p>Perform thermal modeling of the concrete mix and develop a Thermal Control Plan for the concrete placement in accordance with ACI 301 using ACI 207.2R as supplemental information</p> <p>Determine the limits on initial temperature at placement</p> <p>Determine cooling system requirements and duration for operation of the cooling system</p> <p>Define the temperature difference limit so that the thermal stresses do not exceed the tensile strength of the concrete and thermal cracking is prevented</p> <p>Define required curing techniques</p>
93	Coordination	Coordinate with the concrete supplier to meet the temperature requirements for the concrete at the delivery point
94	Methods	<p>Insure concrete cools gradually during and at the conclusion of the specified curing period</p> <p>In cold weather, meet the requirements for cold weather placement</p>
95	Temperature of concrete when deposited	Maximum 70° F, Minimum 35° F unless the Supplier submits an alternative placement plan for acceptance by the Owner
96	Maximum drop in concrete surface temperature during the curing period	20° F in any 24 hour period
97	Maximum temperature gradient between the center and the surface of the concrete during the curing period	35° F
98	Maximum internal temperature	160° F
Joints		
99	Construction Joints	
100	Alternate arrangements	Obtain Owner's acceptance before detailing and fabricating reinforcing steel
101	Joints subjected to differential hydrostatic pressure	Provide a water stop
102	Movement Joints	
103	Types	Expansion, contraction, or isolation joints
104	Installation	<p>Firmly bond joint filler to the previously placed joint face with a suitable adhesive</p> <p>Place new concrete directly against the joint filler</p> <p>Seal accessible edges of each joint with polyurethane sealant.</p>
105	Joints subjected to differential hydrostatic pressure	Provide a water stop

Table 3 - Execution		
106	Sawed slab control joints	
107	Cutting of reinforcement during sawing	Prohibited
108	Size	1/8 inch to 5/32 inch wide
109	Minimum depth	One fourth of the slab thickness but not less than 1 inch
110	Maximum time from concrete placement to completion of sawing	12 hours
111		
Openings in Concrete		
112	Concrete wall and floor openings for piping and other fixtures to be installed after the walls and floors are built	Allow sufficient space to properly compact concrete to fill the space around the pipe or fixture
113	Top of each wall opening	Slope or bevel to provide adequate space for placing and compacting the pipe embedment concrete.
114	Wall openings below grade and floor openings that are exposed to weather or submergence.	Provide a water stop around opening
115		
Finishing and Separate Finishes		
116	Formed surfaces	Standard finish (rough form finish). Surface finish is that imparted by the forms. Mockup not required.
117	Unformed surfaces	
118	Certified ACI Flatwork Concrete Finisher/Technician or certified ACI Flatwork Technician or equivalent	Not required
119	Finish applicability	
120	No surface treatment	Buried or permanently submerged concrete
121	Screeding	Where indicated on the drawings
122	Floating	Slabs to receive separate floor finish as specified under Separate Finishes below Interior sloping floor slabs Exterior slabs other than where brooming is specified Equipment bases for grouted equipment Floors and other surfaces not otherwise specified Where indicated on the drawings
123	Brooming	Roads, sidewalks, walkways, and door stoops
124	Troweling	Slabs to receive separate floor as specified under Separate Finishes below Equipment bases for non-grouted equipment Where indicated on the drawings

Table 3 - Execution		
125	Aggregate exposure	Where indicated on the drawings, including steel column base locations and equipment housekeeping pad locations. Use of a chemical surface retarder to expose aggregate immediately after placing and finishing concrete is permitted, unless the grout manufacturer requires a mechanical means of roughening.
126	Special finish	Where indicated on the drawings
127	Finishing steps	
128	Screeded surfaces	Screeding only
129	Floated surfaces	Screeding and floating
130	Broomed surfaces	Screeding, floating, and brooming
131	Troweled surfaces	Screeding, floating, and troweling
132	Finishing processes	
133	Screeding	Provide a concrete surface conforming to the designated elevations and contours with all aggregates completely embedded in adjacent mortar Limit surface irregularities to specified tolerances
134	Floating	Screed the surfaces followed by an initial float finish as soon as the concrete has stiffened sufficiently to work Remove coarse aggregate disturbed by the float or causing a surface irregularity and replace with mortar Produce a surface of uniform texture and appearance from the initial floating Follow the initial floating by a second floating at the time of initial set Produce a smooth float finish of uniform texture and color from the second floating Perform floating with hand floats or suitable mechanical compactor floats Unless specified to be beveled, edge exposed edges with a tool having a 1/4 inch corner radius
135	Brooming	Perform brooming with an acceptable steel or fiber broom not less than 18 inches wide Slightly overlap adjacent strokes of the broom Insure broomed surfaces are free of porous spots, irregularities, depressions, and small pockets or rough spots

Table 3 - Execution		
136	Troweling	<p>Performed troweling after the second floating when the surface has hardened sufficiently to prevent excess cement from being drawn to the surface</p> <p>Produce a dense, smooth, uniform surface free from blemishes and trowel marks</p> <p>Unless specified to be beveled, edge exposed edges with a tool having a 1/4 inch corner radius</p>
137	Aggregate exposure	<p>Remove surface mortar and expose aggregate from surfaces that will be covered with mortar, concrete, or grout at a later time.</p> <p>Use of a chemical surface retarder to expose aggregate immediately after placing and finishing concrete is permitted, unless the grout manufacturer requires a mechanical means of roughening.</p> <p>Acceptance by the Owner that the method used will be effective is required.</p>
138	Finishing mortar	Add if there is not sufficient mortar available from the concrete mix
139	Finishing mortar proportions	<p>2.4 parts of concrete sand to one part of Portland cement, by weight, mixed with enough water for proper application</p> <p>Maximum slump is 2 inches</p>
140	Finishing aids	May be used to control evaporation during finishing. Follow manufacturer's instructions for use.
141	Separate Finishes	
142	Application	Finish slab surfaces with a separate concrete finish or floor covering as indicated on the drawings
143	Surfaces that receive epoxy set quarry tile or resilient tile	Either trowel finished concrete at the elevation indicated on the drawings or float finished surface set 1/8 inch low and level with trowel finished fill material
144	Surfaces that receive a mortar set quarry tile, ceramic tile, or terrazzo finish	Smooth, tight, and uniform float
145	Base slab preparation for installation of separate finish	<p>Grind or fill until each surface is within the specified tolerances and is acceptable to the Owner</p> <p>Fill low areas</p> <p>Grind high spots slightly lower than required and then fill and smooth to the proper elevation and surface</p>
146		
Curing and Sealing		
147	Applicable Type	
148	Troweled and broomed surfaces, except those that receive a separate finish or coating	Membrane curing compound

Table 3 - Execution		
149	Float finished surfaces, except those that receive a separate finish or coating	Membrane curing compound or water curing
150	Surface receives a separate finish	Water curing unless the curing compound is compatible with the surface finish that will be installed
151	Water retaining structures	Water curing
152	Water curing	Initiate as quickly as possible after initial set of the concrete, but not more than 30 minutes Regulate the rate of water application to provide complete surface coverage with a minimum of runoff Do not allow the concrete surface to dry
153	Membrane curing compound	Initiate within 30 minutes after final finishing of the surface or as soon as possible after finishing without causing damage to the surface Spray applied at a coverage rate recommended by the compound manufacturer A dissipating curing membrane may be used in lieu of wet curing on surfaces that will be covered at a later date with mortar, concrete, dampproofing, tile, or coating
154	Minimum curing duration after concrete is placed	
155	Concrete without mineral admixtures	7 days
156	Concrete with mineral admixtures including fly ash	14 days
157	Floor Sealer	
158	Applicability	Where indicated on the drawings to give concrete floors a coat of clear floor sealer in addition to that applied as membrane curing compound
159	Process	Apply coating at the end of the curing period before any traffic is permitted on the floor Apply a second coat, if required, after the floor has been cleaned in preparation for the final inspection Apply in strict accordance with the manufacturer's recommendations
160		
Repairing Surface Defects in Formed Concrete		
161	Initiate repairs	Within 24 hours of form removal
162	Depth of porous, honeycombed, or otherwise defective concrete required to be removed to sound concrete	In excess of 1 inch
163	Surface preparation	Square cut edges to avoid feathering Remove laitance and expose coarse aggregate on bonding surfaces

Table 3 - Execution		
164	Bonding compound between the hardened and repair concrete profile required	Use either a scrub coat or the specified epoxy bonding adhesive When the epoxy bonding adhesive is used, prepare surfaces and apply adhesive as recommended by the manufacturer
165	Repair process	Do not allow concrete repair work to interfere with the curing of surrounding concrete Finish to match adjacent surfaces Cure mortar and concrete used in repair work
166	Complete repairs	Within 24 hours of initiating repair
167	Acceptance of repairs	To the satisfaction of the Owner
168		
Duct Banks and Concrete Encased Direct Buried Conduit		
169	Reinforcing steel and other magnetic materials	Orient parallel to the lengths of the ducts unless they enclose all the ducts of the duct bank
170	Hardened surfaces that receive additional concrete	Prepare the surface as specified for Bonding to Hardened Concrete Thoroughly wet the surface and spread a thin coating of cement mortar over the surface before concrete is placed
171	Concrete placement	Carefully compact to avoid damaging the conduit Work concrete around reinforcements and embedments and into the corners of the forms
172	Color	Apply red dye to the top concrete surface or use red dyed concrete, where indicated on the drawings
173	Marker tape	Metallic marker tape installed at the top of concrete surface, where indicated on the drawings
Tolerances		
174	Anchor rods for structures, structural members, embedded structural steel shapes, and plates	As specified in AISC 303 unless more stringent requirements specified herein.
175	Formwork, reinforcing steel, equipment anchorages, and finished concrete	As specified in ACI 117 and ACI 301 unless more stringent requirements specified herein.
176	Offset between adjacent pieces of formwork facing material for surfaces exposed to view	1/2 inch
177	Offset between adjacent pieces of formwork facing material for concealed surfaces	1 inch
178	Pipe sleeves, conduit, and other non-structural embedments	1/4 inch of their design locations unless specified otherwise on the drawings or other specification sections
179	Horizontal and vertical location of duct bank riser concrete	1 inch

Table 3 - Execution		
180	Concrete form dimensions and placement for equipment bases	1/2 inch
181	Anchor rods and other structural embedments in equipment bases	
182	Center of each anchor rod group or cluster	1/8 inch
183	Center-to-center dimensions between the anchor rods in a group or cluster	1/16 inch
184	Elevation of top of anchor rods	1/4 inch
185	Unformed surfaces	
186	Screeded surfaces	Flat profile within 1/4 inch deviation as measured from a 10 foot straightedge
187	Float finished floor surfaces	Flat profile within 1/4 inch deviation as measured from a 10 foot straightedge
188	Float finished equipment bases	All points on the finished surface within 1/4 inch of the elevation indicated on the drawings unless a more stringent tolerance is noted on the drawings
189	Trowel finished floor surfaces	Flat plane within 1/4 inch deviation as measured from a 10 foot straightedge
190	Where level floor or equipment base is required for setting equipment directly on the concrete such as for electrical switchgear and transformers	All points on the finished surface within 1/8 inch of the elevation indicated on the drawings unless a more stringent tolerance is noted on the drawings.
191	Surfaces that receive epoxy set quarry tile or resilient tile	Flat profile within 1/8 inch deviation as measured from a 10 foot straightedge placed on any part of the surface.
192	Surfaces that receive a mortar set quarry tile, ceramic tile, or terrazzo finish	Flat profile within 1/4 inch deviation as measured from a 10 foot straightedge
193		
Field Testing and Inspection		
194	Concrete Testing	
195	Mix Classes exempt from field control testing requirements	A1
196	Sampling	Make tests at the point of placement in the presence of Site QA Manager
197	Qualifications to perform tests	An acceptable independent testing laboratory or Contractor's qualified QA personnel
198	Slump	ASTM C143
199	Air content	ASTM C231
200	Concrete temperature	ASTM C1064
201	Concrete test cylinders	
202	In accordance with	ASTM C31

Table 3 - Execution		
203	Marking	Mark or tag each set of compression test cylinders with the date and time of day the cylinders were made, the location in the work where the concrete represented by the cylinders was placed, the delivery truck or batch number, the air content, and the slump.
204	Concrete cylinders compressive strength tests and required number of cylinder tests to qualify as a strength test (based on cylinder diameter and height)	ASTM C39 and ACI 318, Chapter 26
205	Concrete Testing Frequency	The frequency specified for each field control test is a minimum Make additional field control tests if requested by the Owner.
206	Slump	Each of the first three batches mixed each day Make an additional test for each additional 50 yd ³ of concrete placed that day When plasticizers and superplasticizers are added at the site, measure and record the slump before and after the addition
207	Air content	One of the first three batches mixed each day and from each batch of concrete used to make compression test cylinders
208	Concrete temperature	One of the first three batches mixed each day and from each batch of concrete used to make compression test cylinders
209	Concrete test cylinders	Concrete test cylinders shall be made each day concrete is placed Make three sets of test cylinders from the same batch at 150 yd ³ intervals (one set is defined as the number of cylinders required to qualify as a strength test) plus one extra cylinders for early strength indication If Type V cement is used in the concrete, make two extra cylinders for each set
210	Concrete cylinders compressive strength test frequency	Test one concrete cylinders at an age of 3 to 5 days to provide an indication of early strength. This may be used at the Engineer's discretion for formwork removal. For each set of cylinders, test one set at an age of 7 days and one set at an age of 28 days, and store one set until otherwise directed by the Purchaser If Type V cement is used in the concrete, test the two extra cylinders at an age of 45 days

Table 3 - Execution		
211	Test Reports	<p>Include information specified by ASTM C39 and the following additional information:</p> <ul style="list-style-type: none"> Date, time, and ambient temperature of pour Location of pour Mix class <p>Submit copies of failed tests to the Engineer</p> <p>All reports to be retained by Site QA Manager</p>
212	Mechanical Splices	<p>Make the first four mechanical splices made by each operator in the presence of the mechanical splice manufacturer's representative and the Site Construction Manager</p> <p>For each operator, make splices in the same splicing positions (vertical, horizontal, angle, or special) to be made for the project</p> <p>Acceptance by the mechanical splice manufacturer's representative and the Engineer of all splicing procedures is required</p>
Loads on Uncured Concrete		
213	Applied load	<p>Load may not be applied to uncured concrete before the concrete has reached sufficient strength to support the load, including construction loads.</p>
Notes for Table 3		
	<p>1. Plastic concrete is defined as concrete that allows the head of an operating immersion type vibrator head to penetrate its full length into the previously placed concrete by means of its own weight.</p>	

03316 - Concrete Supply Datasheet

Table 1 - General		
General		
1	Application	Ready-mix concrete for on-site construction of concrete structures
2		
Codes and Standards		
3	Mix design and qualification	ACI 301 and ACI 318
4	Concrete proportions	ACI 318, Chapter 26
5	Batch plant and production facilities	ASTM C94 and Concrete Plant Standards of the Concrete Plant Manufacturers Bureau
6	Ready-mix concrete production and delivery	ACI 301 and ASTM C94
7	Making, curing, and storing concrete cylinders	IS 516
8	Water soluble chloride limits	ACI 318, Chapter 19
9		

Table 2 - Products		
Materials		
1	Cement	ASTM C150; Type as referenced in Schedule A at the end of this Data Sheet
2	Supplementary Cementitious Materials	
3	Fly ash	ASTM C618, Class C (Calcareous Fly ash) or F (Siliceous Fly ash) Class C fly ash not permitted for concrete exposed to sulfates in service, unless sulfate resistance is documented by testing in accordance ASTM C452, ASTM C1012, or other method acceptable to the Engineer
4	Loss on ignition	Class C, 2 percent maximum (Class C not permitted with Type II or Type V cement); Class F, 4 percent maximum
5	Ground granulated blast furnace slag.	ASTM C989, Grade 100 or 120
6	Silica fume	ASTM C1240
7	Aggregates	
8	Fine aggregate	ASTM C33; clean, natural sand
9	Coarse aggregate	ASTM C33, Class Designation 4S; crushed rock, washed gravel, or other inert granular material

Table 2 - Products		
10	Aggregates for sulfur pit concrete (Mix Class F1)	Washed quartz, mica, or feldspar. Sedimentary aggregates, such as limestone, are not permitted
11	Alkali-aggregate reactivity potential	<p>Determined as specified under Testing</p> <p>Aggregates which do not indicate a potential for alkali reactivity or do not have reactive constituents may be used without further testing</p> <p>Aggregates which indicate a potential for alkali reactivity permitted only when used in combination with low-alkali cement or other mitigating measures known to inhibit excessive expansion and with effectiveness tested in accordance with specified test procedures</p> <p>Import nonreactive aggregates if local aggregates exhibit unacceptable potential reactivity</p>
12	Water	<p>Potable</p> <p>Non-Potable not permitted</p>
13	Chemical admixtures	<p>All from one manufacturer and compatible</p> <p>Ensure admixtures do not have an adverse effect on the required properties of the concrete nor the specified limiting requirements</p> <p>Obtain chemical admixture manufacturer recommendations in writing prior to conducting the laboratory trial concrete mixture testing regarding the appropriate admixtures to minimize shrinkage and achieve specified initial set time.</p> <p>Comply with the manufacturer's recommendations</p>
14	Water reducing	ASTM C494, Type A
15	Retarding	ASTM C494, Type B
16	Accelerating, non-corrosive, non-chloride type	ASTM C494, Type C
17	Water reducing, normal, mid-range, and retarding	ASTM C494, Type D
18	Water reducing, normal, mid-range, accelerating, non-corrosive, non-chloride type	ASTM C494, Type E
19	Water reducing, high range (extended slump life type)	ASTM C494, Type F
20	Water reducing, high range and retarding (extended slump life type)	ASTM C494, Type G
21	Air-entraining agent	ASTM C260

Table 2 - Products		
22	Prohibited admixtures	Calcium chloride or admixture containing calcium chloride, unrefined or raw lignosulfonic acids or their salts Combinations causing dehydration or post-compaction settlement
23	Polyolefin fibers	ASTM D7508, collated, fibrillated, polyolefin fibers Comply with manufacturer's recommendations for fiber length
24		
Requirements and Performance		
25	Concrete Mix Classes	Specified in Schedule A at the end of this datasheet
26	Minimum Cementitious Material Content based on Maximum Aggregate Size	
27	Normal Exposures	Applicable for Mix Classes B1 and D1
28	Aggregate Size 1-1/2 inch	470 lb/yd3
29	Aggregate Size 1 inch	520 lb/yd3
30	Aggregate Size 3/4 inch	540 lb/yd3
31	Aggregate Size 1/2 inch	555 lb/yd3
32	Aggregate Size 3/8 inch	564 lb/yd3
33	Water Retaining Structures, Concrete Placed in Regions with Frequent Freeze/thaw Cycles, and Chemical Exposures	Applicable for Mix Classes B2, C1, C2, D2, and F1
34	Aggregate Size 1-1/2 inch	515 lb/yd3
35	Aggregate Size 1 inch	535 lb/yd3
36	Aggregate Size 3/4 inch	560 lb/yd3
37	Aggregate Size 1/2 inch	580 lb/yd3
38	Aggregate Size 3/8 inch	600 lb/yd3
39	Concrete Placed Underwater	Applicable for Mix Class E1
40	Aggregate Size 1-1/2 inch	600 lb/yd3
41	Aggregate Size 1 inch	620 lb/yd3
42	Aggregate Size 3/4 inch	640 lb/yd3
43	Maximum Cementitious Material Content	
44	When Type I Cement is used	1.15 times the minimum cementitious content
45	When Type II or Type V cement is used	No more than necessary to achieve the required average compressive strength of concrete used as the basis for selection of concrete proportions (f'_{cr})

Table 2 - Products		
46	Supplementary Cementitious Material	
47	Range when included in the concrete as a percentage of the combined weight of cementitious material	
48	Fly ash	15 to 25 percent
49	Ground granulated blast furnace slag	25 to 50 percent
50	Silica fume	7 percent max
51	Determining Maximum Water-Cementitious Material Ratio	Determine maximum water-cementitious materials ratio on a cement mass basis If fly ash is used, use the combined mass of cement and pozzolan to determine the water-cementitious materials ratio
52	Aggregates	
53	Fine Aggregate – Sand Equivalent	Not less than 75 for an average of three samples tested
54	Ratio of fine to total aggregates, based on solid volumes (not weights), for following coarse aggregate sizes	
55	ASTM C33 Size Number 8 3/8 inch to No. 8 sieve	Minimum 0.45, Maximum 0.60
56	ASTM C33 Size Number 7 1/2 inch to No. 4 sieve	Minimum 0.40, Maximum 0.55
57	ASTM C33 Size Number 67 3/4 inch to No. 4 sieve	Minimum 0.35, Maximum 0.50
58	ASTM C33 Size Number 57 1 inch to No. 4 sieve	Minimum 0.30, Maximum 0.46
59	ASTM C33 Size Number 467 1-1/2 inch to No. 4 sieve	Minimum 0.25, Maximum 0.42
60	Maximum size of coarse aggregate for pumped concrete mixtures	1-1/2 inch
61	Miscellaneous Requirements	
62	Tolerance for total volumetric air content of concrete after placement	±1.5 percent of the specified value
63	Air-entraining admixture	Omit from concrete for interior slabs to be trowel finished
64	Limit on additional slump of pumped concrete above specified maximum slump	Amount of slump loss in the pumping system up to 1 inch maximum increase
65	Time to Initial Set	5-1/2 hours ±1 hour after the water and cement are added to the aggregates, for each concrete mixture
66	Hot Weather Requirements	

Table 2 - Products		
67	Concrete temperature at time of placement that requires a water reducing retarder admixture	Greater than 80° F
68	Maximum concrete temperature at the time of placement	95° F
69	Air temperature that requires special procedures to keep concrete as cool as possible during placement	Greater than 90° F
70	Hot weather concrete procedures	Select from the following: Cool the mix water, aggregate, and cement Add ice Other processes to accomplish the concrete work
71	Cold Weather Requirements	
72	Minimum temperature of delivered concrete immediately after placement when the average of the highest and lowest temperature during the period from midnight to midnight is expected to be less than 40° F for more than 3 successive days	
73	Sections less than 12 inches in the least dimension	55° F
74	Sections 12 inches to 36 inches in the least dimension	50° F
75	Sections 36 inches to 72 inches in the least dimension	45° F
76	Sections greater than 72 inches in the least dimension	40° F
77	Mass Concrete	
78	Applicability	Where specifically indicated on the drawings Provide in accordance with Construction Contractor's Thermal Control Plan
79	Temperature limits of concrete when deposited unless otherwise directed in the Thermal Control Plan	Greater than or equal to 35° F Less than or equal to 70° F
80		

Table 2 - Products		
Mix Design		
81	Preliminary Review	Provide reports covering source and quality of concrete materials and the proposed concrete proportions before performing the required trial mixture designs and before concrete work is started Review of these reports by Owner will be for general acceptability only and continued compliance with all contract provisions is required
82	Design and test concrete mixtures	Provide for each size and combined gradation of aggregates and for each mix specified in Schedule A Develop tests and reports specifically for this project Obtain Owner's acceptance of design quantities and test results on each mix before concrete work is started
83	Changes to source of any concrete materials	Test the materials and the new mix design Provide reports for review and acceptance
84	Basis for concrete proportions	Field experience
85	Permitted time span for documented historical records of established mixes meeting the specified requirements	Within the last 12 months
86	Use of fly ash and ground granulated blast furnace slag in the same concrete mix	Prohibited
87	Aggregates	Use maximum coarse aggregate content consistent with workability and minimizing shrinkage
88	Slump	Select proportions to keep as low as possible, consistent with proper handling and thorough consolidation
89	Chemical admixtures	Comply with the manufacturer's recommendations Include admixture water content in total unit water content when chemical admixtures are used in large dosage rates [10 oz or more per 100 lb of cementitious material] Water reducing chemical admixture required in all structural concrete High range water reducer required in pumped concrete High range water reducer permitted in all concrete
90		
Testing		
91	Sulfate resistance of fly ash	ASTM C452 or ASTM C1012

Table 2 - Products

92	Water soluble chloride ion content	ASTM C1218 Test the concrete components, except aggregates, for water soluble chloride ions during material and mix qualification Report test results as the percentage of water soluble chloride ions in the concrete and as a percentage of chloride ion relative to the mass of cement in the concrete Test hardened concrete and each gradation of aggregate used in the concrete each time a chloride ion test is conducted on a concrete mixture
93	Aggregate testing	
94	Aggregate compliance	ASTM C33
95	Aggregate sampling	ASTM D75
96	Sand equivalent for fine aggregate	ASTM D2419
97	Aggregate sieve analysis (aggregate gradation)	ASTM C136
98	Aggregate soundness	ASTM C88
99	Aggregate bulk specific gravity	ASTM C127 and C128
100	Potential reactivity of aggregates	ASTM C33, Appendix XI
101	Select test method from the following:	
102	Mortar bar method	ASTM C227
103	Concrete prism method (preferred)	ASTM C1293
104	Visual method	ASTM C295
105	Aggregate Testing Interval	
106	Frequency limits	Conduct aggregate gradation testing at least every 6 months Conduct sand equivalent test each time the sand gradation tests are conducted
107	Fine aggregate testing interval, tons	150 (135)
108	Coarse aggregate testing interval, tons	300 (270)
109	Sand equivalent, tons	150 (135)
110	Slump	ASTM C143
111	Pumped concrete	Determine slump loss by tests made at each end of the pumping system
112	Air content	ASTM C231 and verified with ASTM C138

Table 2 - Products		
113	Concrete temperature	ASTM C1064
114	Density (Unit weight) of concrete	ASTM C138
115	Concrete test cylinders	ASTM C31
116	Initial set	ASTM C403 Perform test at 70° F using concrete containing the specified normal set/water reducing admixture and, when required, air-entraining admixture Perform test at 90° F using concrete containing the specified retarding/water reducing admixture and, when required, air-entraining admixture
117	Concrete cylinder compressive strength tests at 7 and 28 days	ASTM C39

Table 3 - Execution		
Batching		
1	Measurement	Measure aggregates, mineral admixture, and cement by weight Adjust aggregate weights for the moisture content Dispense automatically correct proportions of admixtures and water
2	Chemical admixtures	Comply with the manufacturer's recommendations for batching method and time of introduction to the mixture Adjust quantity of retarding admixture to compensate for variations in temperature and job conditions If undesirable characteristics are observed, discontinue use of the concrete mixture and propose an alternate mix design for acceptance by the Owner
3	Additional site-added water limit	Volume that maintains the total mix water to within the volume defined by the maximum specified water-cementitious materials ratio for the mix
4	Polyolefin fibers	Add to the concrete materials at the time the concrete is batched Comply with manufacturer's recommendations for batching and mixing procedures Ensure random orientation and uniform distribution throughout the concrete
5		
Mixing		
6	Duration	Continue until all ingredients are uniformly distributed throughout the batch

Table 3 - Execution		
7	Additional site-added water	Incorporate into the mix by at least 30 additional revolutions of the truck mixer at mixing speed
8	Slump control when a high range water reducer (superplasticizer) is used	<p>Add measured amounts of admixture instead of adding water</p> <p>Verify and record on the delivery ticket each superplasticizer dose dispensed at the site</p> <p>Accurately proportion superplasticizer for each load into a separate container prior to dispensing the admixture into the concrete</p> <p>When truck mounted dispensers are used flushing or cleaning the system with water is prohibited until after the entire load of concrete has been discharged</p> <p>When redosing of superplasticizer at the site is permitted by the Engineer, redosing is limited to one redosing</p> <p>Follow chemical admixture manufacturer's recommended redosing procedures</p>
9		
Delivery		
10	Signed delivery tickets	<p>Required for each load</p> <p>Present to Owner at time of delivery</p> <p>Prepare in accordance with ASTM C94</p> <p>Provide the following additional information:</p> <ul style="list-style-type: none"> Outdoor temperature in the shade Design slump without superplasticizer Design slump after addition of superplasticizer Numerical sequence of delivery Time of concrete discharge from the truck and time when the truck is released after discharge Quantity and type of admixtures Site dispensed admixtures and volume dispensed Allowable water permitted after batch water added Percent moisture compensation for each type of aggregate Both "heated" or "cooled" concrete checkoffs Concrete temperature at batch plant
11	Point of delivery	Discharge chute of the trucks at designated pour areas at the construction site

Table 3 - Execution		
12	Discharge time limit	<p>Within 90 minutes or before the drum has revolved 300 revolutions after the introduction of mixing water to the cement and aggregates, or the introduction of the cement to wet aggregates</p> <p>The time limit is 45 minutes for mass concrete.</p> <p>A shorter time period may be required in hot weather, for mass concrete, or under conditions contributing to quick stiffening of the concrete as required by the Owner</p> <p>Concrete that does not meet the time requirement may be rejected</p>
13		
Evaluation and Acceptance		
14	Slump	Ensure concrete flows sluggishly when vibrated
15	Superplasticizer dispensed at the ready-mix plant	Slump limited to the maximum specified in Schedule A
16	Superplasticizer dispensed at the site	Slump limited to maximum specified slump before superplasticizer is added
17	Compression Test	ACI 301, ACI 318
18	Strength	ACI 301, ACI 318
19	Durability	ACI 301, ACI 318
Substandard Concrete		
20	When a test cylinder indicates the concrete strength is less than the specified minimum	Investigate concrete represented by the test as directed by the Engineer
21	Additional cylinder testing	<p>Use available spares to confirm that the design strength has been achieved</p> <p>Cost for testing borne by the Contractor</p>
22	Additional sampling and testing of the concrete in place	<p>As directed by the Engineer to verify the results of the cylinder testing</p> <p>Cost for the replacement of concrete for the samples removed borne by the Contractor</p>
23	If investigation verifies the existence of defective concrete	<p>Mitigation determined by the Engineer</p> <p>Supplier responsible for:</p> <ul style="list-style-type: none"> Cost of removal and replacement of defective concrete Cost of design and construction changes necessary to incorporate the inferior concrete Satisfactory reimbursement or allowance to the purchaser for acceptance of the lower quality concrete

Schedule A Mix Criteria and Limiting Requirements										
Mix Class	Maximum Exposure Classes ¹	Usage	Minimum Design Cylinder Strength At 28 Days, psi (MPa)	Cement Type	Maximum Water/ Cementitious Materials Ratio	Air Content, percent	Maximum Chloride Ion Content ³ percent	Maximum Coarse Aggregate Size, in. (mm)	Max Slump, in. (mm)	Maximum Slump with Superplasticizer (HRWR), ⁴ in. (mm)
A1	NA	Lean work slabs, duct bank, fill concrete	2,000 (14)	I, II, or I/II	0.75	0	NA	1.5 (38)	6 (150)	10 (250)
A1P	NA	Same as A1 for use with pumping	3,000 ² (21)	I, II, or I/II	0.60	3	NA	1 (25)	6 (150)	10 (250)
B1	F0 S0 W1 C1	General usage – no freeze/thaw	4,000 (28)	I, II, or I/II	0.50	3-6	0.30	1 (25)	4 (100)	8 (200)
B2	F2 S0 W1 C1	General usage – with freeze/thaw	4,500 (31)	I, II, or I/II	0.45	6	0.30	1 (25)	4 (100)	8 (200)
C1	F2 S1 W1 C1	Structure in contact with water or subject to moderate sulfate exposure	4,500 (31)	I (C ₃ A<8%), II, or III (C ₃ A<8%)	0.42	6	0.10	1 (25)	4 (100)	8 (200)
C2	F2 S2 W1 C1	Structure in contact with water or subject to severe sulfate exposure	5,000 (35)	I (C ₃ A<5%), III(C ₃ A<5%), or V	0.40	6	0.30	1 (25)	4 (100)	8 (200)
<p>1. Refer to Chapter 4 of ACI 318-08 and ACI 318-11 and Chapter 19 of ACI 318-14 for Exposure Classes. (In ACI 318-08 and 11 exposure class W1 was originally noted as P1.)</p> <p>2. 450 lb/cy minimum cement content</p> <p>3. Refer to Chapter 4 of ACI 318-08 and ACI 318-11 and Chapter 19 of ACI 318-14 regarding Maximum Chloride Ion requirements.</p> <p>4. High range, water reducing admixture.</p>										

05500 – Miscellaneous Metals Datasheet

Table 1 - General		
General		
1	Application	Miscellaneous metal fittings and components, not covered under other sections, as indicated on the drawings
2		
Codes and Standards		
3	Design and fabrication	AISC Steel Construction Manual, Fifteenth Edition AISC Specification for Structural Steel Buildings, AISC 360-16, with Commentary and Supplements; AISC Seismic Provisions for Structural Steel Buildings, 341-16, with Commentary and Supplements AISC Code of Standard Practice for Steel Buildings and Bridges, AISC 303-16
4	Structural steel fabrication	AISC Certification Program for Structural Steel Fabrication, AISC 201-06
5	Bolting	Research Council on Structural Connections Specification for Structural Joints Using ASTM A325 or A490 Bolts, 2014
6	Welding of structural steel	ANSI/AWS D1.1 Structural Welding Code – Steel. Technical Supplemental Q121.
7	Steel Erection Safety	OSHA Standards – 29 CFR Part 1926 Subpart R, Steel Erection
8	Coatings	SSPC Paint Application Specification No. 1, "Shop, Field and Maintenance Painting"

Table 2 - Products		
Materials		
1	Structural steel	
2	Wide flange and WT shapes	ASTM A992/A992M
3	Channels	ASTM A992/A992M
4	S shapes	ASTM A992/A992M
5	Angles	ASTM A572/A572M, Grade 50
6	Plates	ASTM A572/A572M, Grade 50
7	Shim plates and fill plates	Material to match parent steel material
8	Hollow Structural Shapes – Round	ASTM A500, Grade C, 46 ksi
9	Hollow Structural Shapes – Rectangular	ASTM A500, Grade C, 50 ksi
10	Steel pipes	ASTM A53, Type E, Grade B
11	High strength bolts, nuts, and washers	
12	Grade	ASTM F3125 Grade A325

Table 2 - Products		
13	Diameter	3/4 inch (1-1/8 inch diameter where specially noted) unless noted otherwise on drawings
14	Type	Type 1
15	Flat and beveled hardened washers (where required)	ASTM F436, compatible with bolts
16	Heavy hex nuts	ASTM A563, compatible with bolts
17	Direct tension indicators	ASTM F959, compatible with bolts
18	Self-indicating ("squirter") Direct tension indicators	Applied Bolting Technology DuraSquirt DTI or Engineer approved equal
19	Welding electrodes	Low hydrogen types, with a minimum tensile strength = 70,000 psi
20	Concrete embedments and anchors	
21	Shear connectors for composite construction	FabriSteel Nelson Stud Welding Headed Stud
22	Anchor rods (anchor bolts)	ASTM F1554, Grades 36, 55, and 105 as noted on drawings, with nuts conforming to ASTM A563, Grade A heavy hexagon Provide ASTM F1554 Grade 55 rods in accordance with Supplement S1 of ASTM F1554 Where stainless steel anchor rods are noted on drawings, use ASTM A276 stainless steel, AISI 303/304 or 316 as noted on drawings with compatible stainless steel heavy hexagon nuts and washers
23	Anchor rod sleeves	Plastic sleeves
24	Post-installed mechanical and adhesive anchors	As specified in Technical Supplementals S700, S701, and S702
25	Continuous inserts for concrete	Unistrut P3200 Series, hot-dip galvanized with P3712P inserts installed to prevent concrete seepage
26	Lifting lugs for concrete	Dayton Superior P75 Utility Anchors, hot-dip galvanized with P76 or P76D Utility Anchor Setting Plugs Design for safe working loads
27	Pulling-in irons	Condux International or Osburn Associates, 12 inches with retaining plate and cross bar, galvanized
28	Abrasive nosings for concrete stair treads	Wooster Alumogrit Type 101 or acceptable equal, 3 inch wide with three wing type anchors per nosing
29	Manholes and vaults	
30	Iron castings for manhole/catch basin access and inlets	ASTM A48 Class 35 or better Uncoated
31	Manhole steps	M. A. Industries steel reinforced copolymer polypropylene steps
32	Floor doors, vault hatches	Bilco or acceptable equal with manufacturer's standard coating
33	Rectangular bar grating	

Table 2 - Products		
34	Bar grating	ANSI/NAAMM MBG 531
35	Type - Dry Interior applications	W-19-4 (1-1/4 by 3/16 inch) steel
36	Type - Wet Interior and/or Exterior applications	W-19-4 (1-1/2 by 3/16 inch) [W-30-102 (38.1 mm by 4.8 mm)] serrated steel
37	Banding of panel ends	Required, size 1 by 1/8 inch (25 mm by 3 mm)
38	Kickplate, where indicated on the drawings as welded to grating	4 inches above top of grating by 1/4 inch thick, extend 1 inch below top of grating ASTM A36/A36M, ASTM A1011/A1011M, ASTM A53, acceptable equal
39	Fasteners	G-clip type clamp or approved equal
40	Coating for fasteners, washers, and nuts	Hot dipped galvanized
41	Heavy-duty rectangular bar grating	
42	Heavy-duty bar grating	ANSI/NAAMM MBG 532
43	Type	W-22-4 (3 by 1/4 inch) steel
44	Banding of panel ends	Required, Size 2-1/2 by 1/8 inch (65 mm by 3 mm)
45	Kickplate, where indicated on the drawings as welded to grating	4 inches above top of grating by 1/4 inch thick, extend 1 inch below top of grating ASTM A36/A36M, ASTM A1011/A1011M, ASTM A53, acceptable equal
46	Fasteners	Manufacturer's recommendation, if required
47	Coating for fasteners, washers, and nuts	Hot dipped galvanized
48	Bar Grating Fasteners	Supply enough fasteners to secure each section of rectangular bar grating with at least two fasteners at each support plus a 2 percent overage
49	Checkered steel floor plates	ASTM A786/A786M 1/4 inch (6 mm) thick unless noted otherwise
50	Ladders	
51	Ladder side rails and support brackets	ASTM A572/A572M Gr 50
52	Ladder rungs	ASTM A36/A36M
53	Safety Gate	Self closing Select from: FabEnCo XL Series Benko Protect-O-Gate PS Doors Ladder Safety Gate
54	Safety System	Miller Vi-Go, with the top bracket installed with three rung clamps, as manufactured by Miller Fall Protection, Division of Honeywell, or Engineer approved equal
55	Fixator installation kits	Scope as indicated on the drawings

Table 2 - Products		
Coatings		
56	Embedded structural steel shapes and plates, threaded inserts, continuous inserts	As specified in Technical Supplemental Q300 General Coating Requirements
57	Structural steel shapes, plates, tubes and pipes	As specified in Technical Supplemental Q300 General Coating Requirements
58	Coatings on contact surfaces of slip-critical connections	Class A
59	Coatings on contact surfaces at bearing type connections	Same as adjacent surfaces
60	Shop coating at field welded connections	Not applied within 3 inch
61	High strength bolts	Hot-dip galvanized (ASTM F3125 Grade A325 and Grade F1852 only) per Technical Supplemental Q320
62	High strength nuts and washers	Same as high strength bolt coatings
63	Shear connectors	Galvanized
64	Anchor rods	Mechanically galvanized per Technical Supplemental Q320 Stainless steel anchor rods are uncoated
65	Rectangular bar grating	Hot-dip galvanized
66	Heavy-duty rectangular bar grating	Hot-dip galvanized
67	Checkered steel floor plates	Hot-dip galvanized
68	Ladders	As specified in Technical Supplemental Q300 General Coating Requirements
69	Safety gates	Manufacturer's standard safety yellow coating
70	Shop touchup coating	As specified in Technical Supplemental Q300 General Coating Requirements.

Table 2 - Products		
Drawings		
71	Drawing requirements	<p>Provide drawings in accordance with Technical Supplemental Q500</p> <p>Submit erection drawings with, or prior to, the submittal of the corresponding detail drawings</p> <p>Submit a field bolt list indicating the number and length of each bolt</p> <p>Submit details of the proposed typical beam connections with the first package of drawings</p> <p>Include with each detail drawing a Bill of Material including the total weight, area, or length of material on each sheet in every represented unit price category listed in the Structural Steel Unit Pricing Form</p> <p>Indicate the mark number of each fabricated piece on each detail drawing, as assigned by the Contractor and list any material identification numbers assigned by the Engineer</p> <p>Indicate the top elevation of all horizontal members on detail drawings</p>
72		
Fabrication		
73	Structural Steel	
74	Fabrication tolerances	Tolerance that permits field erection within AISC tolerances
75	Wide flange vertical bracing connections	<p>When the difference in the thickness between the web of the vertical brace and the gusset plate is 1/16 inch or greater, fill plates are required</p> <p>When the difference is less than 1/4 inch, only one fill plate on one side of the web may be used</p> <p>Differences of 1/4 inch or larger require fill plates on both sides</p> <p>Provide fill plates to allow for rolling tolerances of sufficient thickness to reduce the gap to less than 1/16 inch</p> <p>Do not use stacked multiple fill plates</p>

Table 2 - Products		
76	Column splice connections	<p>When the difference in thickness of the webs or flanges between two columns is 1/8 inch or greater fill plates are required</p> <p>For every column splice that requires fill plates, provide a plate on both sides of the web and/or flange to align the center of columns, except for those shapes that provide a constant inside-to-inside flange dimension</p> <p>Provide fill plates to allow for rolling tolerances of sufficient thickness to reduce the gap to less than 1/16 inch</p> <p>Do not use tacked multiple fill plates</p>
77	Column connections to baseplates and column splices	<p>Ensure the bearing surfaces at the connections are square and in full contact with each other</p> <p>Gaps to be less than 1/16 inch and 70% of the joint in full contact</p>
78	Splices	<p>Unauthorized splices are not allowed</p> <p>The Engineer's acceptance of splice location and configuration is required before fabrication</p>
79	Cuts, copes, and holes	Clean cut without torn, ragged edges or burrs
80	Unnecessary bolt holes in structural steel materials	<p>Repair hole following an approved Welding Procedure Specification (WPS), grind smooth</p> <p>Make these repairs before preparing the member for shop painting or galvanizing</p>
81	Notches	<p>Radius of beam copes and weld access holes:</p> <p>Provided free of notches and in accordance with AWS D1.1</p> <p>Repair of notches:</p> <p>In accordance with AWS D1.1</p>
82	Welding stair stringer miters, closure plates, extension pieces, and similar applications	Weld continuously and grind smooth
83	Monorail	<p>Use straight and levelled steel beams</p> <p>Keep the upper surface of the lower flange of each beam smooth and free of projections</p> <p>Keep top surfaces of the lower flange at joints close fitting</p>
84	Monorail fabrication tolerances	
85	Maximum sweep	1/4 inch in a 50 foot girder length
86	Camber	Not vary from the camber given on the drawings by +/- 1/4 inch in a 50 foot girder length
87	Bar Grating Fabrication	

Table 2 - Products		
88	Grinding of crossbar ends	Not required for spacer bars projecting no more than 1/8 inch beyond the outside bearing bars and when the overall panel width used in laying out the work is adjusted to allow for extensions
89	Grating joints at openings	Lay out joints such that each opening is centered on a joint between sections
90	Kickplates	Provide all openings with a kickplate Attach all kickplates to grating extending 1 inch below the top of grating Steel pipe is acceptable for round openings
91		
Connection Requirements		
92	Connection requirements	Shop welded, field bolted
93	Bolting requirements	
94	Bearing connections, threads	Threads included in the shear plane
95	Slip-critical connection scope	All connections with oversized or long-slotted holes in one or more plies, except as noted on the drawings
96	Contact surface class	Class A
97	Pretensioned connection scope	All structural connections
98	Snug-tightened connection scope	Connections to non-structural steel components
99	Control of bolt tension	Direct tension indicators (DTIs)
100	Bolt holes	
101	Standard holes	1/16 inch larger than the nominal bolt dia., unless noted otherwise
102	Holes in clip angle connections	Short slotted perpendicular to the length of the angle unless otherwise noted
103	Holes in gusset plates	Oversized unless otherwise noted
104	Nuts and Washers	
105	Lubricated nuts	Required for all bolts
106	Hardened washers	Provide in accordance with the recommendations in the RCSC Specification for Structural Joints Using High-Strength Bolts
107	Oversized holes in outer plies	Hardened washers required over oversized holes
108	Long-slotted holes in outer plies	Plate washers required over long-slotted holes
109	Length of high strength bolts installed in field connections	In accordance with the RCSC Specification for Structural Joints Using High-Strength Bolts Exercise care in the field bolt list to eliminate the need for additional "long" bolts
110		

Table 2 - Products		
Shop Testing and Inspection		
111	Weld inspection	100 percent visual inspection of all welds
112	Nondestructive testing of welds	As specified in Technical Supplemental Q121
113	Butt joint splices, complete penetration T-joints, plate girder welds, and built-up column welds	Test as specified in Technical Supplemental Q121
114	Testing of high strength bolts	By Bolt Manufacturer, ASTM F3125 Grade A325, A490 and F1852, Production Lot Method
115	Testing of direct tension indicators	ASTM F959, Article 10.2, Production Lot Method by Manufacturer
116		

Table 3 - Execution		
Erection		
1	Storage requirements for steel materials	<p>Store in a manner that will prevent the materials and their coatings from being damaged or subject to deterioration prior to erection</p> <p>Do not store steel materials in direct contact with the earth</p> <p>Take care to prevent ponding of water that could damage the surfaces of galvanized materials</p>
2	Storage requirements for fastener components	<p>Protect fastener components from dirt and moisture in closed containers at the site of installation</p> <p>Remove from protected storage only as many fastener components as are anticipated to be installed during the work shift</p> <p>Return fastener components that are not incorporated into the work to weather protected storage at the end of the shift</p>
3	Metals to be placed in concrete	Install as specified in Section 03311 and locate as indicated on the drawings to the tolerances specified in Section 03311 and on the drawings
4	Damaged anchor rods or anchors installed outside of tolerances	<p>Submit a formal repair plan for review and approval</p> <p>Do not repair, replace or field modify anchor rods without the approval of the Engineer</p>

5	Items required to be addressed in Repair Plan	<p>Removal of soleplates (if applicable) or any other obstacles at damaged anchor(s) and inspection of grout for cracks</p> <p>Removal of grout that has been cracked or otherwise damaged (if found)</p> <p>Visual inspection of damaged anchor(s)</p> <p>Determination of the material alloy type and grade as well as previous heat treatment history</p> <p>Description of proposed repair methods</p> <p>After repair, reinstallation of soleplates (if applicable) and regrouting as required</p> <p>Quality control including checking of vertical straightness by use of a square at several locations</p> <p>Testing</p>
6	General requirements	<p>Erect all materials safely and in a workmanlike manner in accordance with the specified standards, the Owner's drawings, the erection drawings, and these specifications</p> <p>Perform erection in accordance with the requirements of OSHA Standard 29 CFR Part 1926, Subpart R, Steel Erection.</p>
7	Lifting lugs	Remove after erection and grind smooth and flush with the adjacent area
8	Open holes due to mismatched connections	
9	Holes in flanges of beams, bracing members, or bracing connection plates	Contact Engineer to determine if repair is required. If required, repair hole following an approved Welding Procedure Specification (WPS), grind smooth unless directed otherwise by Engineer.
10	Holes in all other locations	Fill hole with structural bolt unless obstructed. If hole cannot be filled with bolt, leave open
11	Structural Steel Column - maximum out of plane	Max. 1 inch displacement of any column center line from the established column line, at any point in the total height of the column
12	Bolting	
13	Pre-installation verification	<p>Test fastener assemblies of each combination of diameter, length, grade and lot to be used in pretensioned connections with a tension calibrator at the jobsite prior to commencing bolt installation on the work</p> <p>Perform in accordance with the Research Council's Specification for Structural Joints</p>
14	Contact surfaces	Ensure free of foreign substances

15	Class A Hand Brushed Galvanized surface condition	Roughen the faying surfaces of slip-critical connections by means of hand wire brushing Power wire brushing is not permitted
16	Drifting and drawing	Drift connections to proper position and inspect the holes to ensure that bolt threads will not be damaged by forcing the bolts in place Tightly draw connections together using at least 25 percent of the total number of bolts, to a minimum of two bolts Distribute initial bolts uniformly about the joint with either fit-up bolts or high strength bolts
17	Bolt tightening	Done by competent and experienced bolting crews Control tightening of bolts using the method indicated in Table 1 under Bolting Requirements.
18	Pretension of high strength bolts	Full pretensioning of high strength bolts required at all connections, and where noted on the drawings
19	"Snug tight" requirement	Ungalvanized ASTM F3125 Grade A325 bolts that have been tightened no more than one-third turn beyond "snug-tight" may be loosened and retightened Do not reuse ungalvanized ASTM F3125 Grade A325 bolts tightened more than one-third turn beyond "snug-tight" without inspection by the Engineer or Site QA Manager Do not reuse ASTM F3125 Grade A490 bolts and galvanized ASTM A325 bolts which have been tightened beyond "snug-tight" Retightening previously tightened bolts that may have been loosened by the tightening of adjacent bolts is not considered a reuse
20	Smooth beveled washers	Use when the bearing faces of the bolted parts have a slope of 1 to 20 or greater with respect to a plane normal to the bolt axis
21	Nut lubrication	Prior to installation to assure that proper tension can be obtained Reject nuts without proper lubrication Do not relubricate twist-off bolts, except by the bolt manufacturer
22	Direct tension indicators (DTIs)	When using DTIs, tighten and inspect in accordance with the manufacturer's written instructions, the Research Council's Specification for Structural Joints, and the following Ensure that each DTI is of the correct capacity and grade for its intended use

23	Deformed Direct tension indicators (DTIs)	Ensure any ASTM F3125 Grade A325 or Grade A490 bolt that has been tightened sufficiently to deform the DTI is not loosened and retightened
24	Undertensioned bolts	Tighten to the correct tension
25	Inspection of Direct tension indicators (DTIs)	Inspect in accordance with the manufacturer's written instructions Inspect after the connection is snug-tight, but before pretensioning, and again after pretensioning Inspect using the appropriate feeler gauge recommended by the manufacturer
26	Baseplate Grouting	Carefully level and align baseplates before they are grouted Perform grouting as specified under Section 03611 Grouting If shim packs are left in place, ensure 1-1/2 inch minimum grout cover measured between the edge of the baseplate and the nearest shim
27	Bar Grating Installation	
28	Grating alignment	Install rectangular grating so that spacer bars and load carrying bars in adjacent panels are in alignment
29	Fastening bar grating	Fasten each section of rectangular bar grating securely in place with at least two fasteners at each support
30	Touchup painting	
31	Field touchup	Touchup painting in accordance with Technical Supplementals Q300 General Coating Requirements or Q320 Galvanizing
32	Touchup painting	Clean and touchup paint all damaged or inadequate paint films of shop primed structural steel materials, all accessible surfaces of field welds, unpainted surfaces at slip-critical connections, ungalvanized field connection bolts, and damaged galvanized surfaces Touchup shop primed materials, all accessible surfaces of field welds, ungalvanized bolts, and damaged galvanized surfaces in accordance with Technical Supplemental Q300 General Coating Requirements
Field Testing and Inspection		
33	Weld inspection	100 percent visual inspection of all welds
34	Nondestructive testing of welds	As specified in Technical Supplemental Q121
35	Butt joint splices, complete penetration T-joints, plate girder welds, and built-up column welds	Test as specified in Technical Supplemental Q121

10210 - Louvers

Table 1 - General		
General		
1.	Application	Scope of work shall include furnishing and installation of louvers and other related services as specified herein. This louver section is required for the Warehouse Building. Louvers are as required to provide proper ventilation for the Warehouse building in accordance with Building Code requirements.
Codes and Standards		
2.	Standard horizontal fixed blade louvers	AMCA 511 Certified Ratings Program for Air Control Devices. AAMA 605.2 High Performance Organic Coatings on Architectural Extrusions.
3.	Acoustical louvers	AMCA 511 Certified Ratings Program for Air Control Devices. ASTM E90 Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions
4.	Vertical storm louvers	AMCA 500-L. AMCA 511 Certified Ratings Program for Air Control Devices. AAMA 605.2 High Performance Organic Coatings on Architectural Extrusions.

Table 2 - Products		
Materials		
1.	Louvers	ASTM B221 - Alloy 60653-T5. ASTM B209 – Alloy 5005
Components		
2.	Type	Vertical storm louver
3.	Size	
4.	Width	As required by detailed design
5.	Height	As required by detailed design
6.	Materials/Style	
7.	Frame	Aluminum - Standard
8.	Depth, in.	6
9.	Blade style	Vertical storm louver
10.	Finishes	Standard mill
Performance Data		
11.	Free area, minimum, percent based on a 48" x 48" sample size	33 (vertical storm louver)
12.	Maximum airflow velocity through free area, ft/min	1200
13.	Airflow, cfm	TBD

Table 2 - Products		
Acceptable Manufacturers of Components		
14.	Vertical storm louvers	Ruskin Manufacturing EME6625D

Table 3 - Execution		
General		
1.	General	Louver blades, frames, sills, and mullions shall be extruded aluminum Alloy 6063T52, minimum. Sills shall be supplied where indicated on the drawings.
2.	Vertical Storm Louvers	<p>Vertical storm louvers shall be as manufactured by one of the manufacturers listed in Article 10210.1.6. Louvers with sinusoidal blade spacing greater than 1 inch shall include an aluminum or stainless steel bird screen.</p> <p>Vertical storm louvers shall incorporate a sinusoidal blade profile with flow enhancers as necessary to increase water removal efficiency. The louver frames, blades, blade supports, and drain pans shall be extruded aluminum construction. The blades shall be supported and aligned with heavy gauge extruded aluminum blade braces and welded to a structural support frame. The structural support frame may be assembled with aluminum and/or stainless steel fastenings. The louvers shall be factory assembled.</p> <p>The spacing between blades shall be maintained throughout the vertical height by bracing, stiffeners, and/or clips. During operation, blade deformation shall not exceed 10 percent of the design spacing. Blades shall be at least 0.075 inch thick, excluding any efficiency enhancement projection of the blades. Blade spacing shall not exceed 1-1/3 inch pitch.</p> <p>The bottom structural support shall also be the drain pan. The drain pan shall drain to the outside face of the building through horizontal slots located in the outside face of the drain pan. If intermediate drain pans are required, internal piping shall be provided to drain the pans to the lowest pan. Piping sections shall be flanged or otherwise connected to allow easy disassembly. Screwed fittings are not acceptable. Piping shall be installed to be self-draining.</p> <p>Vertical storm louvers shall be tested and certified according to the requirements specified in Article 10210.1.7. Vertical storm louvers shall have a Class A certification with an effectiveness of 1 to 0.99 at 8 inch rainfall and 50 mph wind velocity.</p>
Installation		
3.	Installation	<p>Louvers shall be installed plumb and straight with blades aligned between units. Frames shall be secured to supporting walls or framework with stainless steel fasteners as indicated.</p> <p>Caulking of louver perimeter at adjoining materials shall be as specified in Section 07920.</p>

Table 3 - Execution		
		Any abraded or otherwise damaged finish shall be touchup painted with air drying material furnished by the louver manufacturer and matching the color of the factory applied finish.
Notes		
	1. Contractor to size the louvers and ventilation based on heat loads from occupancy and ambient conditions in accordance with the Florida Building Code requirements.	

13120 - Pre-Engineered Metal Building (Warehouse Building)

Table 1 – General Information		
General		
1.	Project Design criteria	See D100
2.	Scope	Refer to section 01100 for scope of building
Codes and Standards		
3.	Building design	MBMA - Metal Building Manufacturers Association Low Rise Building Systems. AISC - Steel Design Guide No. 3-Serviceability Design Considerations for Low Rise Buildings.
4.	Steel design	AISC Specification for Structural Steel Buildings, AISC 360-16, with Commentary and Supplements. AISC Seismic Provisions for Structural Steel Buildings, 341-16, with Commentary and Supplements
5.	Light gauge structural steel design	AISI - Specifications for the Design of Cold Formed Structural Members
6.	Wind loading criteria	UL 580 - Tests for Uplift Resistance of Roof Assemblies; FM Wind Loading Requirements
7.	Deflections and drift of the structural system	AISC - Steel Design Guide No. 3 - Serviceability Design Considerations for Steel Buildings
8.	Concrete design	ACI 318 - Building Code Requirements for Structural Concrete
9.	Welding and related operations for structural steel and low alloy steel	AWS D1.1 - Structural Welding Code-Steel
10.	Welder qualifications	AWS D1.1 - Structural Welding Code-Steel
11.	Fire rated doors and frames	
12.	Class A, 2-1/2 hour, 250° F maximum temperature rise in 30 minutes of exposure	Underwriters Laboratories Inc. or Factory Mutual Classifications
13.	Class B, 1-1/2 hour, 250° F maximum temperature rise in 30 minutes of exposure	Underwriters Laboratories Inc. or Factory Mutual Classifications
14.	Class C, 3/4 hour, 250° F maximum temperature rise in 30 minutes of exposure	Underwriters Laboratories Inc. or Factory Mutual Classifications
15.	Fire rated oversized doors	Underwriters Laboratories Inc. "Certificate for Oversize Construction"
16.	Sound transmission classification (STC)	ASTM E90-81 and E413-73
17.	Aluminum windows	ANSI/AAMA 101
18.	Commercial windows	C20
19.	2 inch deep monumental windows	HC40

Table 2 - Products		
Materials		
1.	Roof panel, wall panel, trim, and flashing	ASTM A924, Grade B
2.	Roof and wall panel galvanizing	ASTM A653, Designation G90
3.	Aluminum zinc alloy coating in place of galvanizing	ASTM A792, Class AZ55
4.	Structural members less than 1/4 inch thick	ASTM A1008 and ASTM A1011 for steel used to form members on built-up sections
5.	Hot-dip zinc coating of structural members	ASTM A653 or A924
6.	Shop prime coating of structural members	Air dried rust inhibitive alkyd primer, containing at least 40 percent solids by volume
7.	Structural members	ASTM A572 Grade 50 or ASTM A992
8.	Column anchor bolts and nuts, furnished by Purchaser	ASTM A36 or A307, Grade A conforming to requirements of ASTM A36
9.	Structural bolts and nuts	ASTM A325
10.	Other bolts and nuts	ASTM A307 galvanized in accordance with ASTM B633
11.	Stainless steel sheet metal screws and self-tapping screws	US Federal Specification QQ-S-763E, Class 410 stainless steel
12.	Motors	NEMA and ANSI standards
13.	Aluminum windows	Alloy 6063-T5, ASTM B221
14.	Cast Iron	ASTM A48
15.	Cold-rolled uncoated steel	ASTM A1008
16.	Cold-rolled hot-dipped galvanized steel	ASTM A653, Grade A60 or G60
17.	Galvanizing commercial steel	ASTM A526
18.	Galvanizing assembled steel products	ASTM A526
19.	Insulation	Foamed in place polyurethane
20.	Door hardware	Door hardware shall be in accordance with ANSI/BHMA A156 and the following requirements
21.	Butts	1-1/2 pair per leaf, 4-1/2 inch by 4-1/2 inch, full mortised, template type, nonremovable pin, ball bearing, extra heavy-duty, bronze US10; two pair for 8 ft door height
22.	Locksets	Key-in-knob, pin tumbler cylinder type, bronze US10. Master key all-keyed locksets, two keys per lock. ANSI/BHMA A156.2 Series 4000, Grade 1
23.	Latch set	Similar to lockset (no key)
24.	Closers	Fed Spec FF-H-121D, US Government Type 3009VH for 3 ft by 7 ft exterior, Type 3009 VIH for 3 ft by 8 ft exterior, hold-open-arm, bronze finish
25.	Thresholds	Extruded aluminum saddle type, 3-1/2 inch by 5/8 inch. Door, when closed, shall seal against threshold.

Table 2 - Products		
26.	Weather-stripping	Extruded vinyl in an extruded aluminum keeper for head and jambs. Extruded vinyl sweep in an extruded aluminum keeper for door bottoms
27.	Kickplates	Stainless steel, door width less 2 inch by 10 inch; centered on push side surfaces of door 1 inch above door bottom
28.	Flush bolts	Stainless steel top and bottom of inactive leaf of pairs of doors
29.	Astragal	Provide at meeting edge of all pairs of doors. When attached to inactive leaf, provide minimum 1-1/8 inch clearance at knob
30.	Caulking	
31.	Exposed joints	Low modulus, one component moisture curing modified polyurethane joint sealant. Fed Spec TT-S-00230C, Type II, Class A
32.	Concealed joints	Polybutene nondrying, nonskimming sealant
33.	Caulking tape	Reinforced poly-isobutylene
34.	Finish	Polyvinylidene fluoride, minimum of 70 percent Kynar 500 or Hylar 5000 resin by weight
35.	Scope of Work	Includes furnishing and installation of pre-engineered metal buildings and shall include other related services as specified herein.
Performance and Design Requirements		
36.	Exterior Columns (no flange braces)	Tapered
37.	Minimum Design Loads	As defined in Article 13120.1.4 except as modified below
38.	Seismic loading	Per Technical Supplemental Specification D100
39.	Wind loading	Per Technical Supplemental Specification D100 and FM loading requirements
40.	Roof live load, psf	20
41.	Floor live load, psf	125
42.	Wind uplift rating	FM180
43.	Overhead Door Wind Pressure Requirements	Inward: 41.1 psf (MDCA Rating)
44.		Outward: 54.9 psf (MDCA Rating)
45.	Wall Design Pressures	
46.	Zone 4	+60/-65 psf
47.	Zone 5	+60/-75 psf
48.	Other collateral loads (refer to drawings), psf	5
49.	Other collateral loads (crane) psf or lbs	N/A
50.	Other collateral loads (phantom) psf or lbs	N/A
51.	Other collateral loads (equipment) psf or lbs	N/A
52.	Other collateral loads (superimposed) psf or lbs	N/A

Table 2 - Products		
53.	Roof Slope	1 in 12
54.	Rails	Other
55.	Building Systems/Accessories	
56.	Electrical Systems	Contractor to provide and install conduit, wire, panels, HVAC, lighting, receptacles, and electrical boxes including 208Y/120V 42 circuit minimum lighting panel, 480 to 208Y/120V step down transformer, and 480V 3-phase, 3W, 200A panelboard. Power supply to be provided by the Contractor from the existing 480v panel board located outside the building per contract drawings
57.	Air conditioning	Forced Fan Ventilation Only
58.	Fire Protection and Detection System	Contractor shall furnish complete fire protection systems including, but not limited to, the following: all spray nozzles, sprinkler heads, heat and smoke detection devices, strainers, OS&Y valves, nonrising stem gate valves with wall post indicator valves, sprinkler and spray system piping, fittings, strainers, fire department connections, pipe hangers and supports, expansion joints, alarms, controls, local control panels, wiring, conduit, fire detection devices, and instrumentation as required for complete fire protection system(s).
59.	Minimum Thickness (US Standard gauge, uncoated metal thickness)	
60.	Exterior metal wall panel	24 gauge
61.	Metal roof panel	22 gauge
62.	Liner panels	26 gauge
63.	Base channel	14 gauge
64.	Gutters and downspouts	26 gauge
65.	Building Systems/Accessories	
66.	Wall System	Insulated
67.		Standard nominal 1-1/2 inch deep rib by approximately 36 inches wide
68.	Roof System	Insulated
69.		Standard nominal 1-1/2 inch deep rib by approximately 36 inches wide, with sufficient fasteners to meet FM-180 uplift requirements.
70.	Trim, Flashing and Gutters	Trim and flashing members, including gutters and downspouts, shall be fabricated of the same material as the wall panels. Members shall be the building manufacturer's standard profiles for the use intended.
71.	Roof Slope	1:12

Table 2 - Products		
72.	Roof and Wall Covering	
73.	Metal roof panel	Embossed
74.	Liner panels	Embossed
75.	Wall	Embossed
76.	Trim and flashing	Embossed
77.	Wall Accessories	
78.	Light transmitting panels	N/A
79.	Doors	(2) Overhead Roll-up MDCA & Fire Rated Doors (2) 36" single swing personnel doors, and (2) 72" double swing personnel doors
80.	Windows - 1 inch insulating glass	
81.	Framed opening	
82.	Louvers	See technical section 10210
83.	Canopies/facades	
84.	Spandrel	Insulated with material providing equivalent U-value.
85.	Above doors	Yes
86.	Above windows	Yes
87.	Below windows	Yes
88.	Roof Accessories	
89.	Gutters	Gutters and downspouts shall be sized for the geographic location of the building. Gutters shall provide a minimum cross-sectional area of 33 sq inch. The gutter apron shall extend under the roof panels to provide positive counterflashing. The outside face of the gutter shall be supported with 16 gauge, (minimum uncoated metal thickness) straps attached to the eave member at a maximum spacing of 36 inches.
90.	Downspouts	Downspouts shall be of a rectangular configuration with a minimum cross-sectional area of 18 sq inch. Each downspout shall discharge above ground or connect to the underground collection system as indicated on the drawings. Downspouts shall be supported with minimum 24 gauge, (uncoated metal thickness) clincher bands attached to the wall covering at a maximum spacing of 10 feet
91.	Light transmitting panels	No
92.	Vents	Manufacturer's standard
93.	Equipment curbs	Manufacturer's standard
94.	Pipe flashing	Neoprene
95.	Canopies	Yes

Table 2 - Products		
96.	Hatches	Manufacturer's standard
97.	Insulation	
98.	Exterior wall insulation	Manufacturer's standard
99.	R-Value, F·h·ft ² /Btu in.	R-19
100	Roof insulation	Manufacturer's standard
101	R-Value, F·h·ft ² /Btu in.	R-38
102	Exterior Finish of Roof and Wall Panels, Flashings, and Trim	
103	Polyvinylidene fluoride with 70 percent PVDF resin	Kynar 500
104	Warranties	
105	Roof panels, years	20
106	Wall panels, years	20
107	Colors	
108	Wall panels	Selected by Owner from Manufacturer's Standard Colors
109	Roof panels	Selected by Owner from Manufacturer's Standard Colors
110	Liner panels	Selected by Owner from Manufacturer's Standard Colors
111	Trim and flashing	To match wall panels
112	Gutters and downspouts	To match wall panels
113	Doors/windows and frames--Refer to drawings	Selected by Purchaser from Manufacturer's Standard Colors
114	Exterior Doors	Hollow metal
115	R-Value	7 F-h-ft ² /Btu in. (1.23 m ² /K/W)
116	STC	26
117	Fire rating	Same as wall fire rating
118	Door grade	I: Heavy-duty
119	Model	1: Full flush-hollow steel
120	Thickness	1-3/4 inch
121	Material	Cold-rolled, hot-dip galvanized steel
122	Face sheet gauge	0.0359 (0.917 mm)(20 gauge)
123	Core	Manufacturer's standard
124	Top	Manufacturer's standard
125	Bottom	Manufacturer's standard
126	Insulated	Manufacturer's standard
127	Door glazing	None
128	Door Clearances	Manufacturer's standard
129	Jamb	Manufacturer's standard
130	Head	Manufacturer's standard

Table 2 - Products		
131	Bottom	Manufacturer's standard
132	Double door meeting	Manufacturer's standard
133	Door Frames	
134	Materials	Col-rolled hot-dip galvanized steel
135	Gauge (min)	0.0598 inch (1.518 mm)(16 gauge)
136	Type	Assembled
137	Joints	Mitered
138	Fastening	Spliced plates and bolts
139	Shape	Single rabbet
140	Depth	Manufacturer's standard
141	Face	Manufacturer's standard
142	Stop	Manufacturer's standard
143	Head	Manufacturer's standard
144	Kerf	At smokeproof enclosures
145	Backbend	Manufacturer's standard
146	Backbend return	Manufacturer's standard
147	Finish hardware	Refer to manufacturer standards
148	Windows	Horizontal sliding
149	Frames	Aluminum
150	Anodic aluminum frame finish	Clear anodized Black
151	Frame type	Regular
152	Frame size	1/8 inch (3 mm) thick, 1-1/2 inch (38 mm) deep
153	Glazing, 1-1/2 inch deep	1/4 inch (6 mm) glass
154	Glazing, 2 inch deep	1/4 inch (6 mm) glass
155	Sealant	Unicrylic
156	Extruded tape	B-44 Extru-Seal
157	Glazing clips	Spring wire
158	Tubular ventilator sections	1/8 inch minimum wall thickness
159	Mullions	T-shape
160	Mullion covers	Formed aluminum
161	Sills	1/8 inch minimum thickness
162	Operating hardware	White bronze
163	Erection fittings	Aluminum
164	Fasteners	Aluminum
165	Weather stripping	Woven pile
166	Window control systems	
167	System type	Manual control
168	Manual control	
169	Control equipment mounting	Surface mounted
170	Operator	Crank operated rotary control box

Table 2 - Products		
171	Motorized control	No
172	Insect screens	
173	Screen wire	18 by 14 mesh aluminum
174	Frames	Formed aluminum
175	Frame finish	Mill finish
176	Splines	PVC
Test Requirements		
177	NA	

Table 3 - Execution		
Installation		
1.	Framing	Framing members shall be accurately set, plumbed, and aligned. All joints and anchorage shall be securely bolted.
2.	Wall Panels	Wall panels shall be continuous from base to eave or to rake line of roof. Horizontal joints shall be kept to a minimum. Panel shall be lapped at least 4 inches. Wall panel assembly shall develop the strength to resist the design wind pressures.
3.	Roof Panels	<p>Roof panels shall be continuous from ridge to eave, overlap the lower by at least 6 inches. Panels shall be properly flashed and caulked at ridge, eaves, fascia, and where trim is otherwise required.</p> <p>Roof panels shall extend beyond the wall line on all four sides. The ends of roof panels shall have a drip angle attached.</p> <p>Flashing for openings shall be designed to positively direct water around each flashed area.</p> <p>Roof panel joints shall be maintained in correct alignment to ensure adequate expansion and contraction between components. Sliding flashings shall be installed at the panel side and roof edge interface to allow adequate movement.</p> <p>Roof curbs shall be installed, nesting with the roof panel configuration, and caulked and fastened as recommended by the manufacturer. Installation shall be weather-tight.</p> <p>Notched and flexible closures and caulking tape shall be installed where indicated on the drawings and as otherwise required by the panel manufacturer for an airtight, moisture-tight, and dust-tight roof.</p>
4.	Door Frames	<p>Frames shall be set in position, plumbed, aligned, and braced securely until permanent anchors are set.</p> <p>Frames shall be anchored to floors with a minimum of two expansion anchors or powder actuated anchors. Jambs shall be secured to adjoining construction.</p> <p>Spreader bars shall remain in place until frames have</p>

Table 3 - Execution		
		<p>been built into the walls. Temporary midheight bracing shall be provided for frames installed in masonry walls.</p> <p>Where floor fill occurs at a door opening, the bottom of the frame shall terminate at the indicated finish floor level and shall be supported by adjustable extension anchors attached to the structural slab.</p>
5.	Door Hardware	<p>Hardware shall be accurately fitted, securely applied, carefully adjusted, and lubricated as necessary. Special care shall be exercised to avoid damage to the hardware and to adjacent work. Hardware on which the finish has been damaged prior to final acceptance of the work shall be replaced at the Supplier's expense</p>
6.	Door Protection and Cleaning	<p>Doors shall be protected from damage during transport, at the jobsite, and after erection during subsequent construction activities. Damaged items will be rejected and shall be replaced with undamaged units.</p> <p>Upon completion, factory finished metal surfaces shall be thoroughly cleaned and touched up as recommended by the manufacturer. Abrasive, caustic, or acid cleaning agents shall not be used.</p>
7.	Windows	<p>Windows shall be installed as the walls are being constructed. Windows shall be set plumb, level, and in alignment. Windows shall be securely anchored. After windows are installed, but before glazing, all ventilators shall be adjusted to operate smoothly and to provide weathertight closing.</p> <p>Operator systems shall be surface mounted and aligned to provide a smooth operation. Window vents shall close completely at all edges for weather-tight installation. Operators shall be installed at the locations indicated on drawings.</p> <p>Except where vinyl seals are provided, all exterior metal-to-metal joints between members of windows, frames, mullions, and mullion covers shall be sealed with sealant tape. Excess sealant shall be removed before it hardens.</p>
8.	Window Cleaning	<p>Metal and glass surfaces of windows shall be thoroughly cleaned, both inside and outside. After all foreign material has been removed, windows shall be washed with soap and water using a stiff fiber brush. If metal surfaces of windows or sills have become stained or discolored, the finish shall be restored in accordance with the recommendations of the AAMA.</p>
9.	Caulking and Flashing	<p>Caulking, and where required, flashing shall be provided at all bases, lap seams, corners, eaves, doors, and other openings to provide a completely weather-tight installation. Exterior flashing shall be</p>

Table 3 - Execution		
		finished in the same color as the section to which it is attached.
10.	Final Cleanup	After completion, all trash and debris shall be removed. Interior and exterior surfaces of the structures and surrounding grounds shall be given a final cleaning After completion of construction, all trash and debris shall be removed. Interior and exterior surfaces of the structures and surrounding grounds shall be given a final cleaning
11.	Weather Integrity	Completed structures shall be guaranteed to be completely weather-tight under all weather conditions. Leaks which occur during the guarantee period, whether through roofs, walls, doors, windows, or accessory equipment or materials, shall be repaired to the satisfaction of the Owner at no additional cost.
12.		

15830 - Fans (HVAC) Datasheet

General				
1	Scope of supply shall include furnishing fans (HVAC) and other services as specified under these technical specifications for the Warehouse Building to provide ventilation in accordance with the Florida Building Code Requirements			
2	Items furnished by Others and Interfaces		Not used	
Codes and Standards				
3	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:			
4	Rotating equipment		ASME Pub. 67-PEM-14, "Vibration Tolerances in Industry"	
5	Safety guards		OSHA	
6	Welding and related operations		AWS D1.1 Structural Welding Code Steel, ASME Section IX	
7	Recommended safety practices for users and installers of industrial and commercial fans		AMCA 410	
8	Methods for the measurement of noise emitted by small air-moving devices		ANSI S12.11	
9	Laboratory methods of testing fans for rating		ANSI/ASHRAE 51, ANSI/AMCA 210	
10	Methods of testing fan vibration - blade vibrations and critical speeds		ANSI/ASHRAE 87.1	
11	Bearing design and fabrication		ABMA standards	
12	Drive arrangements for centrifugal fans		AMCA 99	
13	Drive arrangements for tubular centrifugal fans		AMCA 99	
Testing and Warranty				
14	The following testing shall be conducted in accordance with the specified source. This testing is to be considered part of the defined Scope of Work, and all associated costs are the responsibility of the Supplier unless specifically identified as a Bid Option or Purchaser-conducted. Tests identified as an option are to be priced separately. If identified as Purchaser-conducted, costs for the initial test will be the responsibility of the Purchaser. However, the Supplier is responsible for all costs associated with correcting deficiencies and retesting in the event of a test failure.			
15	Testing	Laboratory methods of testing fans for rating	ANSI/ASHRAE 51, ANSI/AMCA 210	Supplier
		Methods of testing fan vibration - blade vibrations and critical speeds	ANSI/ASHRAE 87.1	Supplier
		Reverberant Method for Sound Testing of Fans	ANSI/AMCA 300	Supplier

Design and Construction Requirements		
16	Fan Motors and Drives	
17	Fan motor rating and service factor requirements shall apply to any useful combination of cubic feet per minute (cfm) (liters per second (L/s)) and pressure of which the fan and motor combination is capable, to enable the unit to be operated at other than the specified conditions. Unless otherwise indicated, the product of the service factor times the nameplate horsepower shall not be less than 15 percent above the maximum fan brake horsepower for any useful condition. The fan motor and drive system shall be capable of across-the-line starting.	
18	Unless noted as "Belt Drive," fans shall be direct drive units with wheel attached to motor shaft. Fan and motor rpm values specified herein are the maximum allowed.	
19	Motor wiring connections, and space heater wiring connections if required, shall be extended through raceway to a terminal block within a factory mounted junction box on the outside of the fan housing.	
20	Propeller Fans	
21	The motor shall be mounted by a frame of welded construction, to a square, heavy gauge steel panel with flanged ends, which provides rigid mounting for the fan assembly. The panel shall incorporate a contoured inlet ring suitably sized for no more than nominal fan blade tip clearance.	
Requirements and Performance		
22	No. required	2 Minimum
23	Identification number	EX-0001A, EX-0001B
24	Service	Exhaust
25	Description	Wall-mounted
26	Location	Indoor or Outdoor
27	Voltage, V	Per contractor's design
28	Phase	3-phase
29	Frequency, Hz	60
30	Sound pressure level, maximum, dBA	85
31	Housing material	Galvanized steel
32	Housing hardware	Stainless steel hardware
33	Flanged ends	No
34	Coating system	Standard
35	Drive	
36	Type	Direct
37	Belt drive	N/A
38	Spare belt sets	N/A
39	Shaft material	Standard
40	Shaft seals	No
41	Spare seals	1
42	Motor enclosure	TEFC
43	Adjustable speed drive	No
44	Terminal housings	Externally mounted on motor frame enclosure, Cast iron, Diagonally or longitudinally split with a gasket between the

		split halves of the housing, with rotation in 90 degree increments and threaded openings	
45	Sheaves		N/A
46	Bearings		
47	Type		Heavy-duty ball
48	Lubrication		Regreaseable
49	Grease fittings		Extended to fan housing
50	Bearing life, minimum		L-10 40,000 hours
51	Spare bearings		1 set
52	Shaft sealed at fan housing		No
53	Spare seals		1 set
54	Fan speed, maximum/minimum		Manufacturer Standard
55	Externally mounted motor		N/A
56	FRP motor cover		No
57	Motor space heater		No
58	AMCA spark resistant construction		
59	General accessories		
60	Disconnect switch enclosure For hazardous applications consult HVAC section		NEMA 12 - Industrial Use - Dusttight and Driptight
61	Lifting lugs		Yes
62	Propeller fan accessories		
63	Filter/filter housing		
64	Arrangement		None required
65	Latched and hinged access door		Yes
66	Dampers		Gravity operated backdraft dampers
67	Insulation		N/A
68	Fan side guard		OSHA approved
69	Motor side guard		1/2 inch mesh
70	Approved Manufacturers of Components		
71	Propeller fan	Industrial	Aerovent, Hartzell, Twin City Fan - Industrial
		Commercial	
72	Only the listed manufacturers above are recognized as maintaining the level of quality of workmanship required by these specifications. If the Supplier wants to propose a non-listed manufacturer that is considered to provide an equivalent level of quality, this manufacturer must be identified and supporting testimony provided. Acceptance of the manufacturer as a substitute is at the discretion of the Purchaser.		
Technical Attachments			

73	Technical attachments relevant to the work under this section are listed in Section 01500.
Supplemental Specifications	
74	Technical supplemental specifications that are applicable to the work covered under this technical specification section are identified and included in Section 01400.
Notes	
75	Contractor to size the fan capacity based on heat loads from the occupancy and ambient conditions within the warehouse building in accordance with Florida Building Code requirements.

15921 - Piping Erection

15921.1 General

15921.1.1 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. Erection of piping systems designated by the system codes and indicated on the drawings listed in Article 15921.1.8 are included, except as otherwise specified herein. The Contractor shall furnish all required materials and perform all related work for completion of the work included under these specifications.

If furnishing any piping or fittings; installing insulation and lagging; furnishing and installing freeze protection, chemical cleaning, steam blow cleaning, trenching, and earthwork for underground piping; or furnishing and/or installing control and instrument piping is included in the Scope of Work, it shall be performed in accordance with separate sections included in these specifications:

Additional Scope	The additional Scope of Work for this package includes the following items:	
System Name	System Code	Category*
Fire Water Piping	STG	
Service Water Piping	WSC	
The systems listed above include the following:		
Above grade piping	Yes	
Below grade piping	Yes	
In addition to erection of the piping systems defined above, the Scope of Work includes the following services and materials:		
Routing of miscellaneous 2 inch (50 mm) and smaller pipe, fittings, and valves	Yes	
Installation of instrument and control piping and tubing as indicated on the attachments	Yes	
Hydrostatic testing of piping erected under these specifications	Yes	
Hydrostatic testing of the following piping systems erected by others:		
Furnish and properly dispose of water for hydrotest	Yes	
Furnish chemicals for treatment of hydrotest water	Yes	

Sterilization of potable water piping and equipment	No
Scope	Not applicable
Freeze protection required	No
Furnish and install pipeline identification	Yes
Metal signs	No
Stencil	No
Adhesive labels	Yes

15921.1.2 Items Furnished by Others and Interfaces

Items furnished by others and not in this Scope of Work include the following:

None.

15921.1.3 Performance and Design Requirements

Not used.

15921.1.4 Codes and Standards

Work performed under these specifications shall be performed 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
Installation of mechanical joint piping	ANSI/AWWA C111/A21.11
Field applied coatings for underground piping	AWWA C209
Repair of damaged field applied coatings for underground piping	AWWA C209, Section 3.4
Polyethylene tubing for underground ductile iron pipe	
Material	ANSI/AWWA C105/A21.5
Installation	ANSI/AWWA C105/A21.5
Sterilization of piping and equipment	AWWA C651, AWWA C652

15921.1.5 Materials

The following materials shall be used:

Component	Material
Nonfire rated penetration seals	Nylon reinforced hypalon with closure zipper and stainless steel worm drive clamps

Component	Material
Field applied protective coating for underground pipe	Tape and primer system
Metal pipe identification signs	Aluminum sheet, No. 5005 H-16, with engraved legends filled with paint
Pipe identification labels	Pressure sensitive vinyl cloth

Flange bolting shall be furnished if so indicated in the table below.

Alloy steel bolting shall be used for joining all raised face, weld neck, alloy or carbon steel flanges when used in conjunction with spiral wound gaskets, regardless of the design pressure rating of the flanges. Carbon steel bolting may be used with raised face, weld neck, alloy or carbon steel flanges of Class 150 and Class 300 design pressure rating, provided that compressed fiber gaskets are used, but alloy steel bolting is acceptable as well. In general, carbon steel bolting should be used with all other flanges not constructed of stainless steel or "exotic" materials. Examples would include carbon steel slip-on flanges, threaded carbon steel or iron flanges, flanged connections making use of elastomeric gasketing, backing rings for HDPE piping joints, etc. Alloy steel bolting may be used in-lieu of carbon steel bolting in these cases as long as appropriate bolt loading procedures and values are utilized to ensure that the flanges, gaskets, and flange-to-pipe joints are not damaged by over-tightening.

High-strength stainless steel bolting shall be used for all raised face, weld neck stainless steel flanges when used in conjunction with spiral wound gaskets, regardless of the design pressure rating of the flanges, unless subject to cryogenic service. Low-strength stainless steel bolting may be used with raised face, weld neck stainless steel flanges of Class 150 design pressure rating, provided that compressed fiber gaskets are used, but high-strength stainless steel bolting is acceptable as well. In general, low-strength stainless steel bolting should be used for all other stainless steel flanges or when required for cryogenic service. Stainless steel bolting may also be appropriate for flanges constructed of nickel based alloys or "exotic" materials. Examples of such materials would include Inconel, Alloy 20, C276, titanium, etc.

Bolting may be threaded studs and nuts or bolts and nuts. Bolts and nuts shall be heavy hexagonal heads conforming to the applicable standard.

Studs, Nuts, Bolts	
Alloy steel bolting materials for use with piping with design temperatures less than 800° F (427° C) and greater than -55° F (-48° C).	
Studs	ASTM A193/A193M Grade B7 ASME SA-193/SA-193M Grade B7
Nuts	ASTM A194/A194M Grade 2H ASME SA-194/SA-194M Grade 2H
High-strength stainless steel bolting materials for temperatures greater than -55° F (-48° C)	
Studs	ASTM A453/A453M, Grade 660 ASME SA-453/SA-453M, Grade 660
Nuts	ASTM A453/A453M Grade 660 ASME SA-453/SA-453M Grade 660

Low-strength stainless steel bolting materials for temperatures greater than -55° F (-48° C)	
Studs	ASTM A193/A193M Grade B8M ASME SA-193/SA-193M Grade B8M
Nuts	ASTM A194/A194M Grade 8M ASME SA-194/SA-194M Grade 8M
Carbon steel bolting materials	
Studs	ASTM A307 Grade B ASME SA-307 Grade B
Nuts	ASTM A563 Grade B ASME SA-563 Grade B
Bolt coating (applies to alloy, stainless steel, and carbon steel bolting)	
Piping design temperatures less than 450° F (232° C)	PTFE coating
Bolt plating (applies to alloy and carbon steel bolting)	
Piping design temperatures less than 450° F (232° C)	Cadmium plating in accordance with ASTM B766 or zinc plating in accordance with ASTM A153 or Nanolaminated Zn Ni coating in accordance with ASTM B841 Type A Grade 5; no red rust after 4000 hours of ASTM B117 salt spray testing.
Nonmetallic flanges without backing ring	Follow nonmetallic flange manufacturer's recommendation

15921.1.6 Acceptable Subsuppliers

For the following components, only the listed manufacturers are recognized as maintaining the level of quality of workmanship required by these specifications. If the Contractor wants to propose a nonlisted manufacturer that is considered to provide an equivalent level of quality, this manufacturer must be identified and supporting testimony provided. Acceptance of the manufacturer as a substitute is at the discretion of the Purchaser:

Component	Manufacturer
Shrink sleeves for underground piping	Raychem Corporation
Pipe identification labels	Brady Corporation (Type B500)
Air and Water Quick Disconnects	Dixon, Chicago type quick disconnects – Part # AM12 (male) and # AM13 (female)

15921.1.7 Test Requirements

The following testing shall be conducted in accordance with the specified source. This testing is to be considered part of the defined Scope of Work, and all associated costs are the responsibility of the Contractor unless specifically identified as a Bid Option or Purchaser-conducted. Tests identified as an option are to be priced separately. If identified as Purchaser-conducted, costs for the initial test will be the responsibility of the Purchaser. However, the Contractor is responsible for all costs associated with correcting deficiencies and retesting in the event of a test failure:

Tests	In Accordance With	Conducted By
Hydrostatic and pneumatic testing of piping	ASME B31.1-2018	Contractor
Hydrostatic testing of underground fire protection piping	NFPA 24	Contractor
Pressure testing of nonmetallic piping	ASME B31.1-2018, Paragraph 137.	Contractor
Testing of electrical isolation flange kits	Manufacturer's recommendations	Contractor

15921.1.8 Technical Attachments

Technical attachments relevant to the work under this section are listed in Section 01100.

15921.1.9 Supplemental Specifications

Technical supplemental specifications that are applicable to the work covered under this technical specification section are identified and included in Section 01400.

15921.2 Products

15921.2.1 Not Used

15921.3 Execution

All piping, valves, fittings, and piping specialties shall be erected in accordance with the requirements of this section. Any piping installation not specified herein shall be performed 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.

15921.3.1 Not Used

15921.3.2 Miscellaneous Piping

Miscellaneous piping is defined as piping 2 inches (50 mm) and smaller which is not shown on the detailed piping drawings. All miscellaneous piping shall be given special attention such that it is routed and installed in a neat, rectangular form. 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.

If routing of miscellaneous piping is included under these specifications, all piping, including tubing, not located on the drawings shall be routed and installed in accordance with the following requirements:

Pipe routing shall allow unobstructed maintenance of plant equipment.

Piping shall not be installed above, or within a horizontal distance of 3 feet (1 m) from, electrical equipment such as switchgear, switchboards, control panels, motor controls,

contactors, communication equipment, batteries, battery chargers, and motor generators unless written consent of the Purchaser is obtained. Improperly located piping shall be removed and relocated.

All branch piping shall be provided with shutoff valves at the main headers.

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.

Piping shall be installed with a minimum of 7'-6" (2.3 m) headroom over passageways and walkways.

Pipe runs that require condensate drainage shall be installed so that they pitch toward the point of drainage.

Piping subject to freezing shall not be routed in the vicinity of large doors which could be open for the moving of mobile equipment or maintenance.

Where building expansion walls are indicated on the drawings, piping shall not be supported from or located on columns or beams on these walls.

Piping indicated on P&IDs or other drawings as having a connection for the future extension of the piping to another unit shall be routed to a convenient point along the column row adjacent to the unit or the location for a future unit.

Routings shall be selected to avoid interference with planned and dimensioned locations for lighting fixtures, electrical trays, raceways, or conduit. The Contractor shall review the Purchaser's drawings for electrical construction to avoid such interferences before routing the piping.

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.

15921.3.3 Not Used

15921.3.4 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 Engineer and shall then be altered or existing piping shall be relocated. All pipe routings shall be subject to acceptance by the Owner.

15921.3.5 Alterations and Cut-ins

All alterations and cut-ins to existing piping and equipment indicated on the drawings shall be made as specified herein and as required for proper installation of the new piping and equipment.

All cut-ins shall be performed by sawing, machining, or careful flame cutting as directed by the Purchaser. Flame cut holes shall be ground smooth. The interior of the piping shall be thoroughly cleaned after cutting.

Whether indicated on the drawings or not, existing miscellaneous piping shall be revised as required to permit installation, without interference, of new piping and equipment. Existing miscellaneous piping that interferes with walkways or presents an unsightly appearance after modification of existing buildings, structures, equipment, or piping shall be relocated as directed by the Purchaser. The alterations to existing piping shall include any required revisions, additions, or replacements of insulation and pipe supports.

Any piping materials and valves removed and not reused shall be disposed of as directed by the Purchaser.

All alterations and cut-ins to existing systems shall be made on a time schedule acceptable to the Purchaser.

After alterations and cut-ins to existing coated equipment or coated piping have been made, the damaged coating shall be repaired. All welds and sharp edges shall be finished smooth and all weld spatter shall be removed. The metal shall be prepared and the coating system applied in strict accordance with the instructions and recommendations of the coating manufacturer.

15921.3.6 Not Used

15921.3.7 Pipe Supports

Welding of pipe supports to structural steel forming a part of the building supporting structure shall be in accordance with the requirements of Supplemental Specification Q280 in Section 21000. Generally, 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.

The support assemblies shall not be used for the attachment of rigging to hoist the pipe into place. The piping shall be securely held in place by other means until the pipe support is completely assembled and attached to the pipe and building structures and the spring support set to take care of pipe sway. All rigging shall be removed in such a manner as not to impose a sudden load on the pipe support.

15921.3.8 Cutting and Drilling Structures

All necessary drilling, cutting, and patching of structures required for proper installation of piping or bolts shall be performed, 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 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, the surfaces ground smooth, and any coatings repaired.

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.

Holes in floor plate shall be machine cut. Aluminum shall be used for banding aluminum plate and steel for steel grating or floor plate. After bands and reinforcements have been installed, all welds shall be ground smooth and weld areas, bands, and reinforcements shall be painted to match adjacent surfaces. Two coats of brush on zinc rich galvanizing repair compound shall be applied to damaged areas of galvanized metals.

Holes in concrete floors shall be provided with machine cut steel pipe sleeves in accordance with the details indicated on the drawings, if details are provided. If no details are provided, holes in concrete floors required for installation of piping shall be formed with steel sleeves that extend the full depth of the concrete and extend 4 inches (100 mm) above the floor line. Sleeves shall be fabricated from 1/4 inch (6 mm) thick steel plate or from standard weight steel pipe. Sleeves greater than 12 inches (300 mm) in

diameter shall be made from 3/8 inch (10 mm) thick steel plate. Each sleeve shall be provided with anchors welded to the sleeve as indicated on the drawings. The minimum spacing of anchors shall be 18 inches (450 mm) except that a minimum of three anchors shall be provided for each sleeve. All sleeves shall be machine cut and ground smooth. Holes for uninsulated cold pipe may be filled with a suitable expansion material in lieu of installing a sleeve.

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

Where boxouts are left in concrete walls for the passage of pipes, the Contractor shall weld 1/4 inch (6 mm) thick steel seal rings on the pipes and fill the space between the pipe and the boxout with concrete.

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.

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

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

15921.3.9 Not Used

~~mm) and 1/8" (3mm)~~

15921.3.10 Not Used

15921.3.11 Not Used

15921.3.12 Not Used

15921.3.13 Making Piping Connections

15921.3.13.1 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 coated with a suitable thread lubricant before the joint is made. The lubricant shall be suitable for the operating temperatures involved.

Flange torque values shall be determined based on the following criteria:

The manufacturer's suggested torque values shall be followed for bolting to equipment.

Where no information on flange torque values is available, the Contractor shall determine torque values and submit them for review and acceptance.

The manufacturer's suggested torque values shall be followed for nonmetallic flanges such as FRP. FRP flanges shall have the required torque values stamped on the flange hub.

The following defines three types of gaskets as defined in ASME VIII Division 1 Appendix 2 Mandatory Rules for Bolted Flange Connections with Ring Type Gaskets used on the majority of flanged piping systems addressed in this Specification:

Self-energized types such as o rings, elastomeric, other self-seating types such as red rubber below 75A Shore Durometer.

Low seating stress such as reinforced teflon, graphite and spiral wound with an approximate minimum design seating stress of 5000 psi or less.

Spiral-wound metallic high seating stress with an approximate minimum design seating stress of 10,000 psi.

The following may be used as a reference for torque values for flat face and raised face flanges.

PCC-1 Guidelines for Pressure Boundary Bolted Flange Joint Assembly indicates that the minimum and maximum loading requirements for bolting must be selected by the end user.

Per PCC-1, the maximum loading on bolts is typically in the range of 40% to 70% of the ambient bolt yield stress. The minimum loading on bolts is typically in the range of 20% to 40% of the ambient bolt yield stress.

The elastomeric gasket on flat face flanges should not protrude (extend) out beyond the flange after tightening. In some cases finger tight plus $\frac{1}{4}$ to $\frac{1}{2}$ turn with a wrench may control in lieu of torque values.

For typical torque values, refer to Article 15921.1.8 Technical Attachments.

Flanges shall use the following or similar approved criteria for bolting sequence of flanges.

Tightening method and load control techniques shall be completed with approved methods that utilize a single tool with one of the following methods; hand wrench, slug/hand wrench, impact wrench torque tools and tension tools.

The tightening sequence shall utilize an approved criteria similar to the five step increment rounds shown in Table 2 Torque Increments for Legacy Cross-Pattern Tightening Using a Single Tool and Table 4 Legacy Cross-Pattern Tightening Sequence and Bolt Numbering System When Using a Single Tool and Table 4.1 Alternative to Legacy Cross-Pattern Tightening Sequence and Bolt Numbering System When Using a Single Tool found in PCC-1.

Flange fit up shall meet the following tolerances:

Holes for bolts shall be within $\frac{1}{8}$ " (3 mm)

The flange faces shall be parallel with $\frac{1}{16}$ " inch/per foot (0.5%) measured across any diameter.

Gaps shall be within $\frac{1}{16}$ " (1.5 mm) plus space for any required gaskets.

Spiral wound gaskets in gas piping shall have inner retainer rings in accordance with ASME B16.20.

15921.3.13.2 Threaded Connections. Pipe threads shall be taper pipe threads in accordance with ASME B1.20.1.

Threading shall be performed after bending or heat treatment if possible. Threads cut before bending or heat treatment shall be protected with hi-temp silicone paint.

Threads shall be clean and full cut, concentric with outside of pipe and protected against damage by any subsequent fabricating operations or handling.

Unless specified on the drawings, no thread joints shall be seal welded. When seal welds are specified, care shall be taken to assure that the threads are free of dirt, grease and thread compounds.

15921.3.14 Hot Tap Branch Connections

Where "Hot Tap" connections are indicated on the drawings to connect new piping with piping that is pressurized and in operation, those connections shall be made using a tapping saddle assembly and equipment designed for the hot tapping procedure and by personnel experienced in hot tapping requirements.

15921.3.15 Traps

Traps shall be installed in accessible locations and as indicated on the drawings. They shall be installed on supports above floor level if possible and shall be readily accessible for repair and removal.

15921.3.16 Not Used

15921.3.17 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.

15921.3.18 Piping Isolation

All necessary flange isolating materials and insulated bushings, unions, and couplings shall be installed as indicated on the drawings and as required to properly isolate the piping. Bolting at insulated flanges shall consist of studs and nuts with sufficient stud length to allow at least one full stud thread protruding through each nut. Sleeves shall extend into the insulating washers. After installation, insulated flanges, bushings, unions, and couplings shall be tested to determine that the piping is properly electrically isolated to the satisfaction of the Purchaser.

The Contractor shall electrically isolate the designated piping from connecting piping and equipment, reinforcing steel, structural steel, the station grounding system, and other buried piping.

15921.3.19 Not Used

15921.3.20 Flexible Weatherproofing

After insulation work is complete, flexible weatherproofing shall be furnished where indicated on the drawings for piping that passes through walls and floors. The flexible weatherproofing shall be installed in accordance with the details indicated on the drawings.

Flexible weatherproofing material shall be as indicated in Articles 15921.1.5 and 15921.1.6 and shall have 0.050 inch (1.25 mm) minimum thickness. Joints in the fabric shall be weatherproof and shall be sealed with a compatible adhesive.

The fabric shall be attached to the piping and sleeves using 3/4 inch (19 mm) wide stainless steel worm drive clamps. The joint between the piping and the fabric shall be sealed with flexible rubber based adhesive.

Flexible weatherproofing shall be constructed with sufficient slack to accommodate the pipe movements indicated on the drawings without causing the fabric to become excessively taut.

15921.3.21 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.

Seals at penetrations in fire rated walls or enclosures shall be fire rated and shall be acceptable to the Purchaser.

Seals in nonfire rated applications shall be Contractor's standard.

Seals shall be installed and sealed in accordance with the manufacturer's installation instructions. Insulation work shall be complete before installing seals on insulated piping. The Contractor shall measure the outside diameter of the insulated and lagged pipe and the outside diameter of the penetration sleeve at each point where a penetration seal is to be installed and shall purchase penetration seals of the proper size.

15921.3.22 Drainlines

When connecting piping of the same size to a bell-up, the connection shall be caulked. When connecting steel pipe to an HDPE stub, the connection shall be made with a sleeve clamp. When one or more smaller pipes drain into a larger pipe, the bell-up shall remain open to allow visible verification of flow.

Caulked joints shall be packed and caulked in a manner acceptable to the Purchaser.

The ends of all steel lines to be caulked shall be built up with a continuous bead of weld metal.

All drain funnels, bell-ups, and floor drains shall be kept unplugged and free flowing.

15921.3.23 Protective Coatings

Protective coatings will be applied to the exterior surfaces of carbon steel piping. Unless otherwise noted in the Pipeline List, the coatings will be shop applied, and the Contractor shall repair the coatings and apply field coatings to field installed joints and to areas not covered by shop coatings.

15921.3.23.1 Coating Repair. The method of field repair of damaged shop applied coatings shall be in accordance with the standard specified for the coating. The repair materials shall be the same as the original coating or as recommended by the coating manufacturer.

15921.3.24 Underground Piping

Underground piping shall be installed as indicated on the drawings and as specified herein.

Excavation, trenching, embedment, and backfilling shall be in accordance with the requirements of Section 02200 - Earthwork.

15921.3.24.1 Blocking. Underground piping shall be provided with suitable concrete thrust blocks at locations indicated on the drawings and as required to prevent any movement of piping by the unbalanced internal liquid pressure. Concrete and reinforcing steel shall be as specified in Section 03311 - Cast-in-Place Concrete.

Thrust blocking to be furnished shall include blocking as required to prevent movement of uncovered piping during hydrostatic testing.

The Contractor shall be responsible for all blocking, and blocking shall not be accepted as adequate until piping has been successfully hydrostatically tested as specified herein.

Thrust blocking shall bear against undisturbed earth and shall be placed so that the pipe joints will be accessible for inspection and repair.

15921.3.24.2 Grade and Alignment. Piping shall be laid to the lines and grades indicated on the drawings. Laser beam equipment, survey instruments, or other acceptable construction methods shall be used to maintain alignment and grade.

All trenches shall be so graded and pipe so installed that the pipe, when laid on the trench bottom as previously prepared and graded, will be in accurate horizontal and vertical position.

Concrete pipe shall be aligned in accordance with the requirements specified below under Article 15921.3.25 - Concrete Pipe Installation.

Terminal point flanges shall be installed such that they are no more than the greater of 3/64" per foot or 1/32" out of level.

All pipe shall be brought to the terminal points specified within the tolerances listed below. For mislocated terminal points, the Construction Manager shall determine the means for correction. Bending will only be permitted if approved by the Engineer.

Description	Erected Tolerance From Drawings
NPS 2 inch and smaller	+/- 1/2 inch
NPS 12 inch and smaller	+/- 3/8 inch
NPS greater than 12 inch	+/- 1/4 inch

15921.3.24.3 Laying Pipe. Pipe shall be protected from lateral displacement by pipe embedment material installed as specified for trench backfill. Under no circumstances shall pipe be laid in groundwater in excavated trenches, and no pipe shall be laid when trench conditions are unsuitable. Trench bottoms that become unstable shall be stabilized in accordance with the requirements stated in these specifications.

15921.3.24.4 Closures. When pipe laying is stopped at the end of the day, or for any other reason, the end of the pipe shall be closed with a watertight plug or bulkhead. All branch outlets shall be adequately sealed as soon as the special or fitting is laid. It is essential that mud, sand, or debris be excluded from the lines at all times.

15921.3.25 Not Used

15921.3.26 Not Used

15921.3.27 Not Used

15921.3.28 Not Used

15921.3.29 Nonmetallic Pipe Installation

The installation of nonmetallic piping, including fiberglass reinforced plastic pipe and high density polyethylene pipe or other nonmetallic pipe, shall be as specified herein.

Nonmetallic piping shall be installed in strict accordance with the piping manufacturer's installation recommendations and the latest effective edition of B31.1, Mandatory appendix N, Rules for Nonmetallic Piping and Piping Lined with Nonmetals. Special attention shall be given to the manufacturer's recommended ambient installation temperatures, recommended embedment materials, pipe jointing system requirements including preparation and curing times and techniques, support requirements during installation, and recommended backfilling sequence and technique.

The Contractor shall submit evidence to the Purchaser that the piping manufacturer has reviewed the piping system layout and has provided proper guidance for the installation work to be completed successfully. The Contractor shall advise the Purchaser of any piping system layout modifications recommended by the manufacturer or otherwise required to properly install the piping. After receipt of concurrence from the Purchaser, the Contractor shall proceed with such changes at no cost to the Purchaser.

Nonmetallic pipe shall be pressure tested after installation as follows. Where the Pipeline List specifies an initial service leak test (ISLT), the pipe "rated pressure" shall be deemed to be the Pipeline List specified design pressure. Otherwise the "rated pressure" shall be the Pipeline List specified test pressure.

1. Cycle (for HDPE materials): Pressurize the entire nonmetallic pipe system to the rated pressure. Hold for five (5) minutes, recognizing that material elasticity will cause some amount of pressure decay, even in leak-free systems. Repeat this process four (4) more times, adding water as required to achieve the rated pressure during each cycle.

Cycle (all other nonmetallic materials): Pressurize the entire nonmetallic pipe system 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.

2. Hold: Pressurize the entire nonmetallic pipe system to the specified test pressure and hold at this pressure for two (2) hours.
3. Test: Reduce pressure to specified design pressure and walk down the entire system to check for leaks.
4. 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.

15921.3.30 Not Used

15921.3.31 Testing

Where required by Article 15921.1.1, materials and equipment tests shall be made by the Contractor as specified herein, as specified on the Pipeline List, and as required by code requirements and local and state regulations.

Water used to test other lines shall be clean, filtered, fresh water (service water or better) and shall be chemically treated to inhibit biological organisms. Treatment levels shall not exceed 2 mg/L of residual chlorine.

Testing water shall not be left to stagnate in the lines.

All materials, equipment, tools, instruments, blocking, bracing, bulkheads, blanking plates, and all labor required to complete the tests shall be furnished by the Contractor. Test water and chemicals shall be furnished by the Contractor or the Owner as specified in Article 15921.1.1.

If any tests reveal unsatisfactory materials of workmanship, such materials or installation shall be repaired or replaced to the satisfaction of the Owner.

15921.3.31.1 Pressure Testing of Piping. When a test pressure is specified for a piping system in the attached piping drawings, the specified test pressure shall be applied to the system upon completion of erection. Where no test pressure is specified, pressure testing is not required for that system except as specified otherwise herein.

Except as otherwise specified herein or in the Pipeline List for "air test," all pressure testing shall be performed hydrostatically in accordance with ASME B31.1. Leaks shall be repaired and the system retested until accepted by the Purchaser as satisfactory.

All underground piping shall be given a hydrostatic test prior to covering the line.

Underground fire protection system piping shall be hydrostatically tested in accordance with the referenced standard in Article 15921.1.4. The maximum allowable leakage for joints and for components other than gaskets or joints shall be as specified in the referenced standard.

The test pressure shall not be applied until the components being hydrostatically tested and the pressurizing medium are at approximately the same temperature. All expansion joint control rods and attachments shall be properly adjusted before application of test pressure.

Before applying the test pressure, all air shall be expelled from the piping being hydrostatically tested. If required, taps at the high points of the piping systems shall be made and shall be plugged upon completion of the testing. The addition of high point vents on alloy piping shall be approved by the Engineer.

Lines to be air tested shall be completed in accordance with a test plan. The test plan shall address internal and external temperature, stored energy in the system, nonflammable and nontoxic media, increasing the pressure in stages, and safe distance zones during testing. The system shall be given an application of a leak detection fluid that shall reveal the presence of leaks by easily visible means, such as bubble formation.

Where specified in Article 15921.1.1, piping installed under separate specifications shall be hydrostatically tested under these specifications. If defects are discovered in the piping that has been installed under separate specifications and tested under these specifications, the Contractor shall inform the Purchaser, who will instruct the installing contractor to return to the site and locate and repair all defects. All costs incurred as a result of defects in piping installed under separate specifications, including costs of subsequent retesting, will be borne by the Contractor who installed that section of pipe in which the leak was found.

Piping that must be hydrostatically tested but would be adversely affected by rust as indicated in Article 15921.1.1 or as directed by the Engineer, shall have a rust preventive added to the test water and shall be forced-air dried after testing. The chemicals shall be added while the piping system is being filled. All temporary piping and equipment required for the addition of the chemicals shall be furnished.

All end closures shall be left in place to prevent foreign materials from entering the piping during other work. The low points of the piping shall be provided with drain taps and plugs. All plugs in the piping shall be seal welded.

15921.3.31.2 Not Used

15921.3.31.3 Underground Water Lines. All hydrostatically tested underground water lines shall be dewatered after the test to the extent necessary to lower the water level below the frost line. Where dewatering is not practical, other suitable methods shall be used to prevent freezing. These methods shall be acceptable to the Purchaser.

15921.3.32 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 fuel gas and compressed air lines shall be air blown.

The cycle makeup and storage, condensate, feedwater, and steam piping shall be flushed with chemically treated water defined as demineralized water with sufficient ammonia to raise the pH to approximately 10.0.

Water used to flush other lines shall be clean, filtered, fresh water (service water or better) and shall be chemically treated to inhibit biological organisms. Treatment levels shall not exceed 2 mg/L of residual chlorine.

Flushing water shall not be left to stagnate in the lines.

15921.3.33 Not Used

15921.3.34 Sterilization

The equipment and piping so identified in Article 15921.1.1 shall be disinfected in accordance with the referenced standards, except as modified herein.

Chlorine solution shall be injected into the system while the system is being filled with raw water to achieve not less than 50 mg/L chlorine residual throughout the system. The valves on the highest portion of the distribution system shall be opened and allowed to remain open until chlorinated water appears. The branch lines of the distribution system that have long runs of piping shall be vented until chlorinated water appears at each distribution point. All valves on the distribution system shall be closed and the system allowed to stand for 24 hours. At the end of this period, the distribution system water shall be sampled at the various appurtenances for residual chlorine. If chlorine residual has dropped below 25 mg/L at any point, the entire system shall be drained, and the process repeated. If all appurtenances contain a chlorine residual of 25 mg/L or more, the entire system shall be drained and refilled with normal chlorinated potable water with a chlorine residual of 1 mg/L if the system is to be placed into immediate service. If the system is not to be placed into service immediately, it shall be refilled with potable water containing 5 mg/L of residual chlorine.

Water storage facilities shall be filled to the overflow level with service water containing a minimum chlorine residual of 10 mg/L. This residual shall be maintained for a 24 hour period. The water storage facility shall be completely drained and refilled with potable water containing a maximum of 2mg/L residual chlorine.

Bacteriological testing is required for both mains and water storage facilities. Mains are to be sampled 24 hours after disinfection. One sample shall be taken for each 1,200 feet (365 m) of distribution piping at points separated by a nominal 1,200 foot (365 m) distance. Water storage facilities shall be sampled and tested before any water is allowed to enter the distribution system. Failure to pass the bacteriological testing requirements for potable water shall be cause for the entire disinfection process to be repeated. In no event shall the water contained in the distribution system or water storage facility be used for human consumption before acceptable bacteriological test results are obtained.

15921.3.35 Final Adjustment

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

15921.3.36 Not Used

15921.3.37 Identification

Where indicated in Article 15921.1.1, pipeline identification markers, indicating the pipeline contents, and direction-of-flow arrows shall be furnished and installed on all piping 2-1/2 inches (63 mm) and larger in diameter.

The markers shall be located at strategic points along the pipe length as directed by the Purchaser. At least one marker for each pipeline shall be visible at each floor or access platform level, on each side of walls where piping passes through, at each branch takeoff, at each valve, and at each termination. Each horizontal run of piping greater than 25 feet (7.5 m) long shall have at least one sign and, if necessary, additional signs shall be provided so that the distance between signs does not exceed 50 feet (15 m).

A list of legends and samples of the markers shall be submitted to the Purchaser for acceptance before the markers are ordered. The composition of the legends shall be as directed by the Purchaser.

15921.3.37.1 Adhesive Labels. Labels shall be pressure sensitive vinyl cloth. Labels shall have 2 inch (50 mm) high legends for pipes and insulation 3 inches (75 mm) or more in diameter and shall have 3/4 inch (19 mm) high legends for pipes and insulation less than 3 inches (75 mm) in diameter. The specific background colors, legend colors, and the names for the pipe contents shall be as directed by the Purchaser.

16120 – AC Panelboards Datasheet(s)

General			
1.	Site Conditions		
2.	Site Location	Baldwin, FL	
3.	Ambient Design Temperature Range	Minimum Per D200	Maximum: Per D200
4.	Design Altitude Above Sea Level	Per D100	
5.	Applicable Standards		
6.	AC Panelboards	ANSI, IEEE, NEMA, UL	
Testing Requirements			
7.	Purchaser Witness Test	No	
8.	Standard Factory testing to be performed in accordance with	ANSI, IEEE, NEMA, UL	
Technical Attachments			
9.			
10.			
11.			
12.			
13.			

Applicability		
14.	Panel Tag	Panel Description
15.	Later	480v-3phase-3W ,200amp Panel
16.	Later	208Y/120V 42 Circuit (minimum) Lighting Panel
17.		
18.		
Accessories and Options		
19.		Provided by Contractor
20.	Convenience receptacle internal to panel	No
21.	Ground Detection System	No
22.	Ground circuit pulsing and tracing system	No
23.	Voltage dropping diode system	No
24.		
25.		

Additional Requirements	
26.	Each panelboard cabinet shall consist of a box with a removable front, complete with hinged door, latch, and master keying lock. The panelboard interior shall be equipped with a dead-front shield separate from the cabinet front and a circuit directory cardholder and card with a clear plastic covering

	shall be provided on the inside cabinet door. The directory card shall have a space to identify each circuit in the panelboard. An engraved nameplate shall be provided on the front of the panelboard door.
27.	All main and branch circuit devices shall be bolt-on. Branch circuit devices shall be individually front replaceable type, and shall indicate ON, OFF, and TRIPPED. Circuit breakers indicated as multiple-pole shall be common trip. Branch circuit breakers installed in the panelboard shall be identified with odd numbers on the left and even numbers on the right.
28.	All AC panelboards shall have neutral and ground busses. The neutral bus shall be insulated from the cabinet with provisions for grounding and have solderless connectors, numbered to agree with the branch circuits. The equipment grounding bus shall have a main lug and solderless connectors, numbered to agree with the branch circuits.
29.	<p>When Circuit Breakers are specified, they shall be thermal magnetic type suitable for the voltage and interrupting capacity specified.</p> <p>When Fused Switches are specified, they shall be replaceable dual element fuses arranged in series with manually operated quick-make, quick-break switches suitable for the voltage and interrupting capacity specified.</p> <p>When Fuses and Circuit Breakers are specified, they shall be fast acting semiconductor protection fuses in series with manually operated thermal magnetic type circuit breakers suitable for the voltage and interrupting capacity specified.</p> <p>Circuit Breakers shall be ground leakage equipment protection type.</p> <p>Circuit Breakers shall be Ground Fault Circuit Interrupter (GFCI) type as shown on load list.</p>

16502 - Lighting for Pre-Engineered Buildings

16502.1 General

16502.1.1 Scope of Supply

Scope of supply shall include designing, furnishing, and installing the building lighting and convenience receptacle system as specified herein.

16502.1.2 Items Furnished by Others and Interfaces

Items furnished by others and not in this scope of supply include the following:

Existing 480v-3phase Panel Board & 200A circuit breaker for Power Supply to Building, located outside of building to be provided by the Owner. Power Feeder from existing 200A breaker to Contractor supplied panelboard by Contractor.

16502.1.3 Performance and Design Requirements

Performance and design requirements for the equipment and materials to be furnished under this section of these specifications are indicated herein.

The lighting system shall be designed by the Contractor to provide personnel with illumination for plant operations under normal conditions, essential lighting in selected electrical/control areas and means of egress under emergency conditions. The power supply for the normal lighting system shall be from Contractor provided 208Y/120 volt, 3-phase, 4 wire lighting panelboards. The power supply for convenience receptacles shall be from Contractor provided 208Y/120 volt, 3-phase, 4 wire lighting panelboards. Emergency egress lighting shall be provided with normally "off," emergency "on" integral lead acid battery powered emergency lighting units with chargers rated for 1.5 hours minimum and in accordance with UL 924.

The lighting system shall be designed in accordance with the recommendations of the Illuminating Engineering Society (IES) Lighting Handbook. Emergency egress and exit lighting shall be designed in accordance with National Fire Protection Association (NFPA) 101, Life Safety Code, latest edition. The illumination levels shall be as listed. Calculations shall be submitted.

Area	Average Maintained Illumination Level (foot-candles)
Warehouse Inactive Area	7.5
Warehouse Active Area	30

Electric power to light fixtures shall be switched with wall mounted light switches or other devices as required by the local state Energy Code, located at the entrance to all rooms on the latch side of the door. Light fixtures located outside above doors shall be provided with integral photoelectric controllers.

Convenience receptacles shall be grounding type and spaced to provide access to any point in the buildings with a 100 foot extension cord. A minimum of one receptacle shall be provided on each wall. One weatherproof GFI receptacle shall be provided on each of the four exterior sides of the building.

Illumination levels for the building spaces shall be in accordance with the IESNA and the NFPA Life Safety Code 101. Illumination calculations shall be provided to the Purchaser for all spaces. Calculations shall be average maintained values determined from a working plane height of 30 inches above the floor. Light loss factors shall be determined as recommended by IESNA.

Lighting in process areas shall be designed with the equipment in the space in mind and to avoid interferences with tray, piping and HVAC ducts which are being designed by others. Contractor shall

obtain information from the Purchaser regarding these other utilities and make use of this information in locating fixtures.

16502.1.4 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
Luminaires	
Light emitting diode (LED)	UL 8750
Emergency and emergency power equipment	UL 924
Hazardous area	UL 844
Duplex and single receptacles	UL 498, 943, 1010, 1449, 1682, 1686
Switches, dimmers, contactor, and photocells	UL 20, 508, 773, 894, 1472
Device plates and outlet boxes (unfinished areas)	UL 514

16502.1.5 Materials

The following materials shall be used:

Component	Material
Switches	
Housing and operating levers	Phenolic compound
Device plates	
Finished areas (metal)	Type 430 satin stainless steel
Unfinished areas	Formed sheet steel coated with zinc of cadmium
Weatherproof receptacle and switches	
Plates and lift cover	Cast aluminum
All other metal parts	Stainless steel or Monel metal

16502.1.6 Approved Manufacturers of Components

For the following components, only the listed manufacturers are recognized as maintaining the level of quality of workmanship required by these specifications. If the Contractor wants to propose a nonlisted manufacturer that is considered to provide an equivalent level of quality, this manufacturer must be identified and supporting testimony provided. Acceptance of the manufacturer as a substitute is at the discretion of the Purchaser. Note that "finished areas" are defined as rooms with a suspended ceiling system, and "unfinished areas" are all other indoor locations:

Component	Manufacturer
Luminaires	
Industrial linear enclosed and gasketed LED suitable for damp and wet locations	Dialight, Holophane, Lithonia
Recessed volumetric LED troffer	Cree, Day-Brite, Lithonia
Wall mounted linear LED	Cree, Day-Brite, Lithonia
Emergency LED wall mounted units with integral lead acid batteries suitable for 90 minute operation	Chloride, LightGuard, Emergi-Lite
Emergency LED recessed ceiling mounted units with integral lead acid batteries suitable for 90 minute operation	Chloride, LightGuard, Emergi-Lite
Emergency LED exit lighting units with a black aluminum enclosure, brushed stencil face, and integral batteries suitable for 90 minute operation for finished areas	Chloride, LightGuard, Emergi-Lite
Emergency LED exit lighting units with white steel enclosure and integral batteries suitable for 90 minute operation for interior unfinished areas	Chloride, LightGuard, Emergi-Lite
Emergency remote LED Head for outdoor areas	Chloride, LightGuard, Emergi-Lite
Convenience Receptacles	
Duplex (gray for finished areas and brown for unfinished areas)	Hubbell (Generic Catalog No. 5362), Pass & Seymour, Cooper Wiring, or Leviton
Single (gray for finished areas and brown for unfinished areas)	Hubbell (Generic Catalog No. 5361), Pass & Seymour, Cooper Wiring, or Leviton
Special purpose outlets, such as kitchen range, AC unit, and clock outlet	Hubbell, Pass & Seymour, Cooper Wiring, or Leviton
Isolated ground	Hubbell (Generic Catalog No. IG5362), Pass & Seymour, Cooper Wiring, or Leviton
Ground fault interrupting	Hubbell (Catalog No. GF20L), Pass & Seymour, Cooper Wiring, or Leviton
Hazardous rated (Class I, Group D and Class II, Group F areas)	Single gang 125 VAC, 20 amp: Appleton EFS "U-Line" or Crouse-Hinds ENR series

Component	Manufacturer
Switches	
Single-pole (gray for finished areas and brown for unfinished areas)	Hubbell (Generic Catalog No. 1221), Pass & Seymour, Cooper Wiring, or Leviton
Three-way (gray for finished areas and brown for unfinished areas)	Hubbell (Generic Catalog No. 1223), Pass & Seymour, Cooper Wiring, or Leviton
Four-way (gray for finished areas and brown for unfinished areas)	Hubbell (Generic Catalog No. 1224), Pass & Seymour, Cooper Wiring, or Leviton
Momentary contact	Pass & Seymour, Cooper Wiring, or Leviton
Two-pole	Hubbell (Generic Cat. No. 1222), Pass & Seymour, Cooper Wiring, or Leviton
Three-way, four-way (Class I, Group D and Class II, Group F areas)	Appleton or Crouse-Hinds "EDS" tumbler series
LED Dimmer	Lutron, Leviton
Fluorescent dimmers	Lutron "NOVA" series, Leviton
Device plates	
Device plates (unfinished areas)	Appleton or Crouse-Hinds
Device plates (finished areas)	Hubbell, Pass & Seymour, Cooper Wiring, or Leviton
Weatherproof duplex receptacle in-use device plates	Hubbell, Red Dot, TayMec
Weatherproof switch device plates	Crouse-Hinds DS185 or Appleton
Miscellaneous	
Photoelectric controller	Fisher Pierce N7790B
Lighting contactors	ASCO, Cutler-Hammer, General Electric, Siemens, or Square D

16502.1.7 Test Requirements

The following testing shall be conducted in accordance with the specified source. This testing is to be considered part of the defined Scope of Work, and all associated costs are the responsibility of the Contractor unless specifically identified as a Bid Option or Purchaser-conducted. Tests identified as an option are to be priced separately. If identified as Purchaser-conducted, costs for the initial test will be the responsibility of the Purchaser. However, the Contractor is responsible for all costs associated with correcting deficiencies and retesting in the event of a test failure:

Tests	In Accordance With	Conducted By
Operational test	Article 16502.1.4	Manufacturer

16502.1.8 Technical Attachments

The following attachments accompany these specifications in either paper or electronic format. The information contained in these documents constitutes requirements under the defined Scope of Work:

Document Number/Description	Title	Revision
Section 01100	Technical Scope and System Performance Requirements	

16502.1.9 Supplemental Specifications

Technical supplemental specifications that are applicable to the work covered under this technical specification section are identified and included in Section 21000.

16502.2 Products

16502.2.1 Luminaires

Luminaires shall be LED Type as specified in this specification section and provided drawings.

Industrial LED luminaires for electrical and mechanical rooms shall be metallic linear enclosures with hardened lens.

High bay and low bay LED luminaires shall be steel or cast aluminum enclosures with adequate heat sinks and a power hook assembly. High bay or low bay luminaires shall have light distribution control. LED wallpack luminaires shall be suitable for wet locations and shall include a black or dark bronze cast aluminum enclosure and cutoff flat glass lens with photocell

LED luminaire color temperature shall be 5000°K with 500mA drivers.

16502.2.2 Luminaire Supports

All required luminaire supports, hangers, clamps, hardware, and fasteners shall be furnished and installed as required for a rigid support. Supports shall be from the building structure support steel or walls. Chain supported luminaires are not acceptable. Supports shall be designed for the project seismic criteria.

16502.2.3 Plugs

One matchup hazardous rated plug shall be furnished for each three hazardous rated receptacles.

16502.2.4 Switches

Switches shall be totally enclosed tumbler type with single mounting yoke design. Single- and double-pole switches shall be position indicating.

16502.2.5 Device Plates

Device plates shall be furnished for all device boxes. Stamped steel shall be provided for unfinished areas, and stainless steel shall be provided for finished areas. Outdoor location device plates shall be suitable for wet locations with the plug installed.

16502.2.6 Lamps

Lamps or LED drivers shall be furnished for all luminaires.

16502.2.7 Lighting Contactors

Lighting contactors shall be as specified in this specification section. Lighting contactors shall be electrically or mechanically held as required by the design and shall include an enclosure suitably rated for the installation environment (NEMA 12 minimum), hand-off-auto control switch, control fuse, and contacts rated for the application.

16502.2.8 Lighting and Convenience Receptacle Conductors

The following conductor types for use in the lighting and convenience receptacle circuits shall be provided in accordance with Cable Specification Sheets included in Section 16510.

Cable Type	Circuit Use
THHN	For 120 volt circuits in heated areas
XHHW-2	All 277 volt circuits and all 120 volt circuits in unheated areas
SF-2	For incandescent luminaire connections

16502.2.9 Lighting and Convenience Receptacle Raceway

The following raceway and raceway fittings (minimum size 1/2 inch) for use in lighting and convenience receptacle circuits shall be provided.

Raceway Type	Use
Electrical metallic tubing (EMT)	Installed in indoor nonhazardous areas
Rigid galvanized steel	Outdoors above grade and indoor hazardous areas
Flexible metallic tubing	Luminaire taps in finished areas

16502.2.10 Lighting and Convenience Receptacle Metal Clad Cable

If metal clad cable is used, the following multi-conductor cable and fittings for use in lighting and convenience receptacle circuits shall be provided. Concealed areas include locations above ceiling systems and within gypsum board walls:

Metal Clad (MC) Cable Type	Circuit Use
(XHHW-2) – Aluminum continuously corrugated welded armor with PVC jacket	Installed in indoor nonhazardous areas and outdoor above grade nonhazardous areas for 120 and 277 volt circuits (alternatively, may be used in indoor, non-air-handling, non-hazardous areas)
(THHN) – Interlocked steel armor	Installed in indoor nonhazardous concealed finished areas for 120 and 277 volt circuits

19000 - Quality System Requirements

If the Contractor believes that an inconsistency exists between this section and other portions of the contract documents, the Contractor shall immediately notify Purchaser for resolution.

19000.1 General Quality System Requirements

19000.1.1 Quality System

The Contractor shall demonstrate a documented Quality Management System (QMS) by providing supporting QMS documentation as defined in the Schedule of Submittals. The Contractor's quality system shall comply with ISO 9001 Quality Management System and/or ASME, when applicable by contract scope, and the codes and standards listed throughout this document.

The Contractor's QMS shall ensure that all equipment, assemblies, services, and commodities supplied are in conformance with the contract drawings and specifications.

The Contractor's QMS shall provide assurance that design, procurement, materials, installation, inspection and testing, storage, and related services comply with the requirements of the contract documents. The Contractor's QMS shall have a defined process for reporting, segregation, evaluation, disposition, and closure of nonconforming product/installation. This QMS shall be available to the Purchaser for review and/or audit where work is being performed subject to these contract documents.

19000.1.2 Subtier Suppliers

The Contractor shall obtain the Purchaser's approval in writing prior to using subcontract suppliers for manufacturing, installation/erection or engineering activities.

All applicable requirements of the contract documents (i.e., technical, quality, and administrative) shall be passed on to the applicable organizations within the Contractor and subcontract supplier's companies. The Contractor shall ensure that subcontract suppliers have the capabilities to fulfill contract document requirements. Contractor shall monitor subcontract suppliers' quality of work and shall indicate the strategy on their inspection and test plan.

Contractor/ shall submit required procedures, drawings, quality management documentation, and/or other submittals when required in the Schedule of Submittals for approval and/or information of subcontract supplier's capabilities, processes, or in-process work involving the engineering, fabricating, installation, and manufacturing of equipment and commodities for the Purchaser.

Subcontract supplier qualification and monitoring are the responsibility of the Contractor. Purchaser has the authority to perform quality audits and inspections and monitor and/or review subcontract supplier processes and facilities, at all locations where work is being performed subject to these contract documents.

19000.1.3 Inspection and Test Plan

In accordance with the Schedule of Submittals, a detailed inspection and test plan (i.e., a Quality Control Plan, including construction inspection and test plans) for the work shall be submitted to the Purchaser as specified in the contract documents prior to starting site installation/erection or commissioning activities as applicable by scope. The Purchaser will designate any additional test witness points or other inspection points required during review of the Contractor's submitted detailed inspection and test plan.

The inspection and test plan (ITP) shall identify the inspection and testing points and include the contract specifications, codes, required documentation, acceptance criteria for major components of the work, relevant procedures, and the location and target date for each inspection or test. The ITP shall be complete when first submitted and shall be maintained current throughout the life of the contract. When the ITP is revised, the Contractor shall submit a revised ITP for review. The ITP shall also include the Contractor's strategy for inspecting subcontract Contractor's work, including inspection by the Contractor.

The Contractor shall inspect the work of subtier Contractor to the extent necessary to ensure that proper materials are furnished, and assembly and erection are accomplished in accordance with the contract documents.

The Contractor shall keep the Purchaser informed of the progress of the work. When inspection and test points have been designated by the Purchaser as witness, in-process, and/or hold points, the Contractor shall notify the Purchaser at least 1 day in advance of the appropriate times for inspections and testing

A pre-fabrication inspection is a point prior to fabrication and inspection activities where the Purchaser will meet with the Contractor at the primary location of fabrication to review fabrication and inspection related activities that will take place. Discussion typically include, but are not limited to; materials, codes, standards, sub-suppliers, welding processes, test facilities and methods, and shop loading. Inspection target is approximately 2 weeks prior to the start of fabrication.

A witness inspection point (if API – Observe) is a step in the installation where the Contractor is obligated to notify the Purchaser in advance of the performed operation so that it may be witnessed unless specified otherwise in the Schedule of Submittals. If the Contractor properly notified the Purchaser but the Purchaser was not present at the time and date specified by the Contractor, the Contractor may proceed.

A hold inspection point (if API – Witness) is a designated stopping place during or following a specific activity at which the Purchaser's inspection or witness is required before further work can be performed. The Contractor may not proceed beyond the hold point without inspection or witness by the Purchaser, unless prior written authorization is obtained from the Purchaser.

An in-process inspection point (If API – Observe) is a Purchaser inspection that occurs during the manufacture/installation process. If the Purchaser is not present at the time and date specified by the Contractor, the Contractor may proceed.

A preshipment inspection point is a Purchaser inspection that may include a check of shipping blinds, packaging, loading and/or verification of purges, dimensional check, coatings protection and/or document review (shop quality, shipping documents). Preshipment inspections can be witness or hold points.

A final inspection point is a Purchaser inspection that may include dimensional check, weld end preps, cleanliness, coatings/coatings protection, and/or shop quality document review. Final inspections can be witness or hold points

The Purchaser may waive the witness of tests; waivers for hold points shall be in writing. Waivers in no way absolve or relieve the Contractor of complying with contractual requirements.

If the Contractor has notified the Purchaser defining the specific test date and time and the Contractor is not ready to conduct the test at the stated date and time, the Contractor shall be accountable for all additional expenses incurred by the Purchaser.

The Purchaser may waive the witness of tests; waivers for hold points shall be in writing. Waivers in no way absolve or relieve the Contractor of complying with contractual requirements.

19000.1.4 Inspections by Purchaser

The Purchaser may elect to perform assessments, quality audits, or perform inspections at any time during the installation process. The Purchaser may designate an authorized agent for assessments, witness testing, or quality audits. Authorized agent may be an employee of the Purchaser or an outside agency. When an outside agency is designated as an authorized agent for the Purchaser, such designation will be in writing with a copy provided to the Contractor. When the term "Purchaser's representative" is used, it may mean the Purchaser or the authorized agent.

The following requirements shall apply for Purchaser's inspection at the Contractor's point of installation, yard, warehouse, or subtier Contractor's work.

19000.1.4.1 Access. The Purchaser's representative shall have the right to access the Contractor's and subtier Contractor's work and related documents during the installation/erection process without delaying the schedule. The Contractor shall provide, without cost, reasonable access for personnel, and instruments for demonstrating acceptability of the work.

19000.1.4.2 Surveillance Activities. In accordance with the contract documents, designated hold points for witnessing tests shall be performed in the presence of the Purchaser's representative unless waived in writing by the Purchaser's representative. The Contractor shall bear all costs for such tests, except the compensation and expense of the Purchaser's representative.

19000.1.4.3 Control of Special Processes. It is the Contractor's responsibility to ensure that qualified personnel are employed to perform special processes such as welding, nondestructive examination (NDE), coating, painting, etc. If special processes are conducted by unqualified employees, the Purchaser has the right to validate and test the work at Contractor's expense and/or reject the work. The Contractor shall be able to demonstrate the qualifications of personnel in writing.

19000.1.4.4 Nonconformance. Upon identification of a noncompliance of the contract documents and/or applicable codes, the Contractor shall document the noncompliant issue in accordance to Contractor's nonconformance procedure. For noncompliance issues where the nonconforming disposition is characterized as "Use-As-Is" or "Repair" as defined in Article 19000.1.4.4.1, the Contractor shall submit the nonconformance report to the Purchaser for review and approval. During witness and hold point activities, if the Purchaser's representative identifies a noncompliance issue, the Contractor shall document the noncompliance issue and provide a copy of the documentation to the Purchaser's representative. If the Contractor disagrees and does not document the noncompliance, the Purchaser's representative shall issue a nonconformance report to the Contractor for disposition and action. The Contractor shall correct, in a timely manner, all deficiencies identified in the nonconformance report.

19000.1.4.4.1 Nonconformance disposition definitions.

Rework - Process by which a nonconforming item is made to conform to a prior specified requirement by completion, correction, reassembling, or other means.

Repair - Process of restoring a nonconforming item to such a condition that the capability of an item to function reliably and safely is unimpaired, even though that item still may not conform to the original requirement.

Use As Is - A disposition which may be used for a nonconforming item when it can be established that the discrepancy will not adversely affect the functional requirements of its intended use (including performance, maintainability, fit, and safety).

Reject/Scrap - Action taken to eliminate a nonconforming item from its specified use and either reject the item or have it scrapped, as appropriate.

19000.1.4.5 Receipt Inspection. Materials or equipment purchased under these contract documents may be inspected at the specified receiving points and will either be accepted or rejected. Receipt inspection may include preservation, maintenance and testing to determine compliance with the contract documents. Initial receipt inspection acceptance tests will be performed by the Contractor at the Contractor expense. Items found to be defective may be returned to the Contractor for correction at the Contractor's expense, including shipping cost, or the cost to correct and inspect the item will be charged to the Contractor.

19000.1.4.6 Deviation. Any technical deviations sought by the Contractor to the contract documents shall require written approval from Purchaser prior to the deviation or change being implemented.

19000.1.4.7 Repair. The Contractor shall submit a repair procedure to Purchaser for all repairs as determined by contract, code, or repair dispositions definition in Article 19000.1.4.10.1. The Contractor shall obtain Purchaser approval of the repair procedure prior to starting the repair.

19000.1.5 Code and Non-Code Inspection

19000.1.5.1 Code Inspection. Code inspection includes functions performed by an authorized inspector, his delegates, government agencies, or other independent third-party inspectors to verify compliance with the applicable codes, government regulations and, when specified, the engineering design.

19000.1.5.1.1 Determination of code requirements. All equipment or materials purchased or specified in accordance with a code or government regulation shall be inspected as required by that code or regulation.

The codes, laws, or regulations of record applicable to a project, together with any additional requirements, shall be those referenced in the Project Design Data.

19000.1.5.1.2 Personnel qualifications. Inspections and examinations required by all codes, laws, or government regulations applicable to the project shall be made by inspectors and other personnel who are officially qualified in accordance with those applicable codes, laws, or government regulations.

Welders, nondestructive examination personnel, and other construction specialists required to be tested or certified by the applicable code, law or government regulation shall be verified as having satisfied these requirements.

In no case shall the Purchaser inspector or inspection representative be construed as the authorized code or independent third-party inspector.

19000.1.5.2 Non-Code Inspection. Non-code inspection includes functions performed by Purchaser or its authorized agent to:

- Review, monitor, and conduct surveillance of the Purchaser Quality Control Program and its implementation.
- Perform quality control functions required by Purchaser standards or specifications that are in addition to code requirements.

The inspection of a Contractor by Purchaser or its inspection representative may include, but is not limited to, the complete or partial performance of the following:

1. Verification of the use of qualified welders and qualified welding procedures.
2. Checks on materials, dimensions, and finishes.
3. Review/audit of nondestructive examinations, including alloy verification if required, including ensuring that personnel are qualified to perform these examinations.
4. Witnessing of pressure tests and equipment mechanical and performance tests.
5. Review of documentation.
6. Audit of the Contractors' quality control program, including document control and disposition of nonconforming work. Audits shall take place at the point of fabrication.

The extent of inspection to be performed on materials and equipment supplied by each Contractor shall be determined by considering the Contractor's quality control program and previous experience of Purchaser with the Contractor.

Purchaser or a designated representative of Purchaser may perform inspections in addition to or exceeding code requirements in order to meet quality standards specified by Purchaser or the Client.

All materials, packaging, equipment, and fabrication items may be subject to non-code inspection during all stages of fabrication, testing, transportation, storage, and erection.

19000.1.5.3 Owner Participation. If applicable, the Owner's inspector shall be given full access to Contractor facilities for inspection. The Purchaser inspector shall act as the official spokesman in all discussions with the Supplier. Supplier shall refer any conflict between Purchaser Order requirements and the Client inspector's requirements to Purchaser for resolution.

In the event the Purchaser inspector is not present when the Owner's inspector encounters an unacceptable condition which may cause a delay in shipment, the Owner's inspector shall immediately send complete information regarding the condition, proposed corrective measures, and estimated delay through the established channels to Purchaser for Purchaser action.

19000.1.5.4 Code or Third-Party Inspection. Unless the governing code or authority requires the Owner to assume the responsibility for the authorized code inspection, the Purchaser shall make the necessary arrangement with the Contractor for all required code or third-party inspections, and shall collect the Authorized Inspectors Reports and the Manufacturer's Data Reports.

19000.1.5.5 General Inspection Requirements.

19000.1.5.6 Items Subject to Inspection. The individual equipment specifications, data sheets and attachments shall define the items subject to inspection, as well as the level of inspection required to ensure adequacy of the Contractor's product quality. The items to be inspected as part of a non-code inspection program will also be identified. All materials and equipment requiring alloy verification are subject to inspection. When the Owner has more stringent inspection requirements than the Purchaser, items shall be inspected according to Owner requirements (when contractually specified between Owner and the Purchaser).

21000 - Technical Supplemental Specifications

This section contains technical supplemental specifications that provide additional requirements applicable to the work covered under the technical sections.

21000.1 Summary of Applicable Supplementals

The technical supplementals applicable to each technical section are indicated below.

Applicable Technical Supplementals	
02220	D100, D200, Q500
03210	D100, D200, Q500
03311	D100, D200, Q500
03316	D100, D200, Q500
05500	Q300, Q310, Q320, Q500
13120	D100, D200, Q500, Q121, S300, S400
15830	E640, M230, Q500
15921	M230, Q100, Q210, Q280, Q500
19000	NA

21000.2 Technical Supplemental Specifications

The technical supplemental specifications follow.

D100 Site Meteorological and Seismic Data

Work shall be designed according to the following building code and site conditions:

General Design Data:	
Building Code	2023 Florida Building Code (ASCE 7-22)
Risk Category	III
Site Elevation (Mean Sea Level), ft	88
Wind Design Data:	
Ultimate Design Wind Speed, V_{ult} Nominal 3 second gust wind speed at 33 ft above ground for Exposure C category, mph	130
Exposure Category	C
Topographic Factor, K_{zt}	1.0
Tornado Wind Design Speed V_t , mph	50

D200 Design Ambients

Area Specific Design. The general design ambient air conditions shall be used unless area specific or equipment specific conditions are indicated in the contract documents:

Area	Temperature, °F		Relative Humidity, %	
	Minimum	Maximum	Minimum	Maximum
General Outdoor Area	27	102	42	90
*Nominal outdoor minimum ambient design temperature for determining commodity material properties (pipe, valves, etc.) will be 28° F.				

Ventilation shall be provided as determined by Building Contractor to ensure design basis (see D200) environmental conditions for equipment and personnel. Design shall be based on the ASHRAE ambient conditions for a Winter and Summer design basis.

The design criteria table below indicates the level of redundancy for HVAC equipment in the indicated areas. Multiplicity means that more than one partial capacity ventilation device shall be used. Some ventilation capacity shall be provided with a single component failure. When redundancy is indicated, only the major active components shall be provided with backup equipment. Static components such as ductwork, duct mounted heaters, duct mounted variable volume boxes, shall not be duplicated. Minimum ventilation rates shall be provided in normally continuously occupied areas in accordance with local codes. In the absence of applicable local codes, ASHRAE Standard 62 requirements shall be met.

Noise criteria are indicated in the HVAC design criteria table below as NC levels, decibels, or as background. Noise criteria (NC) values are as indicated in the ASHRAE Handbook series for acoustic design criteria. Decibels are sound pressure levels, A-weighted to a reference of 0.0002 microbar at 5 feet from the equipment, as measured in a free field with a single reflecting plane. Background indicates that the HVAC equipment shall be 2 dBA less than the room noise at 6 feet above the floor with normal plant equipment in operation.

Maximum design temperatures represent the average building temperature. Cooler temperatures may occur near the ventilation inlets, and higher temperatures may occur at relief and exhaust points.

HVAC Criteria Table								
Building Area	Indoor Temperature		Humidity Control (%RH)	Minimum Ventilation Rate Based on a 12° F Rise or (ac/h) whichever is greater.	Minimum Particle Filtration Efficiency (% MERV)	Pressurization	Redundancy	Noise Criteria
	Maximum °F based on Summer ambient design basis	Minimum °F based on Winter ambient design basis						
Warehouse Area (not air-conditioned)	104	65	None	Minimum 5 ACH	None	None	Multiplicity	75 dBA

E000 Electrical Equipment and System Voltages

Power Supply Code	Continuous Voltage (Volts)	Momentary Voltage Dip to X% of Nominal	Frequency (Hz)	Configuration	System Grounding	Transfer to Alternate Source	Max Sym Short-Circuit Amps
LV-1 Low Voltage (Power)	480 Nom 508 Max 432 Min	80	60 Nom 61.5 Max 58.5 Min	3-Phase, 3 Wire, Wye (3/PE)	High Resistance (IT)	N/A	65,000 (3-Ph) 10 (L-G)

Power Supply Code	Continuous Voltage (Volts)	Momentary Voltage Dip to X% of Nominal	Frequency (Hz)	Configuration	System Grounding	Transfer to Alternate Source	Max Sym Short-Circuit Amps
LV-3 Low Voltage (Power)	208Y/120 Nom 220Y/127 Max 187Y/108 Min	80	60 Nom 61.5 Max 58.5 Min	3-Phase, 4 Wire, Wye (3/N/PE)	Solidly Grounded (TN-S)	N/A	10,000 (3-Ph) 10,000 (L-G)

Definitions: N – neutral; PE – protective earth conductor; IT - unearthed transformer neutral; TN-S - transformer neutral earthed, separate neutral and earth conductors

E100 Wiring Methods, Cable, and Raceway

E100.1 General Requirements

Auxiliary equipment such as terminal blocks, auxiliary relays, or contactors shall be located in compartments, enclosures, or junction boxes in a manner that allows service personnel direct access to the equipment without removal of barriers, cover plates, or wiring.

A shorting type terminal block shall be provided for each set of current transformers supplied. The shorting terminal blocks shall be the nearest to the current transformers.

Current transformers shall be grounded only at the shorting terminal blocks. The grounding conductor shall be identified so that it may be disconnected in the field as required.

Materials containing asbestos shall not be used.

Each terminal block, terminal, conductor, relay, breaker, fuse block, and other auxiliary devices shall be permanently labeled to match the identification on the Supplier drawings. All terminals provided for termination of external circuits shall be identified by inscribing permanent terminal designations on the terminal block. All internal wiring terminations shall be labeled, marked or otherwise uniquely identified at each end of the conductor using the Supplier's standard method. Conductor identification shall be permanent, unaffected by age, heat, or solvents and not easily dislodged.

Reference to NEC means codes and standards as defined by the USA National Electrical Code, ANSI/NFPA 70.

E100.2 Equipment Safety Grounding (Earthing)

Isolated logic system or single-point ground connections required for proper operation of electronic equipment shall be insulated from the equipment safety ground. Such connections will be extended, using insulated cable, to a single termination point suitable for field connections to the appropriate ground system by others.

The raceway and tray system shall not be considered to be a ground conductor except for itself. All metal conduits containing power circuits shall be provided with grounding type bushings and be wired together inside enclosures and connected internally to the enclosure ground pad bus. Ground conductor shall be sized in accordance with NEC but shall not be less than 8 AWG (10 mm²) bare copper conductor.

Ground conductors shall be soft drawn, stranded copper Class B (per NEMA WC 3).

E100.3 Wiring Methods

All electrical wiring interconnections between motors, devices, panels, and boxes shall use one of the following wiring methods.

Non-armored cable supported and protected by raceway or cable tray in accordance with the NEC.

Armored or metal-clad cable supported in accordance with the NEC. Armored or metal-clad cable shall use cable glands for enclosure entry.

The material, sizing and installation of the cable and raceway system shall meet the requirements of NEMA and the NEC and be suitable for the environment in which it will be installed.

Conduit shall be rigid galvanized steel, aluminum or intermediate metallic conduit (RMC or IMC) rated for heavy resistance to impact and compression in accordance with the NEC.

All conduit connections shall be of the threaded type, and all conduit, couplings, and fittings shall be hot-dipped galvanized steel or aluminum. Conduit fittings used on outdoor equipment shall be gasket type.

Moisture pockets shall be eliminated from the conduit raceway system.

Liquidtight flexible metallic conduit (LFMC) may be used where it is not subject to physical damage and is supported in accordance with the NEC. Jacket shall be sunlight resistant.

Raceway for enclosure and building wiring for lights and convenience receptacles, may be the Supplier's standard as long as it meets the requirements of the NEC.

E100.4 Cable

Splices in cable are not allowed.

Wires or cables used for internal wiring of control panels or cabinets may be supplied and installed according to the Supplier's standard as to wire size and insulation, except that all single conductor wires and cables shall meet the IEC 60332-1 flame test, the UL 1581 VW-1 flame test, or the CSA FT1 flame test.

All single-conductor or multi-conductor cables external to control panels or cabinets, and all multi-conductor cables internal to control panels or cabinets provided and/or installed by the Supplier shall pass the IEC 60332-3-24 Category C flame test, the IEEE 1202 flame test, or the CSA FT4 flame test.

All cable shall meet the following requirements:

All cable except thermocouple cable shall be stranded copper conductors

Power cable shall have flame retardant cross-linked polyethylene (FR-XLPE) or ethylene propylene rubber (FR-EPR) insulation with a minimum 600V rating, a PVC, CPE, or CSPE jacket, and a minimum size of 14 AWG (2.5 mm²). Single-conductor, non-armored cable may be un-jacketed.

E100.5 Not Used

E100.6 Terminations

Internal wiring of factory prewired electronic system cabinets may be terminated using the manufacturer's standard method, except as noted herein.

Conductors for current transformer circuits shall be terminated with pre-insulated ring type terminal connectors.

Control conductors 8 AWG (10 mm²) and smaller for circuits that leave an enclosure, cabinet, or skid shall be terminated in a manner consistent with the type of terminal block used. Terminal block requirements are given in the E100.8 Terminal Blocks article below.

E100.7 Electrical Enclosures

Junction boxes and pull boxes shall be provided without knockouts.

All junction boxes or pull boxes 4 inch (100 mm) trade size or smaller in any dimension shall be galvanized malleable iron or acceptable equal. Galvanized steel boxes may be used with electrical metallic tubing.

All enclosures shall be manufactured from materials that will not degrade when subjected to sunlight.

Where single conductor power cables enter an enclosure using cable glands, sufficiently sized, non-magnetic glanding plates shall be provided.

Junction boxes, electrical control panels, and cabinets shall be provided with an identification nameplate mounted on the front of the enclosure. The nameplate inscription shall be acceptable to the Purchaser.

The size and number of conduit entrances and terminal enclosures for terminating the Purchaser's cable shall be coordinated with and acceptable to the Purchaser.

Enclosures for non-hazardous areas shall meet the requirements in the following table:

Location	NEMA	Material
Indoor Dry	Type 12	Mfg's Standard
Indoor Wet or Outdoor	Type 4	Mfg's Standard
Wet-Chemical Corrosive	Type 4X	Mfg's Standard

E100.8 Not Used

E100.9 Hazard Warning Labels

The Supplier shall furnish arc flash and shock hazard warning labels in accordance with National Electrical Code (NEC) 110.16 Arc Flash Hazard Warning. Labels shall be furnished for all medium and low voltage switchgear, panel boards, control panels, and motor control centers. The labels shall be located in a clearly visible area at each point of access to the equipment. Equipment access includes but is not limited to breaker, starter, rear access, panel board, and auxiliary compartment doors. Labels shall be in accordance with ANSI Z535.4 and either one of the examples below:



E220 Electrical Equipment in Hazardous Areas

Enclosure and equipment temperature classifications (T-class) shall conform to that required for the designated electrical hazardous area classification. The maximum surface temperature for each class shall be as defined by NEC Table 500.8 (for NEC projects).

Q100 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.

Q100.1 General

Section Q100 shall be used in conjunction with any other Welding Technical Supplemental Specification section(s) when referenced.

Any conflict identified between the requirements of this Welding Technical Supplemental Specification and the provisions of any applicable industry standard, code, regulation, or any specification, standard, or purchasing document contractually required for a given application shall be referred to Purchaser for resolution prior to the start of welding.

Where requirements of a referenced code or standard differ from the Welding Technical Supplemental Specification sections, 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.

Q100.2 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 within the restrictions or limitations specified in the applicable Welding Technical Supplemental Specification section. Other welding processes may be used, provided the governing code or standard permits it and written approval has been granted by Purchaser.

Any limitation or restriction specified for GMAW short-circuit arc transfer or a variation of controlled wave-form GMAW short-circuit arc transfer marketed by welding equipment manufacturers such as Miller Electric's RMD and Lincoln Electric's STT process shall be applied the same, whether a constant voltage (CV) power supply or other power supply developed by a welding equipment manufacturer is used.

Q100.3 Welding Procedure Qualification

Welding procedures shall be prepared and qualified in accordance with the referenced code. Unless otherwise specified, each manufacturer or contractor is responsible for conducting the tests required by the referenced code to qualify the Welding Procedure Specification (WPS).

Because of the number of different filler metal types and alloys within various alloy P-number groups, WPSs for welding P-Nos. 8, 10H, and 41 - 49 shall identify the required filler metal classification (s) vs the actual base material type(s) to be welded in production to ensure appropriate filler metal selection, e.g., E/ER316 for P-Nos. 8 (Type 316); E/ER308L for P-Nos. 8 Type 304L, etc. Alternatively, filler metal and base metal types may be cross-referenced to the WPS by other means, e.g., a weld map (or a separate listing of WPS and filler metal and base material grades, addendum to the WPS, etc.

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.

Q100.3.1 Welding Procedure Submittals

WPSs and applicable Procedure Qualification Records (PQRs) shall be submitted for review by Purchaser prior to start of fabrication. Submittal of welding procedures and applicable PQRs shall apply to all suppliers and subsuppliers. Suppliers shall review the documents in accordance with the applicable code and specification requirements and shall accept all of their subsuppliers' welding procedures and applicable PQRs prior to submitting accepted documents to Purchaser.

The submittal shall also include a weld map or tabulated listing of WPSs to be used. The applicable code(s) of construction and production base material types and grades shall be listed on the weld map or listing.

Q100.4 Welder/Welding Operator Performance Qualification

Welders and welding operators shall be qualified in accordance with the referenced code. 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.

Field personnel not qualified and certified as welders or welding operators are prohibited from performing any welding activities such as tack welds, temporary welds, permanent welds, manufacturing aids, tools, fixtures, or other welded items. The only field personnel not qualified or certified as welders or welding operators who are permitted to perform welding are personnel completing welding training or performing welding performance qualification testing required by the applicable referenced code or specification.

Shop personnel not qualified and certified as welders or welding operators are prohibited from performing any welding activity on materials designated for permanent or temporary installation by the contract, such as tack welds or temporary welds.

Each manufacturer or contractor is responsible for the qualification of welders or welding operators. Welder or welding operator performance qualification testing shall be performed under the full supervision and control of the manufacturer or contractor.

Q100.5 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 for welding similar base metal types 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's minimum specified properties or characteristics as they pertain to strength, ductility, notch toughness, corrosion-erosion resistance, or other physical or thermal properties.

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

Unless otherwise specified or permitted by an approved deviation request, the use of the nonstandard international classifications or nonstandard AWS-G electrode/wire classification is prohibited (comment: welding consumables produced under standard compositions and the requirements specified by national or international filler metal standards are considered acceptable). When permitted, welding procedures specifying nonstandard classifications or AWS-G classification consumables shall be restricted to the same manufacturer and brand-name consumable used to weld the procedure qualification test coupon. The manufacturer and brand name shall be listed on the WPS and PQR. The manufacturer's standard, including the mechanical properties and chemical analysis, along with the request for using nonstandard classifications (e.g., "G" classification consumables) shall be submitted to Purchaser prior to fabrication.

SAW multipass weld deposits shall use an essentially neutral flux for welding carbon steels. 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.

When using the SAW process, the flux listed in the WPS is restricted to the specific brand-name flux used in the welding procedure qualification test. Any change in the flux brand name or designation shall require a new welding procedure qualification. For SAW welding of stainless or nickel-base alloy

materials, only those fluxes specified by the flux manufacturer as suitable for the particular type of high alloy electrode to be used are permitted.

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.

Q100.5.1 Filler Material Selection

Unless otherwise specified, filler material selection shall be in accordance with the following requirements.

Q100.5.1.1 Filler Materials for Steels and Low Alloy Steels. For the SMAW process, all filler metal shall be of the low-hydrogen type when welding on either carbon steel or low alloy steel materials. Nonlow-hydrogen type electrodes (E6010/E6011 or E7010-A1 only) may be used only for root pass welding on carbon steel piping, unless otherwise specified by other Welding Technical Supplemental Specification sections. SMAW low-hydrogen type ferrous electrodes for all fill passes shall have a minimum tensile strength of 70,000 psi (495 MPa) as defined by the applicable SFA or AWS specification.

For the FCAW process when welding carbon steel materials, only AWS filler metal Classifications E7XT-1, -5, -9, -12 with shielding gas shall be used (current AWS classifications also utilize either an "M" or "C" after the final digit).

Q100.5.2 Filler Material Control

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 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.

SAW fluxes for welding low alloy chromium-molybdenum steels (2-1/4 Cr - 1 Mo) and higher nominal weld deposit composition shall be baked prior to use. This requirement does not apply for fluxes used within the same work shift after removal from a hermetically sealed package or container. Flux that is exposed to an atmospheric exposure limit exceeding one work shift shall be baked prior to use, unless the flux is placed in a heated container within 10 hours of issuance. After baking, fluxes should be stored in hermetically sealed containers or (preferably) stored in a heated container until issuance. Storage in a heated container or baking shall be in accordance with the flux manufacturer's directions.

A written procedure for storing, handling, issuing, and reconditioning electrodes, wires, and fluxes shall be available for review by Purchaser's inspector if requested.

Q100.6 Not Used

Q100.6.4 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. This shall include any previously applied paints, coatings and galvanized surfaces. Previous coated, painted or galvanized surfaces shall be completely removed down to bare metal prior to welding. Any previous coated, painted and/or

galvanizing surface shall be sufficiently removed from either side of the mating members so that no peeling or melting of the coating enters into the weldment.

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 deoxaluminum 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. Partial penetration weld joints not specified by design shall require written approval by Engineer.

Tack welds that are to remain in the completed weld shall have their stopping and starting ends prepared by grinding or other suitable means for satisfactory incorporation into the completed weld. Tack welds that are to become part of the completed weld shall be visually examined; defective tack welds, including cracked tack welds, shall be removed.

When runoff plates are used, they shall be of the same nominal alloy composition as either of the base metals being joined. If runoff plates are used, they shall be properly removed after completion of welding. The method of removal shall not damage the remaining weld or base metal. Runoff plates shall not be knocked off.

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. This requirement is not intended to apply to automated line processes, where the welding from the second side is controlled to provide adequate penetration and ensure full fusion without back gouging.

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 pressure retaining fillet weld joints other than socket welded joints that require a fillet weld size greater than 5/16 inch (8 mm) shall require a minimum of two weld layers, except for those fillet weld joints welded with a mechanized or automatic welding process.

Socket welds shall meet the following requirements within the welding process restrictions and limitations specified in the applicable Welding Technical Supplemental Specification section:

A minimum of two weld layers is required for pipe or tube over 0.200 inch (5 mm) nominal wall thickness.

For pipe or tube 1/2 inch (13 mm) or less in nominal pipe size, the GTAW process shall be used.

One of the specific criteria for exemption from PWHT under ASME B31.1 and B31.3, 2014 edition and later for ASME P-Nos. 1, 3, 4, and 5A is that multiple weld layers are required for nominal material thickness > 3/16 inch (5 mm).

Welding slag and spatter shall be removed from all welds.

The purity and maximum dew point of a gas or gas mixture used for shielding shall meet latest edition of AWS A5.32M/A5.32, Welding Consumables -Gases and Gas Mixtures for Fusion Welding and Allied Processes.

Shop fabricators and suppliers 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 Purchaser is prohibited.

Complete joint penetration welds welded from one side without backing, weld repairs welded from one side without backing, or weld repairs in which the base metal remaining after excavation is less than 0.1875 inch (5 mm) from being through wall, which are fabricated from materials with an ASME P-No. of 5B or higher or unassigned metals with similar chemical compositions, shall have the root side of the weld purged with an argon backing gas prior to welding. Unless otherwise specified, backing gas (purge) shall only be argon. The argon backing gas shall be classified as welding grade argon or shall meet Specification SFA-5.32, AWS Classification SG-A. The backing gas (purge) shall be maintained until a minimum of two layers of weld metal have been deposited and as necessary to minimize the development of bluish internal heat tint colors.

Temporary attachments to pressure boundary components outside the weld bevel groove area 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 (5 mm) 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.

Welding across the flanges of Purchaser's structural steel members (welds that are transverse to the beam or column center line) shall not be an acceptable practice, and Supplier shall design all welded interfaces to Purchaser's steel structure to specifically avoid this condition. Supplier's design of such interfaces shall achieve full required design strength and stability by means other than welds applied across flanges.

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

A written procedure for root side purging shall be described in detail and shall be submitted concurrently with the welding procedures for review by Purchaser.

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 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.

Q100.7 Nondestructive Examination (NDE)

All NDE shall be performed in accordance with the methods specified in the referenced code and any supplemental NDE specified within the other Welding Technical Supplemental Specification sections.

NDE shall be performed in accordance with written procedures that are prepared in accordance with the referenced code and as specified herein. NDE procedures other than for visual examination shall be approved by a qualified and certified NDE Level III. The NDE Level III approval shall be shown on the NDE procedure. NDE procedures shall be submitted for review by Purchaser prior to their use.

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 or prior written approval from Purchaser is obtained. 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 as determined by Purchaser. Visual inspectors' qualifications and certificates shall be submitted for review and verification.

The responsible supplier's welding inspector shall perform in-process visual inspections at suitable intervals during the fabrication and erection process to ensure the applicable requirements of the referenced code, design specification, and WPS are met. Such inspections, on a sampling basis, shall be performed prior to assembly, during assembly, and during welding.

All welds shall receive 100 percent visual examination. Visual inspection of welds shall be performed prior to any painting, coating, or galvanizing. 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.

The NDE results shall be provided in an NDE Report that is evaluated, interpreted, and accepted by Level II or Level III NDE personnel.

Supplier shall obtain and pay for the services of an independent testing laboratory to provide the required field NDE. Any defective weld shall be removed, repaired, and retested at the Supplier's expense.

Purchaser may order NDE by an independent laboratory in addition to any examinations specified herein. The NDE type, extent, and method shall be the same as that required for the original weld. If the weld is defective, the laboratory costs shall be paid by the Supplier. If the weld is not defective, the laboratory costs will be paid by Purchaser. Repair of defective welds and reexamination shall be at the Supplier'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 Purchaser.

Q100.8 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, ultrasonic

examination records and reports, deviation requests including resolution documentation, nonconformance reports, and other records, as required, shall be retained by the Supplier for 10 years after completion of the work. If the Supplier cannot keep the records for 10 years, the Supplier must submit the records to the Purchaser prior to contract closeout.

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.

Q301 Manufacturer's Standard Coating

Unless otherwise specified, the manufacturer's standard coating systems shall be applied in the shop to ferrous metal surfaces of equipment and materials. The coating systems shall provide resistance to corrosion caused by weather and industrial environments. Manufacturer's standard coating systems shall be specified to provide medium (M) durability in a C5 environment in accordance with ISO 12944, Paints and Varnishes – Corrosion Protection of Steel Structures by Protective Paint Systems, for the intended service environment. Surfaces that will be inaccessible after assembly shall be protected for the life of the equipment.

Coating material and application shall conform to the regulations of the air quality management agency having jurisdiction. Materials shall be formulated to contain less than 0.06 percent lead or chromium in the dried film.

Surfaces shall be cleaned, prepared, and coated in accordance with the coating manufacturer's instructions and specified codes. Surfaces to be painted shall be prepared, as necessary, to provide a smooth, uniform base for painting.

Coating films that show defects such as sags, checks, blisters, teardrops, and fat edges will not be accepted. Any coated surface that contains any of the previously mentioned defects shall be repaired or, if necessary, entirely removed from the member or unit involved and the surface recoated.

All internal surfaces that will be exposed to steam or treated feedwater shall be blasted with aluminum oxide (pink or white grade), cut steel wire (SAE J441), steel grit, or steel shot. The blasting media used shall contain no more than 1.2 percent complexed silica and 0 percent free silica.

Surfaces to be finish painted after installation shall be shop painted with one coat of the manufacturer's standard primer.

Touchup paint shall be provided for repair painting of at least 10 percent of the finish painted equipment surface. The touchup paint shall be the same type and color as the shop applied material. Application instructions shall be provided.

No coating shall be applied to surfaces within 3 inches (75 mm) of field welded connections.

Coating dry film thicknesses shall be measured using a magnetic or electronic thickness detector in accordance with Society for Protective Coatings (SSPC)-PA2. Additional coating shall be applied to all areas that show a deficiency in dry film thickness.

Q301.1 Control and Electrical Equipment

Control and electrical equipment, including panels, cabinets, switchgear, transformers, and motors, shall be finish painted. Exterior surfaces shall be the manufacturer's standard color unless specified otherwise. The interior portions of cabinets shall be painted a light reflecting color.

Q301.2 Not Used

Q301.3 Documentation

Shop drawings shall identify the shop applied coating systems. Data to be provided shall include the coating system manufacturer's name and product designation, the degree of surface preparation, dry film thickness, finish color, and Safety Data Sheets (SDSS). Final dry film thickness test results shall be submitted to Purchaser for verification.

Q320 Galvanizing

Structural steel members and steel assemblies shall be "pickled" after all cutting, punching, reaming, drilling, tapping, and other fabrication processes, which damage galvanizing, have been completed. The pickling shall be done in accordance with the latest accepted practice and shall continue until all scale, rust, grease, and other impurities have been completely removed. The steel shall then be hot-dip galvanized.

When either member to be bolted is galvanized and where required by the technical specifications, erection and structural bolts shall be galvanized.

Q320.1 Codes and Standards

Work performed under this specification shall be done in accordance with the following codes and standards. The version that is latest adopted, published, and effective at the date of bid shall apply unless specifically stated otherwise:

Work	In Accordance With
Hot-dip galvanizing	ASTM A123, ASTM A153, ASTM A792, or ISO 1461, ASTM A385
Bolt galvanizing	ASTM B695, F2329

Q320.2 Lead and Chrome Limitations

Galvanizing metal shall contain less than 0.06 percent lead by weight and less than 0.06 percent chrome by weight.

Q320.3 Reflectivity Limitations

Where required by the technical specifications, the surface of newly galvanized structural members shall be dulled utilizing a zinc phosphating process. The zinc phosphate solution may be applied by either spraying or immersion in tanks. Purchaser shall specify the maximum surface reflectivity prior to any work being performed.

Q400 General Equipment Requirements

Q400.1 Miscellaneous Materials and Services

Miscellaneous materials and services not otherwise specifically called for shall be furnished by the Supplier in accordance with the following, as applicable:

All nuts, bolts, gaskets, special fasteners, backing rings, etc., between components and equipment furnished under these specifications.

All piping integral to or between any equipment furnished under these specifications, except as otherwise specified.

All necessary connections for the Purchaser's piping and instruments.

All necessary instrument, power, and control wiring and raceways integral to any equipment furnished under these specifications. This shall include terminal blocks and internal wiring to these terminal blocks for equipment requiring external connection.

Erection drawings, information, instructions, and other data for use by the Purchaser's erection contractor.

Lifting eyes and lugs for offloading and setting equipment.

The use of all special tools required for erection of the equipment, exclusive of the maintenance tools furnished. Erection tools shall remain the property of the Supplier, and all shipping costs to and from the jobsite shall be at the Supplier's expense.

Q400.2 Fabrication Restrictions

Unless specifically provided otherwise in each case, all materials and equipment furnished for permanent installation in the work shall conform to applicable standard specifications and shall be new, unused, and undamaged.

Asbestos containing materials will not be allowed.

Flanges, fittings, and valves manufactured in the People's Republic of China shall meet following requirements.

Manufacturer's quality system shall be in accordance with ISO 9001 and the manufacturer shall hold a valid ISO 9001 certificate issued by the certified ISO 9000 certification organization.

Manufacturer shall hold a manufacturer's license issued by the China Special Equipment Inspection & Research Center (CSEI) under General Administration of Quality Supervision, Inspection and Quarantine of the People's Republic of China (AQSIQ) or an acceptable equivalent in accordance with Purchaser's Engineer.

Products shall have markings as required by ASME B16.1, ASME B16.5, ASME B16.9, ASME B16.10, ASME B16.11, ASME B16.25, or ASME B16.34 as applicable.

The final quality certificate and quality inspection documents shall bear the official stamp of CSEI or AQSIQ or its branches.

Individual parts shall be manufactured to standard sizes and gauges so that repair parts furnished at any time can be installed in the field. Like parts of duplicate units shall be interchangeable.

Q500 Shop Drawings and Instruction Manuals

This section, in conjunction with the Schedule of Submittals, stipulates the requirements for engineering data that Supplier shall submit for design information and review. Document submittal procedures shall be in accordance with the requirements of this Purchase Order.

Q500.1 Submittal Requirements

Technical data shall be submitted in electronic format.

Electronic technical data submittals shall be made using the Project Central project collaboration system, a Web-based file transfer service. If Supplier does not already have Project Central transmittal capability, the Purchaser will provide the required credentials for access upon Purchase Order award.

Notification to Purchaser that submittals have been posted to Project Central shall be in accordance with the correspondence requirements of this Purchase Order.

Q500.3 Not Used

Q500.4 Drawings

Drawings shall be in sufficient detail to indicate the kind, size, arrangement, component weight, breakdown for shipment, and operation of component materials and devices; the external connections, anchorages, supports, and grouting requirement; the dimensions needed for installation and correlation with other materials and equipment; and the information specifically requested in the Schedule of Submittals.

Drawings for use in installation and erection shall include a Bill of Quantity (BOQ), identifying the unit of measure, quantity, description, part number (or piece mark identifier), location reference on the drawing and any other details required by Purchaser. It may be acceptable to have the BOQ detail in other means or media, if approved in advance by Purchaser.

Supplier shall fully complete, check, and certify drawings, including drawings produced by a subcontractor, for compliance with the Purchase Order requirements prior to submittal. Drawings shall have title block entries that clearly indicate the drawing is certified.

Each submitted drawing shall be project unique and shall be clearly marked with the name of the project, unit designation, Purchaser's Purchase Order title, Purchaser's Purchase Order file number, project equipment or structure nomenclature, component identification numbers, and Purchaser's name. Equipment, instrumentation, and other components requiring Purchaser-assigned identification tag numbers shall be clearly identified on the drawings. If standard drawings are submitted, the applicable equipment and devices furnished for the project shall be clearly marked.

Transmittal letters shall identify which Schedule of Submittals item (by item number) is satisfied by each drawing or group of drawings. The transmittal letter shall include the manufacturer's drawing number, revision number, and title for each drawing attached as well as all fields listed in the transmittal letter. Each drawing title shall be unique and shall be descriptive of the specific drawing content. Transmittal letters for resubmitted drawings shall include the Purchaser's drawing numbers.

Catalog pages are not acceptable, except as drawings for standard nonengineered products and when the catalog pages provide all dimensional data, all external termination data, and mounting data. The catalog page shall be submitted with a typed cover page clearly indicating the name of the project, unit designation, specification title, specification number, component identification numbers, model number, Supplier's drawing number, and Purchaser's name.

Drawings shall be submitted with all numerical values in English and/or metric (SI) units.

All multi sheet documents shall be submitted in their entirety for all revisions.

Q500.4.1 Drawing Submittal

A standard drawing submittal template form is included at the end of this section. Supplier shall use this form for all submittals. (An electronic copy of this form will be made available upon Purchase Order award.)

Drawings shall be submitted electronically in Portable Document Format (PDF). AutoCAD or MicroStation format files are not acceptable unless specifically requested by Purchaser. If Supplier does not have the capability to provide Portable Document Format (PDF), an alternative submittal format shall be used as mutually agreed between Purchaser and Supplier.

Reproducibles can be plots or photocopies for drawings larger than 34 inches by 44 inches.

Q500.4.2 Drawing Processing

Supplier's engineering schedule shall allow a minimum of three (3) weeks for transmittal, processing, and review of drawings and data by Purchaser.

Unless this Purchase Order indicates that a drawing or engineering data submittal by Supplier is to be for Purchaser's information only, Purchaser, upon receipt of submittals, shall review and return same to Supplier, marked "No Exceptions Noted," "Exceptions Noted," "Received for Distribution," "Returned for Corrections," "Release for Record," "Void," "Superseded" or "Hold". The timing of Supplier's submittals and Purchaser's review shall be in accordance with the Completion Dates for same as set forth in the Purchase Order. The submittal of any drawing or other submittal document by Supplier to Purchaser under this Purchase Order will be certification by Supplier that the information set forth therein is accurate in all material respects.

Q500.4.2.1 No Exceptions Noted (NE) or Received for Distribution (RD). Upon receipt of a submittal marked "No Exceptions Noted" or "Received for Distribution," Supplier may proceed with its Work to the extent of and in accordance with the submittal. Supplier shall not resubmit unless the drawing or document is revised, in which case it shall be resubmitted as a new document revision in accordance with Q500.4.2.7.

Q500.4.2.2 Exceptions Noted (EN). Upon receipt of a submittal marked "Exceptions Noted" and if Supplier concurs with Purchaser's comments, Supplier shall incorporate same and may proceed with its Work to the extent of and in accordance with the annotated submittal. Supplier shall submit to Purchaser **within fourteen (14) calendar days** a revision to the original submittal in which Purchaser's comments have been incorporated. If Supplier determines that it cannot incorporate Purchaser's comments without prejudice to Supplier's warranty or other obligations under this Purchase Order, Supplier shall so advise Purchaser in writing within seven (7) calendar days of its receipt of Purchaser's comments, stating the reasons therefore. Supplier may proceed with its Work to the extent of and in accordance with the annotated submittal only upon Purchaser and Supplier resolving Purchaser's comments.

Q500.4.2.3 Returned for Corrections (RC). Upon receipt of a submittal marked "Returned for Corrections," Supplier shall immediately take all necessary action to revise its submittal in accordance with Purchaser's comments, the Specification, and the Drawings, and shall resubmit to Purchaser for review the corrected original submittal, voiding previous information and adding new documents if required. In no event shall Supplier proceed with the affected Work until its revised submittals have been returned to Supplier marked "No Exceptions Noted" or "Exceptions Noted" by Purchaser.

Q500.4.2.4 Release for Record (RR). Receipt of a submittal marked "Release for Record" indicates that there are no specific objections to the document. Work may proceed. Certain project information required by the Purchaser's document management system may have been added electronically to the drawing and provided to Supplier for the record. Supplier shall not resubmit the drawing or document unless revisions to the design are required. If revisions are required, Supplier shall incorporate Purchaser's information and resubmit as a new revision. Purchaser's project-specific information shall be added if future revisions and submittals are made.

Q500.4.2.5 Void (VO) or Superseded (SS). Receipt of a submittal marked "Void" or "Superseded" does not require any action by Supplier. "Void" indicates that the submittal is no longer applicable to the project and is not being replaced by other drawings or data. "Superseded" indicates that different drawings or data have replaced the previously submitted drawings and data; this status does not pertain to revisions of the same drawings and data.

Q500.4.2.6 Hold (HO). A submittal may be given a status of "Hold" by the Purchaser, or the Supplier may have "Holds" on the submitted drawing.

For a Hold status designated by the Purchaser, the Supplier shall not proceed with the work that is designated on "Hold" except as specifically directed by the Purchaser. Additional information required for the Supplier to release the "Hold" will be transmitted from the Purchaser later.

The Supplier shall provide information to the Purchaser about the cause for any "Holds" designated on the drawing and immediately take all action necessary to resolve the "Holds". The Supplier shall resubmit the drawing for review once the "Holds" are removed from the drawing and should make all efforts to not submit drawings to the Purchaser until drawing review comments have been received back from the Purchaser.

Q500.4.2.7 Resubmittals. If during or subsequent to the completion of the submittal process, Supplier makes further changes to the equipment and materials shown on submittals that have been reviewed by Purchaser, the changes shall be clearly marked on the submittal by Supplier and the submittal process shall be repeated. If changes are made by Supplier after delivery to the Jobsite, drawings conforming to construction records indicating the changes shall be prepared by Supplier and submitted to Purchaser for review. Any resubmittal of information shall clearly identify the revisions by specific footnotes or by a form of back-circle, with revision block update, as appropriate. The Supplier shall put the Black & Veatch drawing number on the transmittal letter and submit a complete document.

Q500.4.2.8 Purchaser's Review. Purchaser's review of drawings and other submittals will cover only general conformity of the data to the Specifications and Drawings, external connections, interfaces with equipment and materials furnished under separate specifications, and dimensions that affect plant arrangements. Purchaser's review does not include a thorough review of all dimensions, quantities, and details of the equipment, material, device, or item indicated or the accuracy of the information submitted. Review and comment by Purchaser of Supplier's Drawings or other submittals shall not relieve Supplier of its sole responsibility to meet the Completion Dates requirement of this Purchase Order and to supply Goods that conform to the requirements of this Purchase Order.

Q500.4.2.9 File Returns to Supplier. The Project Central web service will be used by Purchaser to return PDF files to Supplier.

Each packet of drawings returned to Supplier will include a manifest generated by Purchaser along with Purchaser's drawing review markups. The manifest will include a list of drawings transmitted, manufacturer's drawing numbers, Purchaser's assigned drawing numbers, Purchaser's drawing titles, and the status of the drawings. Note that drawings statused as NE (No Exceptions Noted) will not be included in the returned packet, but will indicate "NE" status on the manifest.

Q500.5 Wiring Diagrams

If required by the Specifications, Wiring Diagrams shall be submitted in accordance with Supplemental Q502.

Q500.6 Instruction Manuals

If required by the Specifications, Instruction Manuals shall be submitted in accordance with Supplemental Q501.

										DC Use Only	
										DC Packet:	
Supplier Name		Transmittal Letter				Date: XX/XX/20XX Sheet: 1 OF XX					
Project: JEA BGS Warehouse								Mixed Submittal <input type="checkbox"/> New Submittal <input type="checkbox"/> Resubmittal <input type="checkbox"/>			
Contract: Enter Contract Title Here		Contract No.: XX.XXXX		Packet Designation: XX		Transmittal No.: XXXX					
Number of Documents: XX											
Supplier Drawing Data		Mfr. Document Title:		B&V Drawing No. (Resubmittals Only)		Document Data from the Schedule of Submittals (New Submittals Only)					
Mfr. Drawing No. & Sh. No.	Rev No.					Doc Class	Unit #	Seqn ID	Schedule of Submittal Item No.	Advance Work Packaging (AWP)	
								CWA	CWP	EWP IN/OUT	
Distribution for groups who should review documents: For B&V Internal Use Only											
<input type="checkbox"/> Chemical/Process			<input type="checkbox"/> Electrical			<input type="checkbox"/> Civil/Structural			<input type="checkbox"/> All of the Above		
<input type="checkbox"/> Control			<input type="checkbox"/> Mechanical			<input type="checkbox"/> Other					
Special Instructions: For B&V Internal Use Only											

Guideline for Filling in Transmittal Letter

An electronic copy of this form is available upon request from the RE upon Contract Award.

1. Packet Designation

This information will be supplied by the Responsible Engineer upon award of contract.

2. Submittal Information

Mixed Submittal – A combination of new drawings and resubmitted drawings.

New Submittal – All drawings are new.

Resubmittal – All drawings have been previously submitted.

3. Manufacturer Drawing No. and Sheet No.:

Mfr # 12345 Sh 1

4. Rev. No.:

Current rev. of drawing; Rev. # A, B, C, or 1, 2, 3, etc.

5. Mfr. Doc. Title (CONTAINS 120 CHARACTERS):

Title of Manufacturer's Drawing; example: HRSG Wind Tunnel Fans

6. B&V Drawing No. (RESUBMITTALS ONLY):

Give B&V drawing # assigned to drawing; example: 5-35001

7. Document Classification (Type of drawing Mfr is submitting on transmittal):

- ☐ 04 Quality Documents/Manuals (weld procedures, etc.)
- ☐ 05 Contractor's Drawings
- ☐ 06 Contractor's Technical Data (test reports, curves, specs, etc.)
- ☐ 07 Construction Books, Operating and Maintenance Manuals

8. Unit No. (Unit the job is for):

7

9. Sequence Identifier (Type of drawing Mfr is submitting):

- | | |
|---|--|
| <input type="checkbox"/> 0 General Arrangements/Equipment Access | <input type="checkbox"/> 5 Electrical |
| <input type="checkbox"/> 1 Foundations and Foundation Interface | <input type="checkbox"/> 6 Instrumentation and Control |
| <input type="checkbox"/> 2 Structural Steel, Enclosures, Ductwork | <input type="checkbox"/> 7 Technical Information and Lists |
| <input type="checkbox"/> 3 Mech/Chem Equipment, Valves, Piping | <input type="checkbox"/> 8 Other |
| <input type="checkbox"/> 4 P&IDs/Flow Diagrams | <input type="checkbox"/> 9 Construction/Erection |

10. Schedule of Submittal Item No.

This information is listed in the Schedule of Submittals for the contract.

11. Construction Work Area (CWA)

This information is listed in the Schedule of Submittals for the contract.

12. Construction Work Package (s) (CWP)

This information is listed in the Schedule of Submittals for the contract.

13. Engineering Work Package (EWP) IN/OUT

This information is listed in the Schedule of Submittals for the contract.

Q501 Instruction Manuals

This section, in conjunction with Section Q500 and the Schedule of Submittals included in the Supplemental Terms and Conditions of this Purchase Order, stipulates the requirements for Instruction Manuals that Supplier shall submit for design information and review. Document submittal procedures shall be in accordance with the requirements of this Purchase Order, Section Q500, and the following.

Q501.1 Submittal Requirements

Hard copies shall be submitted to the address indicated for Technical Documents in the Supplementary Terms and Conditions of this Purchase Order for the documents listed below. The following number of copies shall be submitted unless otherwise indicated in the Schedule of Submittals:

Submittal Description	Copies Required
Proof Copies	Electronic
Final Copies	2 Hard Copies + 4 Electronic*

* Searchable and organized as shown in Q501.2 with an electronic table of contents and tabs. Electronic copies should be DVD or flash drive.

Q501.2 Instruction Manuals

Supplier shall furnish proof and final instruction manuals for the unloading, storage, installation, operation, and maintenance of the equipment. The manuals shall be delivered as specified in the Schedule of Submittals.

Manuals shall include the following information specific to the furnished equipment. The documents or drawings submitted within the Instruction Manual shall be consistent with the documents or drawings previously submitted for Purchaser's review. Documents or drawings which were previously submitted for review and are included within the Instruction Manual shall be identical, with the same revision number. If these documents or drawings were revised due to design revisions subsequent to issuance of the Instruction Manuals, the document or drawing shall be resubmitted in accordance with Article Q500.4.2.7 in Supplemental Q500 so the Purchaser can provide updated drawings to the holders of the Instruction Manuals.

Table of contents and index tabs. (If multiple volumes are required, a table of contents listing materials included in each volume shall be supplied for each volume.)

Specifications, test data, and all performance curves specified in the technical specifications.

Description of the equipment, including illustrations showing elevations, cross section, and all details of the equipment with all parts named, numbered, and identified with Purchaser's tag numbers. When multiple model numbers are shown on the drawings, the equipment supplied for the project shall be clearly identified.

Complete and detailed operating instructions, including safety precautions, philosophy of operation and, where applicable, process optimization techniques.

Detailed minor and major maintenance instructions, including description, use of special tools furnished, and preventive maintenance schedule.

Instructions for receiving, inspection, storage, and handling of equipment prior to installation.

Installation instructions.

Inspection procedures.

Troubleshooting guide.

All fluid systems schematics and piping diagrams.

Control logic diagrams, as applicable.

Electrical wiring diagrams, as applicable.

Calibration Data Sheet for each adjustable instrument included in the scope of supply.

Motor Information Sheets, as applicable.

Electric Actuator Information Sheets, as applicable.

Control Panel Arrangements, as applicable.

Supplier and Sub-supplier operating and maintenance manuals.

Illustrated parts breakdown.

Assembly drawings.

Parts lists.

List of acceptable lubricants.

Nameplate information and shop order numbers for each item of equipment and associated component parts thereof.

List of recommended spare parts.

List of maintenance tools furnished with the equipment.

The above listed requirements are the minimum requirements; however, requirements that are clearly not applicable to the equipment may be deleted with Purchaser's approval. Additional information that is necessary for proper operation and care of the equipment shall also be included.

Q501.2.1 Binding

Each hard copy of the manuals shall be assembled and bound in three-ring or post binders designed for rough usage. Light-duty binders will not be acceptable.

Front covers and backbones of the manuals shall be marked with lettering per the Typical Instruction Book Cover attached at the end of this section.

TYPICAL INSTRUCTION BOOK COVER

<p><NAME OF EQUIPMENT></p> <p>JEA</p> <p>Brandy Branch Generating Station</p> <p>Warehouse Building Addition</p> <p><PURCHASE ORDER NUMBER**></p> <p>VOLUME <NUMBER*></p>	<p>JEA BRANDY BRANCY GENERATING STATION WAREHOUSE BUILDING ADDITION</p> <p>INSTRUCTION BOOK FOR <NAME OF EQUIPMENT> VOLUME <NUMBER*></p> <p><PURCHASE ORDER NUMBER**></p> <p><MANUFACTURER'S NAME> <MANUFACTURER'S ADDRESS></p> <p>BLACK & VEATCH Jacksonville, Florida</p>	<p>36</p> <p>24</p> <p>24</p> <p>36</p> <p>36</p> <p>36</p> <p>36</p> <p>24</p> <p>24</p> <p>24</p> <p>14</p> <p>14</p>
(Backbone)	(Cover)	

NOTES:

1. All lettering shall be a block style font such as Arial.
2. All backbone lettering shall be 14 point.
3. Cover lettering shall be point sizes indicated in column to right of cover illustration.
4. *Volume number required only if instructions are contained in more than one volume.
5. **Purchaser assigned Purchase Order number.

Q502 Electrical Data

This section, in conjunction with Section Q500 and the Schedule of Submittals included in the Supplemental Terms and Conditions of this Purchase Order, stipulates the requirements for Electrical Data that Supplier shall submit for design information and review. Document submittal procedures shall be in accordance with the requirements of this Purchase Order, Section Q500, and the following.

Q502.1 Submittal Requirements

Electronic copies shall be submitted to the address indicated for Technical Documents in the Supplementary Terms and Conditions of this Purchase Order for the documents listed below. The following number of copies shall be submitted unless otherwise indicated in the Schedule of Submittals:

Submittal Description	Copies Required
Motor Information Sheets	Electronic
Electric Actuator Information Sheets	Electronic
Wiring Diagrams	Electronic
Supplier Cable Data	Electronic
Supplier Circuit List	Electronic

Q502.2 Not Used

Q502.3 Not Used

S300 Structural Design Loads

S300.1 General

Design loads and load combinations for all buildings, structures, structural elements and components, handrails, guardrails, and connections shall be determined according to the criteria specified in this section, unless the governing building code specified in Technical Supplemental D100 requires more severe design conditions. Loads imposed on structural systems from the weight of all temporary and permanent construction, occupants and their possessions, environmental effects, differential settlement, and restrained dimensional changes shall be considered.

The live loads used in the design of buildings and structures shall be the maximum loads likely to be imposed by the intended use or occupancy, but shall not be less than the minimum uniform live loads presented in Article S300.3, unless allowed by the governing building code. Components of the structural system may be designed for a reduced live load in accordance with the governing building code. Roofs shall be designed to preclude instability resulting from ponding effects by ensuring adequate primary and secondary drainage systems, slope, and member stiffness.

Structural elements supporting major equipment shall be designed for the greater of the uniform live load or the loading imposed by the actual equipment.

Construction or crane access considerations may dictate the use of temporary structural systems. Special considerations shall be made to ensure the stability and integrity of the structures during any periods involving use of temporary bracing systems.

S300.2 Design Loads

Design loads shall be in accordance with the following.

Load Types	Criteria/Source
Dead Loads	ASCE 7, Tables C3-1 and C3-2.

Load Types	Criteria/Source
Pipe Support, other piping and electrical conduit and cable tray	Design for not to exceed uniform area, line, and/or concentrated loads located to create maximum moments and shears as a representation for the future actual loads if actual loads are not available to support the detailed design. Design loads shall be verified such that the resultant stresses from actual loads do not exceed the design stresses generated from the design loads.
Live Loads	Calculated weight of the contents of tanks: contents of silos, bins, and hoppers, in accordance with Technical Supplemental D400; movable loads, such as people, equipment, tools, and components during construction, operations, and maintenance; maximum loads likely to be imposed by intended use or occupancy, but not less than the loads in Article S300.3, nor actual equipment weight.
Impact Loads	Article S300.3 loads allow for ordinary impact conditions. Reciprocating or rotating machinery, elevators, cranes, pumps, and compressors shall have specific calculations addressing dynamic forces. Impact loads shall be as specified in ASCE 7 Chapter 4 unless analysis indicates higher values are required.
Wind Loads, buildings and structures	Design wind speed shall be in accordance with Technical Supplemental D100. No shielding shall be permitted for ground conditions or for adjacent structural members.
Rain Loads	Where applicable, rain loads shall be in accordance with ASCE 7, Chapter 8, and the building code
Seismic Loads, buildings (by building, if appropriate)	Seismic loads for buildings shall be accordance with Technical Supplemental D100.
Seismic Loads, components and attachments	Seismic loads for components and attachments shall be accordance with Technical Supplemental D100. Amplification and response modification factors shall be in accordance with ASCE 7.
Construction Loads, roads	AASHTO HS 20 or equivalent.
Fatigue Loads	In accordance with AISC 360 - Specification for Structural Steel Buildings

S300.3 Minimum Uniform Live Loads

Minimum uniform live loads shall be in accordance with the following.

Area	Live Load, psf (kN/m ²)
Ground Floor Slabs	
Shops, warehouses	125 (6.0)
Other structures	100 (4.8)
Control Room	100 (4.8)
Grating Floors	60 (2.9)
Roofs	20 (1.0)
Stairs	100 (4.8)

S400 Supplier Loads for Structures, Equipment, and Components

S400.1 General

This article specifies the Supplier load information that shall be provided for all structures (including structures which support equipment), components (including tanks, vessels, and piping or cable tray systems) and all equipment or skid mounted equipment that is directly supported by the Purchaser's structural steel and/or concrete foundations, unless noted otherwise within these specifications. Accurate loads are critical to proper design of the supporting structures and communication of load information between the Supplier and Purchaser must be consistent and inherently clear.

S400.2 Load Table Requirements

Loads provided by the Supplier shall be in tabular format clearly identifying the load classification (Not-to-Exceed, Final) and the load type (Dead, Live, Fluid/Contents, Wind, Seismic, Snow, Rain, Ice, Impact, Dynamic, etc.), magnitude, direction, and units. If the equipment or structure stores a fluid or other bulk material, loads shall be provided for empty, operating, and full conditions. The document on which the loading information is provided shall clearly indicate the Supplier's name, structure/equipment/component name, purchase order number, and revision number.

S400.2.1 Load Classifications

S400.2.1.1 Not-To-Exceed (NTE) Loads. NTE loads are defined as loads that may be used for detailed design by the Purchaser but are not classified as final or certified loads. NTE loads are generally submitted by the Supplier when certified load information is not available but the Purchaser needs to begin detailed design of the supporting structure(s). NTE loads shall be based on data that is representative of the equipment being supplied without excessive safety factors on the loads. It is expected that final loads will not exceed the NTE loads. Any load submittal classified as "Not-to-Exceed" in the Schedule of Submittals shall be in accordance with this article.

If the Supplier anticipates that the certified loads for any structure, piece of equipment, and/or load case may be more than or significantly less than previously submitted NTE loads, the Supplier shall notify the Purchaser as soon as they are aware of this situation and re-submit the load tables with the updated NTE loads soon thereafter.

S400.2.1.2 Final (Certified) Loads. Certified loads are defined as loads that have been verified as final and accurate by the Supplier and which may be used for detailed design by the Purchaser. Certified loads shall be submitted by the Supplier as soon as the verified load information becomes available but no later than the date identified in the Schedule of Submittals. Certified loads shall be submitted by the Supplier regardless of whether NTE loads were submitted at a prior date. Any load submittal classified as "final" or "certified" in the Schedule of Submittals shall be in accordance with this article.