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Schedule CS-D1

EA-2024-0237

SPEC-000002

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Schedule CS-D1

EA-2024-0237

SPEC-000006

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Schedule CS-D1

CONSTRUCTION SPECIFICATION CB-SPEC-000005

FOR

DESIGN, FABRICATION, AND CONSTRUCTION OF FIELD ERECTED, WELDED STEEL STORAGE TANKS

AT

CASTLE BLUFF ENERGY CENTER

Prepared by Power Operations Combined Cycle And Simple Cycle Project Execution Team

for

Ameren MISSOURI

Rev	Date	Revisions	Originator	Reviewer	Approver
B	*04/16/2024*	*Issued for Review*	*MJV*		
0	*xx/xx/2024*	*Issued for Bid*	*MJV*	*JAB*	*NPP*
1		*Conformed to Contract*			

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I N D E X

REVISION SUMMARY

Revisions are noted only for Revision 1 and later issues of the Specification. Revisions to the Specification are identified by a revision bar (vertical line) in the right hand margin adjacent to the revised lines or paragraphs.

The revision bar indicators are removed upon the issuance of the next revision of the Specification unless further changes are incorporated in the same line or paragraph.

Minor spelling, grammatical, and formatting corrections and/or changes are not noted as revisions.

Revision Number	Section / Paragraph	Description

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SECTION 1A
GENERAL CONDITIONS

The Contract Documents shall be interpreted as being complementary and required for a complete Project. Any requirement occurring in any one of the Contract Documents is as binding as though occurring in all Contract Documents.

All capitalized terms used in this Specification which are not defined in the applicable Section have the meaning set forth in Appendix A – Definitions attached hereto. Specific duties set forth herein do not constitute an exclusive list of requirements but complement the Contract. In the event of a conflict between this Specification and the Contract, this Specification shall control.

Any notice, form or document which is stated to be provided by the Owner may, at the Owner's discretion, be revised by the Owner or other notices, forms or documents with similar substance may be provided by the Owner, in each case, without altering the effect of such provision in these Specifications.

1.0 COMMERCIAL

1.1 The work described in this Specification shall be performed at Ameren's Castle Bluff Energy Center (hereinafter referenced as the job site or plant). The Castle Bluff Energy Center is located in St. Louis County, Missouri on the west bank of the Mississippi River.

The job site's mailing/shipping address is:

Ameren Missouri
Castle Bluff Energy Center
8200 Fine Road
St. Louis, MO 63129

1.1.1 Contacts

All commercial matters shall be directed to the Ameren Sourcing Specialist designated on the Request for Proposal or listed on the Purchase Order.

All technical questions regarding this Specification shall be directed to:

Mr. Mac Voss, PE
Consulting Engineer
Ameren Power Operations Services
11149 Lindbergh Business Court
St. Louis, MO 63123
636-575-5333
mvoss@ameren.com

1.2 High Level Scope/Project Objectives

Unless otherwise set forth in this Specification, the Contractor shall provide all design engineering, supervision, labor, materials, equipment, tools, lifting and rigging, scaffolding, and incidental items necessary to design, fabricate, install, construct, commission and test each portion and/or component of the Project.

The storage tank(s) shall be designed and fabricated in accordance with API 650 (or AWWA D100 and NFPA 22, as indicated) and furnished complete with all required nozzles; vents; vent screens; overflows; flanges; ladders; platforms; handrails; drains/cleanouts; manholes and access openings with covers, bolts, nuts, and gaskets; inside pipe with suitable supports; and such braces, brackets, lift lugs, and all appurtenances required for a complete system.

Project Objectives – The work described herein covers the design, fabrication, field erection, and testing of vertical, cylindrical, aboveground welded steel storage tanks.

1.2.1 The scope of work includes the following items:

1. Two (2) Fuel Oil Storage Tanks fabricated from carbon steel.
2. One (1) Demineralized Water Storage Tank fabricated from stainless steel.
3. One (1) Service / Fire Water Storage Tank fabricated from carbon steel.

1.3 Project Milestone Dates

Milestone*	Date*	Liquidated Damages
Specification Issued for Bidding	05/20/2024	N/A
Bids Due	06/17/2024	N/A
Contract Award (Limited Notice to Proceed – Tentative)	08/01/2024	N/A
Final Notice to Proceed	3/01/2025 (No Earlier Than)	N/A
Mobilization ***	11/01/2025 **	N/A
Equipment in Service (Substantial Completion)	06/01/2026 ** (No Later Than)	Yes
Final Completion	07/01/2026 **	None

* Milestone dates may be revised by the Owner as provided in the Contract.
** The Contractor shall propose a schedule for the completion of the work based on material/equipment deliveries at the time of Contract Award.
*** Mobilization shall be coordinated with the Owner and the Foundation Installation Contractor (Site EPC Contractor)

1.4 Warranty

1.4.1 The Work shall be warranted by the Contractor against defects in materials (provided by the Contractor) and workmanship for a period of not less than 2 years from Substantial Completion.

1.4.2 The Contractor shall indicate if the warranties provided by the equipment manufacturers are greater than 2 years or if extended warranties are offered.

1.5 Participation in Coordination Activities/Meetings

Description	Meeting Lead	Frequency*	Contractor Deliverables
Pre-Construction Meeting	Owner	Once	Notes
Pre-Construction Environmental Hazard Meeting	Contractor	Once (Scheduled with the Pre-Construction Meeting)	Identify construction/demolition areas that require testing (e.g., insulation, painted surfaces)
Safety Meetings	Contractor	Daily during construction periods	Agenda, notes
Safety Walk-downs	Owner	Weekly or more frequently if needed.	Findings, Corrective Actions
Construction/Outage Progress Meetings	Owner	Weekly	Agenda, notes
Multi-Contractor Coordination Meeting	Owner	TBD	TBD

*Note: For any dates, frequencies or deliverables identified as “TBD”, the Owner will determine the appropriate date, frequency, or deliverable.

1.5.1 The Contractor shall provide a representative for and participate in coordination and information exchange activities with representatives of the Owner and other contractors involved with other work at the Site, including the following activities as described below and set forth in the table above:

1.5.1.1 Exchange of information necessary to coordinate Contractor's Work with the work performed by the Owner or its other contractors.

1.5.1.2 During much of the Work, at least one construction meeting per week and at least one multi-contractor coordination meeting per week is anticipated.

1.5.1.3 The Owner will inform the Contractor of safety walk-down meetings dates and times as necessary.

1.5.1.4 The Contractor is responsible for setting up the design review meetings, if applicable, and coordinating conference calls.

1.5.2 A Contractor representative with authority to make binding Work and schedule commitments shall attend all meetings.

1.5.3 Construction progress meetings will typically concentrate on safety and housekeeping, schedule and work progress, job related problems, and site coordination.

1.5.4 The Contractor shall deliver progress reports to Owner, generally monthly, in addition to the minutes described herein.

1.5.5 The Contractor shall deliver an updated Project Schedule showing actual progress and the Critical Path of the Work at each progress meeting. See Contractor Scheduling Requirements in Appendix D for additional schedule requirements.

1.5.6 The Contractor shall take and within 2 working days deliver the meeting minutes to the Owner for the weekly Construction Progress Meetings.

1.5.7 The Contractor shall electronically track safety findings from safety walk-downs and document corrective actions taken.

1.6 Contractor On-Site Project Management

1.6.1 The Contractor shall provide a full-time onsite Project Manager or Job Superintendent unless an exemption is provided in writing by the Owner.

1.6.2 At mobilization, the Contractor shall appoint a competent onsite safety and health representative who will coordinate Contractor safety and health activities, hazardous material, and waste handling. The safety and health representative shall work with the Owner personnel on safety and health related issues and implement safety and health rules necessary for safe execution of the project.

2.0 TECHNICAL

2.1 Background Information: The purpose of this project is to provide fuel oil storage and demineralized water storage for Ameren's new Castle Bluff Energy Center. The Caste Bluff Energy Center will consist of four simple cycle combustion turbine generating units.

2.2 Scope of Work

2.2.1 Design, fabrication, erection, and testing of the tank(s) as described herein.

2.2.2 Application of any external coatings and internal linings as described herein.

2.2.3 Insulation (materials and installation) of the tank(s) as described herein.

2.3 Drawings

2.3.1 The following drawings are intended to delineate and detail the Contractor's scope of the Work and are part of this Specification. These drawings are generally to scale, but figures shall always be followed, and drawings are not to be scaled. Contractor requests for additional available drawings shall be made in writing to the Owner.

Drawing Number	Description
New Ameren Drawings	
CBSC-MSK-GA-001	General Arrangement, Site Arrangement
CBSC-MSK-GA-002	General Arrangement, Power Block Arrangement
CBSC-MSK-GA-003	General Arrangement, Site Arrangement, Photo Overlay

2.3.2 The Contractor shall provide a detailed design with a complete drawing package and other information that includes, at a minimum, component details, material lists, design calculations, etc. Reference Appendix S – Submittals for more information on the drawing/data requirements.

2.3.3 Design interface and/or tie-in points:

- Tank Foundations
- Tank Nozzle Location/Orientations

The Owner will contract with an EPC firm to engineer, procure, and construct the balance of plant (BOP) facilities for the new Castle Bluff Energy Center. The EPC contractor will be responsible for the design and installation of the tank foundations and for the piping to/from the storage tanks. Coordination will be required between the Owner, EPC contractor, and the Tank Supplier for details associated with the items listed above.

2.3.4 Any design change, material change/substitution, or request for extra work require that the Contractor submit a written request to the Owner. Written approval is required from the Owner prior to proceeding with any change or additional work.

2.3.5 Professional Engineering (PE) License Seals

2.3.5.1 All design documentation meant for fabrication, permitting, erection (critical lifts), or construction such as design drawings, specifications, and calculations shall, to the extent required by Law, have a Professional Engineering seal applied, signed, and dated by the Contractor's registered professional engineer(s).

2.3.5.2 The license shall be current, valid, and in good standing for the State in which the Work is performed.

2.3.5.3 Professional seals are not required for review items (not to be constructed), sketches, samples, design control documents, operations manuals, Contractor material design documents, engineered product drawings (not required for permitting) and such other documents approved by the Owner.

2.3.5.4 The Contractor shall clarify any seal requirements for any Project-specific documents.

2.4 Work, Materials and Equipment Provided and/or Retained by the Owner

2.4.1 The Owner will provide the Owner's nurse and first aid office for use by Contractor personnel during the Energy Center's eight-hour day shift, Monday through Friday.

2.4.2 The Owner will provide power connection point for use by Contractor supplied trailers if the trailer is located near the EPC Contractor trailers.

2.4.3 The Owner (EPC contractor) will provide (design and install) the foundations and anchor bolts if required.

2.4.4 Connecting piping and pumps will be provided (designed and installed) by others.

2.4.5 Furnishing and installation of all required permanent stair or ladder lighting systems will be by others.

2.4.6 Design, furnishing, and installation of grounding system below grade will be by others.

2.4.7 Design and furnishing of tank immersion heaters along with the wiring of the heaters will be by others. Mechanical installation of the heaters shall be by the Tank Supplier. (Design and supply of the heaters is requested as an option, reference Appendix P)

2.5 Utilities and Facilities

2.5.1 The Contractor shall supply sanitary facilities, drinking water and shower facilities (if needed) for his personnel at the job site.

2.5.2 Temporary lighting, wiring, plumbing, guard lights, barricades or any other items required for protection of work, local regulation, or Law for public protection shall be provided by the Contractor.

2.5.3 The Contractor shall furnish the tie-in and any extensions required for connection to utilities (electric and water service). The Contractor shall provide 480/120-volt transformers as required.

2.5.4 The Contractor shall provide all power required at the work site (e.g. generators for welding).

2.5.5 Non-potable (construction) water will not be provided by the Owner to the Contractor for the purposes of clean up/wash down. Potable water (for drinking) will not be provided by the Owner.

2.5.6 The Owner will provide the water supply for hydrostatic testing of the storage tank(s). The water supply for hydrostatic testing will be potable water from Missouri-American Water via fire hydrants at/near the site. The Contractor shall provide all piping/hoses from the water source to the tanks. If multiple tanks are included in the Work, the Contractor shall use the hydrostatic test water for the testing of multiple tanks to the greatest extent possible. The Contractor shall be responsible for the pumping of the hydrostatic test water from tank to tank.

The Contractor shall notify the Owner ten working days in advance of the need for hydrostatic test water to allow for a notification to Missouri-American Water. Slow opening/closing valves shall be used on the hydrostatic water supply piping to prevent water hammer back into the Missouri-American Water system (i.e. ball valves are not permitted, gate valves are preferred).

2.5.7 The tanks shall be drained within 5 days after successful completion of the hydrostatic test. The Contractor shall coordinate the disposal of the hydrostatic test water with the Owner to ensure proper disposal.

2.6 Materials and Equipment

2.6.1 The Contractor shall be responsible for receiving, unloading, inspecting and security of all Materials and Equipment supplied by him, or Materials or Equipment provided by the Owner, unless otherwise stated in the Contract. The Contractor shall unload Material in the designated laydown areas. The Contractor shall develop an inventory list of all Materials received. The Contractor shall provide adequate protection for Equipment or Material stored outside from external forces such as rain, wind, and storms. (See Appendix G for material handling and storage requirements.)

2.6.2 All Contractor supplied Materials and Equipment may be inspected by the Owner. Inspection may include testing necessary to determine compliance with the Contract requirements. All expense of initial acceptance tests will be borne by the Owner. The expense of any subsequent test due to failure of Materials or Equipment first offered will be charged against the Contractor. The Owner may reject damaged or defective Materials or Equipment at any time prior to Substantial Completion.

2.6.3 Equipment and Material and the Contractor's tool, office, and lay-down areas and trailers areas will be designated by the Owner as close to work site as practical. The Contractor's lay down area will be as determined by the Owner and coordinated with the EPC contractor.

2.7 Codes, Standards and Regulations

2.7.1 The latest revisions or addenda to codes, standards and regulations set forth as of the date of the Contract shall apply.

2.7.2 The Contractor shall comply with the following codes, standards, and regulations:

- ACI American Concrete Institute
- AISC American Institute of Steel Construction
- ANSI American National Standards Institute
- API American Petroleum Institute
- ASME American Society of Mechanical Engineer
- ASTM American Society for Testing and Materials
- AWS American Welding Society
- FM Factory Mutual Engineering Corporation
- NFPA National Fire Protection Association
- NETA National Electrical Testing Association
- OSHA Occupational Safety and Health Administration
- UL Underwriters' Laboratories
- SSPC The Society for Protective Coatings
- All Federal, State, County, or Municipal Codes, laws, or applicable ordinances.

2.8 Testing and Inspection

2.8.1 The Owner reserves the right to observe all tests being performed. The Contractor shall notify Owner of all scheduled tests not less than 5 working days prior to the date of test.

2.8.2 Certified copies of inspection and test reports shall be provided by the Contractor for all tests and inspections. One (1) copy of each report shall be submitted to the SPOC within one (1) week after completion of each such test or inspection. Reference Appendix S – Submittals for further requirements.

2.8.3 The Owner reserves the right to inspect any portion of the work performed at the Site. Reference Appendix F – Piping, Welding, NDE, & Excavation Requirements for further information on inspection and testing requirements.

2.9 Field Safety Program

2.9.1 The Contractor shall comply with the Safety Requirements as described in Appendix B.

2.9.2 Transfer of Information (OSHA Safety Requirement)

2.9.2.1 The Owner will notify the Contractor of known characteristics and conditions as relating to the safety of the Work to be performed at the job site. This will be accomplished before commencement of the Work during the Owner's pre-construction meeting.

2.9.2.2 The transfer of information will be shared with the Contractor and the Contractor shall share such information with its subcontractors.

3.0 INFORMATION REQUIRED FROM BIDDERS

3.1 Information Required with the Bids. The Contractor shall supply the following information with his Bid to the Owner.

Category	Item	Description/Reference
Pricing	Bid	Per RFP – Reference Appendix P – Pricing Sheet
	T&M Rates	T&M rates for Contractor and mark-ups for all Subcontractors and equipment rentals (needed for any extra work that may be authorized on a T&M basis).
Safety	Safety and Health Data Form	Contractor shall complete Appendix B, Attachment B.6.8
	Cost of Safety Representative	See Appendix B – The cost of a full time safety representative shall be indicated separately in Appendix P – Pricing Sheet
	If applicable, Lattice Crane Areas	See Appendix B, Paragraph 7.3 Critical Lifts, including normal and severe weather lay-down plans for on-site lattice cranes.
Quality	Contractor's Quality Management Program	Overview/description of Contractor's Quality Management Program and supportive procedures.
Preliminary Project Execution Plan	Level 2 Project Schedule	See Appendix D – Contractor Scheduling Requirements
	Organizational Chart	Must include identification of Key Personnel with resumes, including but not limited to Project Manager to foreman level.
	List of Proposed Subcontractors and each one's scope of work	List shall include all planned subcontractors and subcontractor cost mark-ups.
	Lay-down Plan	Proposed/required location and size of Material lay-down areas and Contractor facilities.
	Access and Heavy Equipment	Contractor shall provide all access and accommodation requirements for heavy equipment, if applicable.
	Power Requirements	Contractor shall provide its estimated temporary (construction) power requirements.
Environmental	Chemicals of Interest	Contractor shall complete and submit Attachment G.2.8, if applicable.
Diversity	Diverse Supplier Business Plan	Contractor shall complete and submit a Diverse Supplier Business plan as required in the RFP.

3.2 Information After Contract Award: Contractor shall supply to Owner the following information after the Contract is awarded. Reference Appendix S – Submittal for detailed information on information required after award of the contract.

Category	Item*	Description/Reference	Due Date
Diversity	Diverse Supplier 2nd Tier Report	Attachment provided in RFP.	10 Weeks after the notice to proceed.

*All items submitted by Contractor are subject to Owner's review and approval.

4.0 LIST OF ADDITIONAL CONTRACT DELIVERABLES

In addition to the items to be delivered as defined in Paragraphs 3.1, 3.2, and Appendix S - Submittals, the Contractor shall deliver the following items as defined in the Table below. Generally, these items are required on an "as needed" basis.

Section	Description	Due Date
Appendix B, Attachment B.6.1	Safety Incident/Accident Reporting	Immediately for fatality or serious Incident/Accident or within 24 hours of other Incident/Accident.
Appendix B, Paragraph 9.11	Respiratory Protection Plan	Before using respirators.
Appendix B, Attachment B.6.4	Monthly Contractor Accident Statistics Report	By 2nd business day of each month.
	Time Sheets for T&M Work	Daily, weekly, etc.
	Design Change, Material Change Information, Change Order or Extra Work Request	Prior to implementing changes, must be approved by the Owner prior to execution of the work.
	Certification from Contractor to Owner that the Equipment is complete and ready for service.	Before Equipment startup date.
Appendix C, Attachment C.1.3	Reduction in Force Report	When employees are released from Site.

END OF SECTION 1A

SECTION 05120
STRUCTURAL STEEL

1.0 GENERAL

1.1 Scope

1.1.1 Structural steel framing members, support members, struts, and fasteners.

1.2 References

1.2.1 ASTM A6 – General Requirements for Delivery of Rolled Steel Plates, Shapes, Sheet Piling & Bars for Structural Use

1.2.2 ASTM A992 – Standard Specification for Structural Steel Shapes

1.2.3 ASTM A36 – Standard Specification for Carbon Structural Steel

1.2.4 ASTM A307 – Carbon Steel Externally Threaded Standard Fasteners

1.2.5 ASTM A325 – High Strength Bolts for Structural Steel Joints

1.2.6 ASTM A500 – Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Round & Shapes

1.2.7 ASTM A501 –- Hot-Formed Welded and Seamless Carbon Steel Structural Tubing

1.2.8 ASTM A53 – Standard Specification for Steel Pipe

1.2.9 AWS A2.4 – Standard Welding Symbols

1.2.10 AWS D1.1 – Structural Welding Code

1.2.11 AISC Manual for Steel Construction LRFD 13th Edition – Specification for the Design, Fabrication and Erection of Structural Steel for Buildings

1.2.12 AISC Manual for Steel Construction ASD 13th Edition – Specification for the Design, Fabrication and Erection of Structural Steel for Buildings

1.2.13 AISC – Code of standard practice for steel buildings and bridges

1.2.14 AISC – Specification for Structural Joints using ASTM A325, or A490 Bolts approved by the Research Council on Riveted and Bolted Structural Joints of the Engineering Foundation and endorsed by AISC.

1.3 Submittals

1.3.1 Submit under provisions of Contract.

1.3.2 Shop Drawings

1.3.2.1 Submit shop drawings prepared under supervision of a registered professional engineer, licensed in the state of Site including complete details and schedules for fabrication and assembly of structural steel and all other materials specified in this Section.

1.3.2.2 Verify by taking onsite measurements, dimensions for existing conditions and for items requiring coordination with other trades before fabrication. Show dimensions on the Shop Drawings and note that they have been verified.

1.3.2.3 Indicate profiles, sizes, spacing and locations of structural members, openings, connections, attachments, and fasteners.

1.3.2.4 Indicate welded connections with AWS A2.0 welding symbols. Indicate net weld lengths.

1.3.2.5 Show surface preparation and painting requirements.

1.3.3 Welder's Certificates: Submit qualification record of procedures, tackers, welders, and welding operators to the Engineer. Provide certification that welders to be employed in work have satisfactorily passed AWS qualification tests within the previous 12 months. If re-certification of welders is required, re-testing will be Contractor's responsibility.

1.3.4 Product Data: Submit producer's or manufacturer's specifications and installation instructions for all products specified. Include data to show compliance with specifications (including specified standards).

1.4 Quality Assurance

1.4.1 Fabricate structural steel members in accordance with AISC – Specification for the Design, Fabrication and Erection of Structural Steel for Buildings, Load & Resistance Factor Design, Second Edition.

1.4.2 Maintain one copy of document onsite.

1.5 Qualifications

1.5.1 Fabricator: Company specializing in performing the work of this Section with minimum 5 years' documented experience.

1.5.2 Erector: Company specializing in performing the work of this Section with minimum 10 years' documented experience.

1.6 Field Measurements

1.6.1 Verify that field measurements are as shown on Drawings.

1.7 Delivery, Storage And Handling

1.7.1 Store materials to permit easy access for inspection and identification. Keep steel members off ground, using pallets, platforms, or other supports. Protect steel members and packaged materials from corrosion and deterioration.

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

2.0 PRODUCTS

2.1 Materials

2.1.1 Wide Flange sections and Structural Tees cut from Wide Flange sections: ASTM A992

2.1.2 M shapes, S shapes and Structural Tees cut from M or S Sections, HP shapes, Channels and Angles: ASTM A36

2.1.3 Structural Plates and Bars: ASTM A36 or ASTM A992

2.1.4 Steel Pipe: ASTM A53, Type E or S, Grade B or ASTM, A501

2.1.5 Cold-Formed Steel Tubing: ASTM A500, Grade B

2.1.6 Unfinished (Machine) Threaded Fasteners: ASTM A307, regular low-carbon steel bolts and nuts with hexagonal heads. SAE Grade bolts may not be used in any connections.

2.1.7 High-Strength Threaded Fasteners: ASTM A325, heavy hexagon structural bolts, hot formed heavy hexagon nuts, and hardened washer. Bolts, nuts, and washers shall conform to the AISC Specification for structural joints using ASTM A325 or A490 bolts. Bolts, nuts, and washers shall be hot dipped galvanized to conform to ASTM A153 or mechanically galvanized to conform to ASTM B695.

2.1.8 Welding Materials: AWS D1.1; Welding electrodes shall be low hydrogen type electrodes compatible with the type of steel welded. An E70 electrode shall be used for all Carbon Steel to Carbon Steel welds. Weld materials shall match or exceed the base metal in strength.

2.2 Fabrication

2.2.1 Fabricate items of structural steel in accordance with AISC Specification for the Design, Fabrication and Erection of Structural Steel for Buildings and in accordance with the final shop drawings.

2.2.2 Connections of new steel to existing steel shall typically be welded. Connection of new steel to new steel will be either bolted or welded, as indicated.

2.2.2.1 Provide high-strength threaded fasteners for bolted connections, except where unfinished (machine) bolts are indicated.

2.2.3 All existing bolts shown to be removed and replaced shall be replaced with new ASTM A325 bolts, unless noted otherwise.

2.2.4 All bolted joints shall be in accordance with AISC Specification for Structural Joints using ASTM A325 or A490 bolts. All bolted connections shall have a minimum of two bolts.

2.2.5 All welded construction shall comply with the building and tubular provisions of AWS D1.1 Code.

2.2.5.1 Assemble and weld built-up sections by methods which will prevent warping.

2.2.5.2 Use welding procedures and sequences that prevent locked-in stresses or distortions.

2.2.6 All connections will be subject to the Engineer's review.

2.3 Finish

2.3.1 Painted steel: Clean, prepare, shop prime and finish coat structural component surfaces in accordance with Section 9900 – Painting. Do not prime surfaces that will be field welded. Field touch-up painted steel as required per Section 09900 – Painting.

2.3.2 Galvanized steel: Where noted on drawings or in specification, fabricated steel shall be hot-dip galvanized after fabrication per ASTM A123. Zinc coating thick shall be a minimum of 0.45 oz. per sq. ft. or 0.76 mils thick. Equivalent to G90 coating thickness of 0.90 oz. per sq. ft. on two sides of steel. Field touch-up galvanized steel as required per Section 09900 – Painting.

2.3.3 Painted fasteners: Unfinished carbon steel fasteners, and unfinished ends of tension control fasteners at removed splines, shall be touched up painted per spec Section 09900 – Painting.

2.4 Source Quality Control and Tests

2.4.1 Testing of components will be performed as defined in this Specification. Reference Appendix F – Piping, Welding, NDE, & Excavation Requirements for further information on inspection and testing requirements.

3.0 EXECUTION

3.1 Examination

3.1.1 Verify that field connections are acceptable and are ready to receive work.

3.1.2 Beginning of installation means erector accepts existing conditions.

3.2 Erection

3.2.1 Erect structural steel in accordance with AISC Specification, Bolting Specification and Code of Standard Practice as herein specified.

3.2.2 Allow for erection loads, and for sufficient temporary bracing to maintain structure safe, plumb, and in true alignment until completion of erection and installation of permanent bracing.

3.2.3 Field weld components indicated on Drawings.

3.2.4 Do not field cut or alter structural members without approval of the Engineer.

3.2.5 Provide temporary planking, scaffolding, and working platforms as necessary to effectively complete work.

3.2.6 Do not enlarge unfair holes in members by burning or by use of drift pans. Ream holes that must be enlarged to admit bolts.

3.2.7 Immediately after erection, prime welds, abrasions, and surfaces not shop primed, except surfaces to be in contact with concrete.

3.3 Field Quality Control

3.3.1 Field inspection will be performed under the provisions of Section 1A, Paragraph 2.8.

END OF SECTION 05120

SECTION 05500
METAL FABRICATIONS

1.0 GENERAL

1.1 Work Included

This Work includes all items necessary and reasonably incidental to the completion of the overall metal fabrication job. Work generally includes metal fabrications made from iron and steel shapes, plates, bars, strips, tubes, pipes, and castings which are not a part of structural steel or other metal systems specified elsewhere.

1.2 References

1.2.1 Hot-Rolled Structural Steel Wide-flange Shapes: Comply with ASTM A992. All other Hot-Rolled Structural Steel Shapes shall conform to ASTM A36 or A992.

1.2.2 Hollow Structural Sections: Rectangular, square, or round; comply with ASTM A500, Grade B.

1.2.3 Hot-Formed Welded and Seamless Carbon Steel Hollow Structural Sections in Round and Shapes: Comply with ASTM A501 Grade B.

1.2.4 Steel Pipe: Comply with ASTM A53.

1.2.5 Steel Members Fabricated from Plate or Bar Stock: Provide 42,000psi min yield strength. Comply with ASTM A529 or ASTM A570.

1.2.6 Steel Members Fabricated by Cold Forming: Comply with ASTM A607, Grade 50.

1.2.7 Cold-Rolled Carbon Steel Sheet: Comply with requirements of ASTM A366 or ASTM A568.

1.2.8 Hot-Rolled Carbon Steel Sheet: Comply with requirements of ASTM A568 or ASTM A569.

1.2.9 Bolts, Nuts and Washers for Structural Framing: Comply with ASTM A325 for design loads and connection details.

1.2.10 Welding Materials: AWS D1.1; type required for materials being welded.

1.3 Submittals

1.3.1 Product Data: Submit manufacturer's specifications, anchor details and installation instructions for products used in miscellaneous metal fabrications, including paint products and grout.

1.3.2 Shop Drawings: Submit shop drawings for fabrication and erection of miscellaneous metal fabrications. Include plans, elevations and details of sections and connections. Show anchorage and accessory items. Provide templates for anchor and bolt installation by others.

1.3.2.1 Where materials or fabrications are indicated to comply with certain requirements for design loadings include structural computations, material properties and other information needed for structural analysis.

2.0 PRODUCTS

2.1 Materials: Ferrous Metals

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

2.1.2 Structural Steel Wide-Flange Shapes: ASTM A992.

2.1.3 All other structural steel shapes plate and bar: ASTM A36 or A992.

2.1.4 Provide bolts, washers and shims as required.

2.2 Paint

See Section 09900 – Painting

2.3 Fabrication, General

2.3.1 Workmanship: Use materials of size and thickness indicated or, if not indicated, as required to produce strength and durability in finished product for use intended. Work to dimensions indicated or accepted on shop drawings, using proven details of fabrication and support. Use type of materials indicated or specified for various components of Work.

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

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

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

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

2.3.2 Shop Painting

See Section 09900 – Painting

2.4 Rough Hardware

2.4.1 Furnish bent or otherwise custom fabricated bolts, plates, anchors, hangers, dowels and other miscellaneous steel and iron shapes as required for framing and support of other work and for anchoring or securing to concrete or steel.

3.0 EXECUTION

3.1 Preparation

3.1.1 Field Measurements: Take field measurements prior to preparation of shop drawings and fabrication, where possible. Do not delay Work progress; allow for trimming and fitting in the field where taking field measurements before fabrication may delay Work.

3.2 Installation, General

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

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

3.2.3 Fit exposed connections: Accurately together to form tight hairline joints. Weld connections which are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Grind exposed joints smooth and touch-up shop paint coat. Do not weld, cut or abrade the surfaces of exterior units which have been hot-dip galvanized after fabrication, and are intended to for bolted or screwed field connections.

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

3.3 Adjust And Clean

3.3.1 Touch-Up Painting: Cleaning and touch-up painting of field welds, bolted connections, and abraded areas of the shop paint on miscellaneous metal is specified in Section 09900 – Painting of this Specification.

END OF SECTION 05500

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SECTION 05520
HANDRAILS AND RAILINGS

1.0 GENERAL

1.1 Scope

1.1.1 Steel pipe handrails, balusters, and fittings

1.2 Related Sections/Standards

1.2.1 Section 05120 – Structural Steel: Attachment plates and angles.

1.2.2 Section 09900 – Painting

1.2.3 Standard Drawings:

- AUE-STND-ARCH-000001-001
- AUE-STND-ARCH-000002-001

The Ameren standard guardrail system consists of a top rail, two mid-rails, and a toe plate.

1.3 References

1.3.1 ASTM A53 – Pipe Steel, Black and Hot-Dipped, Zinc-coated Welded and Seamless

1.4 Design Requirements

1.4.1 Handrails shall be in accordance with OSHA requirements.

1.4.2 Railing assembly, wall rails and attachments to resist lateral force of 200 lbs. at any point without damage or permanent set.

1.5 Submittals

1.5.1 Submit under provisions of Section 1A – General Conditions and Appendix S – Submittals.

1.5.2 Shop Drawings: Indicate profiles, sizes, connection attachments, anchorage, size and type of fasteners and accessories.

1.6 Field Measurements

1.6.1 Verify that field measurements are as indicated on Drawings and Shop Drawings.

2.0 PRODUCTS

2.1 Steel Railing System

2.1.1 Pipe: ASTM A53, Grade B, Schedule 40.

2.1.2 Fittings: Elbows, T-shapes, wall brackets, escutcheons; machined steel.

2.1.3 Exposed Fasteners: Flush countersunk screws or bolts; consistent with design of railing.

2.1.4 Splice Connectors: Steel welding collars.

2.1.5 Finish: Railing system shall be finished as noted on drawings or in specification. For painted railing see Section 09900 – Painting. For galvanized railing see Section 05120 – Structural Steel. Field touch-up painted and galvanized railing as required per Section 09900 – Painting.

2.2 Fabrication

2.2.1 Fit and shop assemble components in largest practical sizes for delivery to site.

2.2.2 Fabricate components with joints tightly fitted and secured.

2.2.3 Exposed Mechanical Fastenings: Flush countersunk screws or bolts; unobtrusively located; consistent with design of component, except where specifically noted otherwise.

2.2.4 Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.

2.2.5 Continuously seal joined pieces with weld.

2.2.6 Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt-tight, flush and hairline. Ease exposed edges to small uniform radius.

2.2.7 Accurately form components to each other and to building structure.

3.0 EXECUTION

3.1 Examination

3.1.1 Verify that field conditions are acceptable and are ready to receive Work.

3.1.2 Commencement of installation means Erector accepts existing conditions.

3.2 Preparation

3.2.1 Clean and strip steel items to bare metal where site welding is required.

3.3 Installation

3.3.1 Install components plumb and level, accurately fitted, free from distortion or defects.

3.3.2 Provide anchors, plates and angles required for connecting railings to structure. Anchor railing to structure.

3.3.3 Field weld anchors as indicated on Drawings. Touch-up welds with primer. Grind welds smooth.

3.3.4 Conceal bolts and screws whenever possible. Where not concealed, use flush countersunk fastenings.

END OF SECTION 05520

SECTION 05530
GRATING

1 GENERAL

1.1 Scope

1.1.1 Formed metal gratings.

1.1.2 Formed openings.

1.1.3 Perimeter closures.

1.2 Related Work

1.2.1 Section 05120 – Structural Steel: Framed steel openings

1.2.2 Section 05520 – Handrails and Railings

1.2.3 Section 09900 – Painting

1.3 References

1.3.1 ANSI/NAAMM MBG531-93 – Metal Bar Grating Manual

1.3.2 Wide Flange sections and Structural Tees cut from Wide Flange sections: ASTM A992

1.3.3 M shapes, S shapes and Structural Tees cut from M or S Sections, HP shapes, Channels and Angles: ASTM A36

1.3.4 ASTM A569 – Steel, Carbon, Hot-rolled Sheet and Strip, Commercial Quality

1.4 Submittals

1.4.1 Submit shop drawings and product data under the provision defined in this Specification.

1.4.2 Provide details of grates, plates, supports, span and deflection table, openings, and perimeter construction details and tolerances.

1.4.3 Submit manufacturer's installation instructions under provisions defined in this Specification.

2.0 PRODUCTS

2.1 Acceptable Manufacturers

2.1.1 The following manufacturers are acceptable:

IKG Borden
McNichols Co.

2.2 Materials

2.2.1 Grating Bearing Bar: ASTM A569

2.2.2 Formed Steel: ASTM A36, 36 ksi of shapes indicated.

2.3 Fabrication

2.3.1 Fabricate grates and plates of sizes indicated.

2.3.2 Weld joints of intersecting grating sections.

2.3.3 Provide support framing for openings.

2.3.4 Grating type W-19-4 (bearing bars spaced 1-3/16” on center and cross bars spaced 4” on center).

2.3.5 Bearing Bar: 1¼” x 3/16” smoother bar or, serrated bar, as shown on drawings.

2.3.6 Anchorages: Welded or saddle clipped per ANSI MBG-531, as shown on drawings. Saddle clips shall not be shared between grating panel pieces.

2.4 Finishes

2.4.1 Grating finish: Fabricated grating sections shall be hot-dip galvanized after fabrication per ASTM A123. Zinc coating thick shall be a minimum of 0.45 oz. per sq. ft. or 0.76 mils thick. Equivalent to G90 coating thickness of 0.90 oz. per sq. ft. on two sides of steel.

3.0 EXECUTION

3.1 Inspection

3.1.1 Verify that opening sizes and dimensional variations are acceptable to suit grating tolerances.

3.1.2 Verify that supports are correctly positioned.

3.1.3 Beginning of installation means acceptance of existing conditions.

3.2 Installation

3.2.1 Install grates in accordance with manufacturer’s instructions.

3.2.2 Secure grating with welds or saddle clips to prevent movement.

3.3 Tolerances

3.3.1 Conform to ANSI/NAAMM A202.1.

END OF SECTION 05530

SECTION 09900
PAINTING

PART 1 GENERAL

1.1 WORK INCLUDED

Work includes providing finishes for new structural and miscellaneous steel framing. This will also include all items necessary and reasonably incidental to the completion of the overall job. The work generally includes:

1.1.1. Prepare surfaces that are to receive finish.

1.1.2 Shop finish new steel, field touch-up for damaged coatings and field coating of field welded connection areas. Finish surfaces as indicated in schedule at end of this Section.

1.1.3 Color selection schedule.

1.2 RELATED WORK

1.2.1 Section:

05120	Structural Steel
05520	Handrails and Railings
15455	API 650 Welded Steel Storage Tanks

1.3 QUALITY ASSURANCE

1.3.1 Product Manufacturer: Company specializing in manufacturing quality paints and finish products with 10 years' experience.

1.3.2 Applicator: Company specializing in industrial painting and finishing with 5 years' documented experience.

1.4 REFERENCES

1.4.1 ASTM D16 - Standard Terminology for Paint, Related Coatings, Materials, and Applications

1.5 DEFINITIONS

1.5.1 Conform to ASTM D16 for interpretation of terms used in this Section.

1.6 REGULATORY REQUIREMENTS

1.6.1 Conform to applicable code for flame/fuel/smoke rating requirements for finishes.

1.6.2 All coatings, thinners, etc. shall be lead and chromate free and VOC compliant. Volatile organic compounds per gallon of coating shall be limited to less than 3.5 pounds/gallon (preferably less than 2.8 pounds/gallon) in the coatings thinned, ready to apply state.

1.6 3 Zinc Dust Powder shall be ASTM D520, Type II Zinc Version.

1.7 SUBMITTALS

1.7.1 Submit product data under provisions of Appendix S – Submittals.

1.7.2 Provide product data on all finishing products.

1.7.3 Submit manufacturer's application instructions under provisions of Appendix S – Submittals.

1.7.4 Provide color samples.

1.8 DELIVERY, STORAGE AND HANDLING

1.8.1 Deliver products to site in a timely manner to avoid delays in construction.

1.8.2 Store and protect products from weather, extremes in temperatures and direct sun.

1.8.3 Paint materials shall be received in sealed original labeled containers, bearing manufacturer's name, type of paint, brand name, color designation and instructions for mixing and/or reducing.

1.8.4 Store paint materials at minimum ambient temperature of 45°F and a maximum of 90°F, in well-ventilated area, unless required otherwise by manufacturer's instructions.

1.8.5 Take precautionary measures to prevent fire hazards and spontaneous combustion.

1.9 ENVIRONMENTAL REQUIREMENTS

1.9.1 Ensure surface temperatures or the surrounding air temperature is above 50°F, below 90°F and a minimum of 5°F above dewpoint before applying finishes, unless manufacturers product data sheet allows for low temperature cure conditions.

1.9.2 Provide adequate continuous ventilation and sufficient heating facilities to maintain temperatures above 50°F for 24 hours before, during and 48 hours after application of finishes, unless required otherwise by manufacturer's instructions.

1.9.3 Do not apply exterior coatings during rain or snow, or when relative humidity is above 50%, unless required otherwise by manufacturer's instructions.

PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS - PAINT

2.1.1 Exterior Steel and Uninsulated Piping (new materials)

2.1.1.1 Three Coat System – Organic Zinc-Epoxy-Polyurethane

Blome International / PPG Protective & Marine Coatings (as represented by Blome Int'l.)

Shop Coatings:	Prime Coat	–	Amercoat 68HS
	First Coat	–	Amerlock 2 / 400
	Finish Coat	–	Amercoat 450H
Field Touch-Up:	Prime Coat	–	Amerlock 2 / 400
	First Coat	–	Amerlock 2 / 400
	Finish Coat	–	Amercoat 450H

2.1.1.2 Three Coat System – Organic Zinc-Epoxy-Polyurethane

Carboline

Shop Coatings:	Prime Coat	–	Carbozinc 859
	First Coat	–	Carboguard 890
	Finish Coat	–	Carbothane 134 HG
Field Touch-Up:	Prime Coat	–	Carboguard 890
	First Coat	–	Carboguard 890

2.1.1.3 Two Coat System – Epoxy-Polyurethane (if noted on drawings or specified elsewhere)

Blome International / PPG Protective & Marine Coatings (as represented by Blome Int'l.)

Shop Coatings:	Prime Coat	–	Amerlock 2 / 400
	Finish Coat	–	Amercoat 450H
Field Touch-Up:	Prime Coat	–	Amerlock 2 / 400
	Finish Coat	–	Amercoat 450H

Finish Coat – Carbothane 134 HG

2.1.2 Exterior Steel and Uninsulated Piping (existing materials, rusted)

2.1.2.1 Blome International / PPG Protective & Marine Coatings (as represented by Blome Int'l.)

Field Coatings: Prime Coat – Blome EC-2500
First Coat – Amerlock 2 / 400
Finish Coat – Amercoat 450H

2.1.2.2 Carboline

Field Coatings: Prime Coat – Rustbond or Rustbond FC
First Coat – Carboguard 60
Finish Coat – Carbothane 134 HG

2.1.3 Exterior Steel (galvanized touch-up)

2.1.3.1 Blome International / PPG Protective & Marine Coatings (as represented by Blome Int'l.)

Field Coatings: Prime Coat – Blome EC-2500
First Coat – Amerlock 2 / 400
Finish Coat – Amercoat 450H

2.1.3.2 Carboline

Field Coatings: Prime Coat – Rustbond or Rustbond FC
First Coat – Carboguard 890
Finish Coat – Carbothane 134 HG

2.1.4 Interior Steel (new)

2.1.4.1 Blome International / PPG Protective & Marine Coatings (as represented by Blome Int'l.)

Shop Coatings: Prime Coat – Amercoat 68HS

Field Touch-Up: Prime Coat – Amerlock 2 / 400

2.1.4.2 Carboline

Shop Coatings: Prime Coat – Carbozinc 859

Field Touch-Up: Prime Coat – Carboguard 890

2.1.5 Interior Concrete or Haydite Block Walls

2.1.5.1 Blome International / PPG Protective & Marine Coatings (as represented by Blome Int'l.)

Hole Repair: Repair Mortar – Blome 925

Field Coatings: Prime / Fill Coat – Amerlock 400 BF (Epoxy Block Filler)
First Coat – Aquapon WB Epoxy 98-1 Series (Waterborne Epoxy)
Second Coat (if required) – Aquapon WB Epoxy 98-1 Series (Waterborne Epoxy)

2.1.5.2 Carboline

Hole Repair: Repair Mortar – Carboguard 510

Field Coatings: Prime / Fill Coat – Sanitile 600 (Epoxy Block Filler)
First Coat – Sanitile 555 (Waterborne Epoxy)
Second Coat (if required) – Sanitile 555 (Waterborne Epoxy)

2.1.6 Interior Concrete or Haydite Block Walls – Chemical exposure areas

2.1.6.1 Blome International / PPG Protective & Marine Coatings (as represented by Blome Int'l.)

Hole Repair:	Repair Mortar	–	Blome 925
Field Coatings:	Prime / Fill Coat	–	Amerlock 400 BF (Epoxy Block Filler)
	First Coat	–	Aquapon WB Epoxy 98-1 Series (Waterborne Epoxy)
	Second Coat	–	Aquapon WB Epoxy 98-1 Series (Waterborne Epoxy)

2.1.6.2 Carboline

Hole Repair:	Repair Mortar	–	Carboguard 510
Field Coatings:	Prime / Fill Coat	–	Sanitile 600 (Epoxy Block Filler)
	First Coat	–	Sanitile 555 (Waterborne Epoxy)
	Second Coat	–	Sanitile 555 (Waterborne Epoxy)

2.1.7 Interior Structural Steel and Metal Wall Panels – Chemical exposure areas

2.1.7.1 Blome International / PPG Protective & Marine Coatings (as represented by Blome Int'l.)

Field Coatings:	Prime	–	Amerlock 2 / 400
	First Coat	–	Aquapon WB Epoxy 98-1 Series (Waterborne Epoxy)
	Second Coat	–	Aquapon WB Epoxy 98-1 Series (Waterborne Epoxy)

2.1.7.2 Carboline

Field Coatings:	Prime Coat	–	Carboguard 890
	First Coat	–	Sanitile 555 (Waterborne Epoxy)
	Second Coat	–	Sanitile 555 (Waterborne Epoxy)

2.1.8 Interior Metal Stud and Drywall Partition Walls – Chemical exposure areas

2.1.8.1 Blome International / PPG Protective & Marine Coatings (as represented by Blome Int'l.)

Field Coatings:	Prime Coat		
	-Metal Substrates	–	Pitt-Tech 90-712 Series
	-Previously Painted	–	Seal Grip 17-921 Series
	First Coat	–	Aquapon WB Epoxy 98-1 Series (Waterborne Epoxy)
	Second Coat	–	Aquapon WB Epoxy 98-1 Series (Waterborne Epoxy

2.1.8.2 Carboline

Field Coatings:	Prime Coat	–	Sanitile 120
	First Coat	–	Sanitile 555 (Waterborne Epoxy)
	Second Coat	–	Sanitile 555 (Waterborne Epoxy)

Substitutions: Owner will consider comparable products from the following manufacturers: Ameron, Tnemec and Sherwin Williams.

Contractor shall indicate weight of V.O.C. compounds per gallon as well as percent of zinc in dry film thickness on substitutions (any substitution should have a minimum of 80% zinc). Products must be V.O.C. compliant.

2.2 MATERIALS

2.2.1 Coatings: Ready mixed, except field catalyzed coatings. Ensure associated pigments and/or aggregate are free of clumps.

2.2.2 Coatings: Spray, squeegee, roller, trowel, and brush properties; capable of producing an installation meeting specification requirements.

2.2.3 Accessory Materials: Paint thinners and other materials not specifically indicated but required to achieve the finishes specified, of commercial quality.

2.3 FINISHES

2.3.1 Refer to schedule at end of Section for surface finish and color schedule.

PART 3 EXECUTION

3.1 INSPECTION

3.1.1 Thoroughly examine surfaces scheduled to be painted prior to commencement of work. Report in writing to Engineer any condition that may potentially affect proper application. Do not commence until such defects have been corrected.

3.1.2 Correct defects and deficiencies in surfaces which may adversely affect work of this Section.

3.1.3 Shop finish new structural steel, except around field welded connections.

3.1.4 Upon delivery of steel to the site, all surfaces shall be free of defects. Surfaces shall be inspected by the Construction Supervisor upon receipt and unloading. If defects are found, the Construction Supervisor shall determine the extent of the touch-up work will be done at Contractor's expense.

3.1.5 For field touch-up work Contractor shall notify the Construction Supervisor and allow him to inspect surfaces after cleaning and before primer or paint is applied.

3.2 PREPARATION FOR SHOP PAINTING

3.2.1 Correct minor defects and clean surfaces which affect work of this Section.

3.2.2 Remove grease, rust, scale, dirt and dust form steel and iron surfaces. Remove oil and grease with solvents, in compliance with Solvents, in compliance with SSPC-SP1-82, Solvent Cleaning. Prepare surfaces to be painted with a Commercial Blast SSPC-SP-10 achieving a 2 to 3 mil anchor profile, not to exceed 3.5 mils. Ensure steel surfaces are at the specified preparation level immediately prior to paint application.

3.3 PREPARATION FOR FIELD PAINTING

3.3.1 Correct minor defects and clean surfaces that affect work of this Section.

3.3.2 Remove grease, rust, scale, dirt and dust from steel and iron surfaces. Remove oil and grease with solvents, in compliance with SSPC-SP1-82, Solvent Cleaning. Prepare surfaces to be field painted to a hand or power tool cleaning in accordance with SSPC-SP-2 or 3. Feather edges to make touch-up patches inconspicuous. Ensure steel surfaces are at the specified preparation level immediately prior to paint application.

3.3.3 Remove electrical plates, hardware, light fixture trim and fittings prior to preparing surfaces or finishing.

3.3.4 Mask-off or shield all mill finish aluminum or items not to be painted.

3.3.5 Impervious Surfaces: Remove mildew by scrubbing with solution of tri-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.

3.3.6 Pervious (concrete or haydite block) Surfaces: Remove old paint and clean surface by 5000psi vacuum water blast method. Collect paint chips and blasting water for proper disposal. Coordinate disposal of existing lead based paints with the Plant EHS representative. Allow surface to dry. Fill holes with repair mortar prior to paint application.

3.4 PROTECTION

3.4.1 Protect elements surrounding the work of this Section from damage or disfiguration.

3.4.2 Repair damage to other surfaces caused by work of this Section.

3.4.3 Furnish drop cloths, shields, and protective methods to prevent spray or droppings from disfiguring other surfaces.

3.4.4 Remove empty paint containers from site.

3.5 APPLICATION

3.5.1 Apply products in accordance with manufacturer's instructions.

3.5.2 Do not apply finishes to surfaces that are not dry.

3.5.3 Apply each coat to uniform finish.

3.5.4 Apply each coat of paint slightly darker than preceding coat unless otherwise approved.

3.5.5 Allow applied coat to dry before next coat is applied.

3.5,6 Contractor shall notify Ameren Missouri one day prior to applying the primer and each coat of paint. Ameren Missouri shall have the Construction Supervisor and/or a Technical representative from the painting manufacture inspect the application of each coat of paint.

3.5.7 Sand down and repaint sags and other deficiencies.

3.5.8 Strictly observe materials stated pot life. Discard mixed materials beyond their pot life.

3.6 CLEANING

3.6.1 As work proceeds, promptly remove paint where spilled, splashed, or spattered.

3.6.2 During progress of Work maintain premises free of unnecessary accumulation of tools, equipment, surplus materials, and debris.

3.6.3 Collect cotton waste, cloths and material which may constitute a fire hazard, place in closed metal containers, and remove daily from site.

3.7 PAINT SCHEDULE

3.7.1 Shop paint structural steel and piping as follows:

AREAS & ITEMS TO BE PAINTED	PRIME COAT	FIRST COAT	FINISH COAT	COLOR
All new structural steel, including miscellaneous plates, angles, etc. and uninsulated piping. NOTE: All back-to-back angles shall be blasted and primed prior to fabrication and full primer application.	3-5 mils DFT	4-5 mils DFT (exterior only)	2-3 mils DFT (exterior only)	Medium Gray (Carboline C703) (PPG C703)
Two coat paint system on all new structural steel, including miscellaneous plates, angles, etc. and uninsulated piping. NOTE: All back-to-back angles shall be blasted and primed prior to fabrication and full primer application.	6-8 mils DFT	NONE	2-3 mils DFT (exterior only)	Medium Gray (Carboline C703) (PPG C703)
Grating, grip strut, checker plate (Galvanized)				
Ladders, handrails, bumper posts & toe plates	3-5 mils DFT	4-5 mils DFT	2-3 mils DFT (exterior only)	ANSI Safety Yellow (Carboline 6666) (PPG 6666)

3.7.2 Field touch-up paint structural steel and piping as follows:

AREAS & ITEMS TO BE PAINTED	PRIME COAT	FIRST COAT	FINISH COAT	COLOR
Touch-up for field welded connections and other damaged areas.	5 mils DFT	5 mils DFT	2-3 mils DFT (exterior only)	Match colors as applicable.

3.7.3 Field paint exterior structural steel and piping (existing, rusted) as follows:

AREAS & ITEMS TO BE PAINTED	PRIME COAT	FIRST COAT	FINISH COAT	COLOR
All existing exterior structural steel, including miscellaneous plates, angles, etc.	1.5 mils DFT	5 mils DFT	2-3 mils DFT or 3-5 mils DFT	Match colors as applicable.

3.7.4 Field paint interior concrete / haydite block as follows:

AREAS & ITEMS TO BE PAINTED	PRIME COAT	FIRST COAT	SECOND COAT	COLOR
All new and/or existing concrete or haydite block walls	20 mils DFT	3-4 mils DFT	3-4 mils DFT	As selected by Plant

3.7.5 Field paint interior concrete or haydite block walls – Chemical exposure areas as follows:

AREAS & ITEMS TO BE PAINTED	PRIME COAT	FIRST COAT	FINISH COAT	COLOR
All new or existing interior concrete or haydite block walls in chemical exposure areas	2 - 20 mils DFT	3 - 4 mils DFT	3 – 4 mils DFT	Match colors as applicable.

3.7.6 Field paint Interior structural steel and metal wall panels – Chemical exposure areas as follows:

AREAS & ITEMS TO BE PAINTED	PRIME COAT	FIRST COAT	SECOND COAT	COLOR
All new or existing interior structural steel or metal panel walls in chemical exposure areas.	4 – 6 mils DFT	3-4 mils DFT	3 - 4 mils DFT	As selected by Plant

3.7.7 Field paint Interior metal stud and drywall partition walls – Chemical exposure areas as follows:

AREAS & ITEMS TO BE PAINTED	PRIME COAT	FIRST COAT	SECOND COAT	COLOR
All new or existing interior metal stud and drywall partition walls in chemical exposure areas.	1 – 2 mils DFT	3-4 mils DFT	3 - 4 mils DFT	As selected by Plant

3.8 WARRANTY

3.8.1 Contractor shall warrant his work to be free from all defects in material and workmanship for a period of five years from the date of written acceptance by Ameren Missouri.

3.8.2 Warranty shall cover the prepared existing coatings and new coatings (i.e., from steel substrate out). Warranty shall be based on zero percent (0%) failure rate. Warranties based on percentage failure per year, or which are prorated or conditional warranties, shall be deemed unacceptable.

3.8.3 As a portion of the Contract covering the work of this specification, Contractor shall be responsible for correction of all coating's defects and failures. All repairs shall be scheduled and completed within four (4) months of written Contractor notification of required repairs.

3.8.4 All required repairs shall be in accordance with the provisions of the original coatings work.

PART 4 CLEAN-UP

4.1. All project and plant generated wastes/debris shall be and remain unmixed and separate.

4.2 Blast and coating residue shall be removed from the enclosure to the appropriate waste storage containers daily unless otherwise directed by the Construction Supervisor.

4.3 Provide prompt removal and proper disposal of all Contractor generated debris and trash as required, maximum weekly interval.

4.4 Remove all tools, surplus materials, equipment, scrap, debris, and waste from the plant site immediately upon completion of the project.

4.5 Blast wastes may remain on site until proper waste classifications is determined. Blast/paint residue shall be removed within one week of the receipt of analytical data.

4.6 Contractor generated solvent wastes and coatings application waste is the sole responsibility of Contractor. All such wastes shall be managed by Contractor in accordance with the appendix.

4.7 Correct and restore to original condition any property and equipment damaged as a result of project operations.

END OF SECTION 09900

SECTION 15455
API 650 WELDED STEEL STORAGE TANKS

1.0 GENERAL

1.1 Scope

1.1.1 This specification covers the materials, design, fabrication, field rection, and testing for vertical, cylindrical, aboveground, welded steel storage tanks in accordance with the requirements of API 650. Reference the API 650 Storage Tank Data Sheet(s) included in this section for details regarding the design of the tank(s).

This specification covers tanks fabricated from carbon steel and stainless steel. Stainless steel tanks shall follow the requirements defined in API 650, Annex S – Austenitic Stainless Steel Storage Tanks.

1.1.2 The Fabricator shall provide all design engineering, supervision, labor, materials, equipment, tools, lifting and rigging, scaffolding, and all incidental items necessary to design, fabricate, construct, install, commission, and test each portion and/or component of the Work described herein, unless otherwise specified.

1.2 Quality Assurance

1.2.1 Contractor's Quality Management Program shall include procedures identifying the quality requirements for the design, fabrication, and erection of welded steel storage tanks.

1.3 References

1.3.1 American Society of Mechanical Engineers (ASME)

1.3.1.1 ASME B16.5 – Pipe Flanges and Flanged Fittings

1.3.1.2 ASME B16.9 – Factory Made Wrought Steel Buttweld Fittings

1.3.1.3 ASME B16.11 – Forged Steel Fittings, Socket-Welding and Threaded

1.3.1.4 ASME B16.25 – Buttwelding Ends

1.3.1.5 ASME B31.1 – Power Piping

1.3.2 American Petroleum Institute (API)

1.3.2.1 API 605 – Large Diameter Carbon Steel Flanges

1.3.2.2 API 650 – Welded Steel Tanks for Oil Storage

1.3.2.3 API 653 – Tank Inspection, Repair, Alteration, and Reconstruction

1.3.3 ASTM International

1.3.3.1 ASTM A105/A105M - Standard Specification for Carbon Steel Forgings for Piping Applications.

1.3.3.2 ASTM A106/A106M - Standard Specification for Seamless Carbon Steel Pipe for High Temperature Service.

1.3.3.3 ASTM A193/A193M - Standard Specification for Alloy Steel and Stainless Steel Bolting Materials for High Temperature or High Pressure Service and Other Special Service Applications.

1.4 Submittals

The Fabricator shall submit all data and information as defined in Appendix S - Submittals of this Specification. The data and information shall include but is not limited to the following:

1.4.1 Design calculations.

1.4.2 Tank Drawings.

1.4.3 Certified Mill Test Reports (CMTRs).

1.4.4 Welding procedure specifications and associated procedure qualification records.

1.4.5 Welder/Welding operator performance qualifications. All welder certification records must include two photographs of the welder to whom they pertain.

1.4.6 NDE personnel certification records.

2.0 MATERIALS

2.1 General

2.1.1 Materials shall be as defined in the API 650 Storage Tank Data Sheet(s) included at the end of this Section or if the material for a component is not specifically defined the Fabricator shall submit their proposed materials for approval by the Owner.

2.1.2 If the material type is not specified by the Owner, the Fabricator shall select the material type based on the generic type (carbon steel, stainless steel, etc.) specified in the Data Sheet. This selection should be based on economics and delivery time and shall meet the requirements of API 650.

2.1.3 All material shall be new.

2.2 Stainless Steel Fabrication

2.2.1 Stainless steel is normally selected for corrosion resistance. The design, fabrication, and inspection methods of API 650 and the alternate methods described in their appendices shall be used for the design and construction of tanks constructed of type 304, 304L, 316, and 316L stainless steels.

2.2.2 The materials, design, fabrication, erection, and testing requirements for vertical, cylindrical, aboveground, welded, austenitic stainless steel storage tanks constructed of material grades 304, 304L, 316 and 316L shall be per API 650, Annex S – Austenitic Stainless Steel Tanks.

2.2.3 Unless the calculated hoop stress is less than 8,000 psi and except for type 304 SS, impact testing shall be included in the qualification of welding procedures for all stainless steel at design temperatures below -20° F (-30° C).

2.2.4 Internal supports shall be fabricated from stainless steel to match the shell material.

2.2.5 External appurtenances not required to be stainless steel for corrosion resistance shall be carbon steel to the extent that it is economical and practical.

2.2.6 Stainless steel internal surfaces shall be solvent washed to remove grease, oil, and other surface contaminants prior to and as part of the tank final closure preparations.

3.0 EXECUTION

3.1 General

3.1.1 This Section provides the Fabricator with information necessary to make design decisions not covered by API 650 and specifies the design responsibilities of the Fabricator in areas not covered by those standards.

3.1.2 This Section includes tanks constructed of carbon steel and stainless steel. Even though API 650 applies only to tanks made of carbon steels, it is recommended that the API 650, Annex S – Austenitic Stainless Steel Storage Tanks criteria be followed when applicable in the design and fabrication of stainless steel tanks.

3.1.3 Some items in the API 650 Storage Tank Data Sheet(s) may be left blank to be determined by the Fabricator. Items to be determined by the Fabricator and included in quotations/bid proposal are indicated by an asterisk (*).

3.2 Drawings

3.2.1 Vertical and horizontal reference centerlines shall be shown on the layout sketch or drawing for each tank. Plan view centerlines shall run north-south and east-west and shall be identified by angular dimensions (0°, 90°, 180°, 270°) proceeding clockwise from 0° at the north. Roof or top head nozzles and openings shall be dimensioned from these centerlines. Head nozzle extensions shall be dimensioned from the roof-to-shell junction, or to the tangent line of flanged and dished heads. Shell nozzles and openings shall be located by an angular dimension and a dimension from the bottom of the bottom plate at its periphery. Shell nozzle extensions shall be dimensioned radially from the outer surface of the tank shell.

True north may or may not align with "Plant" north. North will be indicated on the site drawings provided.

3.3 Shell Design

3.3.1 Shell Thickness (1-Foot Method)

The minimum thickness of the tank wall at any level shall be the greater of the following:

(1) 3/16 inch (4.8 mm) plus the corrosion allowance specified in the Tank Data Sheet(s).

(2) The calculated thickness per API 650, Paragraph 5.6.3.2, plus the corrosion allowance.

Specification of the width of the shell plates shall be determined by the Fabricator.

3.3.2 All vertical and horizontal shell joints shall be butt-welded with full penetration welds.

3.3.3 Wind loads and Seismic (Earthquake) Loads

Vertical cylindrical storage tanks shall be designed to resist local buckling of the shell due to wind and shall be anchored as required to withstand the overturning effect of wind loads. Wind load data shall be taken from the IBC 2015 / ASCE 7-10. The weight of the empty tank shall be used in computing the resistance to overturning.

The Fabricator shall design the tank using the seismic criteria as defined in the IBC 2015 / ASCE 7-10.

3.3.4 Intermediate Wind Girders

The design procedures of API 650 shall be used to calculate wind girder spacing and section moduli on all tanks.

3.3.5 Roof to Shell Detail

The preferred top angle arrangement is for the angle to be outside, with the vertical leg away from the shell, to form an insulation rain shield for possible future tank insulation. See API 650, Annex F, Figure F.2, Detail f (for non-frangible roof; use Detail b for frangible roof design). Reference the Tank Data Sheet(s) for information on the tank insulation system (if specified).

3.3.6 Bottom Design

The corrosion allowance for the bottom shall be the same as for the shell.

The baseplate extension for the tank shall be 1½" outside the tank shell or the thickness of the insulation (if specified), whichever is greater.

3.4 Roof Design

3.4.1 Roof Thickness

Roof plates shall have a minimum nominal thickness of 3/16 inch (5 mm) plus corrosion allowance or the calculated minimum thickness plus corrosion allowance, whichever is greater.

The corrosion allowance for the roof is specified separately from that for the shell and bottom. Reference the Tank Data Sheet(s) for information on the corrosion allowance.

3.4.2 Snow Loads and Roof Live Loads

The maximum snow load for design and any unusual live loads are indicated in the Tank Data Sheet(s). Roof design shall provide for personnel access to instruments and equipment. The minimum 25 lb/ft^2 (125 kg/m^2) live load required by API 650 is adequate for personnel access to instruments and equipment.

3.4.3 Weak-Seam (Frangible) Roof

The design of the weak-seam (frangible) roof shall be per API 650 Paragraph 5.10.2.6.

Ladders, stairs, and platforms shall be supported only from the shell if a frangible roof is specified. Vents, manways, and other nozzles shall be close to one edge and accessible from one platform. Walkways on the roof itself should be avoided. Fixed piping to and from the tank should connect to shell nozzles if possible. Connections to roof nozzles must not interfere with lifting the roof (threaded, Schedule 40 piping not over NPS 2 meets this requirement).

3.5 Structural Design for Internals

The corrosion allowance for the tank shall be applied to both sides of internal structural members.

3.6 Additional Design Loads

The loads described in the following paragraphs shall be considered by the Fabricator in the design of the tank.

3.6.1 Differential Thermal Expansion Tank Shell and Bottom

Thermal expansion shall be considered in the design of the tank bottom and shell when the design temperature is below 0°F (-18°C) and above 200°F (94°C). The maximum differential between ambient temperature and the design temperature shall be used in the calculations. The Fabricator shall check the specified fill and discharge rates against the tank design.

Tank internal thermal expansion shall be considered in the design of all internals.

3.6.2 Vibration Loading

Vibration of internals and of tank parts should be investigated and adequate supports furnished to keep stresses in the tank or internals below the endurance limits.

3.6.3 Superimposed Loads

When applicable the type and magnitude for the external load shall be furnished by the Owner. Supports for roof and shell mounted agitators and other equipment shall be designed by the Fabricator. Adequate reinforcing or supports shall be furnished for the tank roof and shell to keep the local membrane stress $\leq 1.5S_a$ and the local membrane plus bending stress $\leq 3S_a$.

S_a = Allowable stress specified by the applicable tank standard.

3.6.4 Miscellaneous Loading

Dam or compartment baffles shall be designed for a full head of liquid on one side.

3.6.5 Deflections

Deflections caused by loads specified in Paragraphs. 3.6.2, 3.6.3, and 3.6.4 shall be determined by the Fabricator and submitted to the Owner for evaluation.

3.7 Tank Weight

The empty and full weight of the tank shall be calculated by the Fabrication and indicated in quotations/proposals and shown on the drawings in order that adequate foundations and supports can be designed. The foundation design will be by others.

3.8 Hold Down Lugs

The Fabricator shall determine if hold down lugs are required to resist overturning due to wind loading, earthquake loading, or uplift due to overpressure. When tank hold down lugs are required, it shall be the Fabricator's responsibility to design them.

3.9 Nozzles and Connections

3.9.1 API 650 nozzle installation details shall be used unless otherwise specified.

3.9.2 All nozzle and manway neck welding to the vessel wall (and reinforcement pad, if used) shall be full penetration.

3.9.3 Flange stops shall be installed on all such nozzles used for piping connections where lap joint flanges are used/specified. Stops are used for spreading flanges for insertion of blinds, etc.

3.9.4 Reference the Tank Data Sheet(s) for a Tank Nozzle Schedule.

3.9.5 All manway covers shall be equipped with hinges or a davit.

3.9.6 Manway openings in the vertical plane (tank shell/wall) shall have hand grips inside the vessel, above the opening.

3.9.7 Manways shall be a minimum of 24-inch (600 mm) diameter.

3.9.8 Pairs of flange bolt holes of shell nozzles shall straddle the axial centerline. The centerline for head nozzles shall straddle a line parallel to the reference centerline shown on the drawing.

3.9.9 Where practical, nozzles shall extend far enough that flange bolts may be installed from the vessel side with clearance for insulation.

3.9.10 Flush type clean-out fitting (API 650 Figures 5.12 and 5.14), bottom draw-off connection, and/or draw-off sump (API Figure 5.21) shall be provided as indicated on the Tank Nozzle Schedule. Reference the Tank Nozzle Schedule for the number and type to be provided.

3.9.11 Threaded connections shall not be used in the tank shell. Threaded piping couplings larger than NPS 2 shall not be used in the tank roof.

3.9.12 The minimum size of a flanged nozzle is NPS-1. When used, the nozzle shall be Sch 80, the flange shall conform to ANSI B16.5 for class 150 steel flanges, and the nozzle extension shall be no more than 6 inches (150 mm).

3.9.13 Generally, the flange rating shall be the ANSI pressure class for the flange. On sizes NPS 24 and over, API 605 large diameter flanges are usually more economical than flanges made to B16.1 or MSS SP-44 dimensions. They should be used unless a valve is to be mounted on the flange. Since there is a choice of flange drillings above NPS 24, the Fabricator shall clearly indicate the drilling to be furnished.

3.9.14 Commercially available flanges and stub ends shall have the "stock" spiral serrated gasket surface. Any shop fabricated flange or stub end shall be provided with a gasket surface machined with a spiral serrated surface having a 250 rms surface roughness. Any radial tool marks, gouges, or scratches will be grounds for rejection.

3.9.15 The Fabricator shall provide bolting hardware for all connections where the Fabricator is supplying both mating parts (i.e., blind flanges, sight glasses, manways, hand-holes, dip pipes, instruments, etc.). All external bolting shall be ASTM A193 Gr. B7 (carbon steel) studs with heavy hex nuts, ASTM A194 Gr. 2H, for 150# class joint. Threads shall protrude from 1/8 inch to one stud diameter beyond nuts. All studs and nuts shall be coated with a fluorocarbon coating by Industrial Metal Finishing Co., Houston, TX (Coating IMF-3 or approved equal – color blue).

3.9.16 The Fabricator shall provide three service gaskets for all connections where the Fabricator is supplying both mating parts (i.e., blind flanges, sight glasses, manways, hand-holes, dip pipes, instruments, etc.). Reference the Storage Tank Data Sheet(s) for gasket material.

3.10 Ladders and Platforms and Other External Tank Attachments

3.10.1 The Fabricator shall furnish welded attachments as part of the tank construction. An ASME Code qualified welder shall make attachments to tanks. External attachments not exposed to the tank contents may be carbon steel except as directed by Table 3.10.1 – External Attachments.

Table 3.10.1 – External Attachments

Vessel Material	Permissible Attachments
Low Alloy Steel, t < ¼"	Same material as the tank, Low Alloy Rod
Low Alloy Steel, t ≥ ¼"	Carbon Steel
304, t ≥ ¼" 316, t ≥ ¼"	Carbon Steel, 308 SS Rod Carbon Steel, 308 SS Rod
304, t < ¼" 316, t < ¼"	SS, 308 SS Rod or ENiCrFe-2 or -3 SS, 308 SS Rod or ENiCrFe-2 or -3
304L and 316L, All values of t	SS, 308 SS Rod
304 and 316 Solution Heat Treated of Stress Relieved. All values of t	SS, 308 SS Rod

3.10.2 All ladders, stairs, and platforms shall be designed, fabricated, and installed by the Fabricator. If the tank is insulated ladders, stairs, and platforms shall be designed with "stand-offs" to allow for installation of the insulation system.

3.10.3 The Fuel Oil Storage Tanks and the Demin Water Storage Tank shall be provided with a spiral stairs/staircase on the exterior of the tank shell to provide access to a platform at the top of the tank and the tank penetrations on the roof. The Service / Fire Water Storage Tank may be provided with a ladder to access the tank roof.

3.10.4 Handrails with toe plates on the tank roof shall extend approximately six feet on each side of the ladder/platform exit. Reference Owner provided standards for design of the handrail system.

3.10.5 Two grounding clips shall be provided at locations around the tank perimeter (180° apart).

3.10.6 Anode clips (if required and indicated) shall be provided.

3.10.7 A scaffolding hitch shall be provided at the top, center of the roof. Reference API 650, Figure 5.22.

3.10.8 The tank shall be tagged with the manufacturer's standard stainless steel nameplate affixed to a "T"-shaped stainless steel bracket that allows the nameplate to extend 1 inch beyond the thickness of the insulation (if applicable). The nameplate shall be located near a shell/tank wall manway.

3.11 Foundations

3.11.1 The foundation is an integral part of the tank design. The foundation will be provided (designed and constructed) by others. The Tank Fabricator shall provide sufficient foundation loading information as required for the foundation design. Foundation embedments (anchor bolts) if required will be provided and installed by others (i.e., the foundation installation contractor).

3.12 Inspections and Testing

3.12.1 The Fabricator shall be responsible for all inspections and testing required for the tank(s).

3.12.2 The Owner reserves the right to observe all tests being performed. The Fabricator shall notify Owner of all scheduled tests not less than 5 working days prior to the date of test.

3.12.3 The Owner's Weld Inspector reserves the right to inspect all welds for cracks, arc, strikes, excessive undercuts, surface porosity, incomplete fusion, and other defects.

3.12.4 Certified copies of inspection and test reports shall be provided by the Fabricator for all tests and inspections. One (1) copy of each report shall be submitted to the SPOC within one (1) week after completion of each such test or inspection. Electronic submission of the test reports is acceptable.

3.12.5 The preferred method of testing the tank shell is by hydrostatic test in which the tank is filled with water per API 650, Paragraph 7.3.6 and Annex F, Paragraph 4.4 for a tank with a gas-tight roof.

3.12.6 All roof welds shall be tested using soap suds for the detection of leaks while air pressure is being applied to the tank during the hydrostatic test according to API 650, Paragraph 7.3.6 and Annex F, Paragraph F.4.4.

3.12.7 The tank bottom seams shall be vacuum box tested; per API 650 Paragraphs 7.3.3, 7.3.4, and 8.6.

3.12.8 All leak testing shall be performed prior to the application of any internal or external coating or lining system and prior to the installation of the insulation system if specified.

3.12.9 All tanks shall have spot radiography as a minimum quality control measure. Radiographic examination requirements are defined in API 650 Paragraph 8.1.

3.13 Coatings and Linings

3.13.1 Refer to Section 09900 – Painting for requirements of coating systems.

3.13.2 The exterior surfaces of carbon steel tanks (side walls and roof) shall be provided with a 3-coat paint system per Paragraphs 2.1.1.1 or 2.1.1.2 of Section 09900 – Painting. Exterior insulated surfaces do not require a paint system.

3.13.2.1 The tank exterior color shall be white.

3.13.2.2 Handrails, ladders, and ladder safety cages shall be painted safety yellow.

3.13.2.3 Alternatively, handrails, ladders, and ladder safety cages may be hot-dip galvanized. No final color coat is required for galvanized surfaces.

3.13.3 The interior roof surface of carbon steel tanks shall be coated with an organic zinc-rich epoxy prime coat only.

3.13.3.1 The prime coat shall be per Paragraphs 2.1.1.1 or 2.1.1.3 of Section 09900 – Painting.

3.13.4 The interior surfaces of carbon steel tanks (side walls and floor) shall be provided with a novolac phenolic epoxy coating system. Follow all coating system manufacturers instructions for the application of their product. The acceptable coating systems are:

3.13.4.1 Phenoline® Tank Shield by Carboline.

3.13.4.2 Novaguard™ 840 by PPG.

3.13.5 Interior lining systems shall be holiday spark tested.

3.13.6 Stainless steel tanks do not require an exterior coating system or an interior lining system.

3.13.6.1 The interior (wetted surfaces) of stainless steel tanks shall be solvent washed to remove grease, oil, and other surface contamination.

3.14 Tank Insulation System (if required/specified)

3.14.1 The insulation system shall be a water-tight standing seam insulation system that utilizes prefabricated thermal insulation panels with metallic jacketing (22 gauge) and stainless steel hardware. The insulation shall cover the full surface of the tank shell and roof, except as defined in Paragraph 3.14.5 below.

3.14.2 The thermal insulation material shall be polyisocyanurate.

3.14.3 Insulation support rings, studs, and clips shall be installed as required for the insulation system.

3.14.4 Insulation shall be installed per manufacturer's instructions. Fasteners shall use neoprene washers. Panels shall be sealed with non-shrink, paintable sealing caulk between panels.

3.14.5 The insulation system shall be installed so as to not cover the bottom 6" of the tank shell/wall to allow for visual inspection of the tank bottom-to-wall weld seam. This exposed section of the tank shell/wall shall be painted as defined in Paragraph 3.13.2 above.

3.15 Tank Heating System (if required/specified) (Quote as an Option, Reference Appendix P)

3.15.1 Fabricator shall be responsible for furnishing, designing, and installing an electric heater system to maintain a tank contents minimum temperature at the site minimum temperature and wind speed as specified herein (see Table 3.15.6). The system shall be optimized to minimize the required power consumption.

3.15.2 The heater(s) shall be a calrod immersion type.

3.15.3 The heater elements shall have Inconel sheaths and shall be equipped with corrosion-resistant metallic NEMA-4 terminal boxes. Each heater shall be supplied with an overheat thermocouple. The Heater Supplier shall also supply an overheat temperature controller which will convert the thermocouple output signal to an output contact (normally closed, open on increasing temperature) that will prevent damage by high heater-sheath temperatures. The thermocouple leads shall be of sufficient length to reach the overheat temperature controller. The output contacts will be wired (by others) to deenergize the heaters.

3.15.4 The tank heating system shall be furnished with a temperature controller for the heater(s), which shall be activated by a sensing bulb to be located in a thermowell (location and type to be determined by Fabricator so that optimum tank heater control characteristics are obtained). The overheat temperature controller and the temperature controller shall be mounted by the Fabricator on the tank near the heaters in a corrosion-resistant metallic NEMA-4 enclosure.

3.15.5 The heater control cabinet shall be provided with a local disconnect switch.

3.15.6 The heater(s) shall be located near the bottom of the tanks, equally spaced around the tank perimeter, and installed by the Fabricator through the sides of the tanks with necessary provisions so that elements are accessible and removable without draining the tanks (dry-well) and so that the maximum allowable sheath temperatures are not exceeded. The Fabricator shall furnish auxiliary contacts to actuate Owner's low-temperature alarms.

Table 3.15.6 – Tank Heater Requirements

Service Conditions				Units
Minimum Ambient Design Temperature:		-20		°F
Design Windspeed at Minimum Temperature:		2		MPH
Fuel Oil Tank Content Design (Maintain) Temperature:		50		°F
Water Tank Content Design (Maintain) Temperature:		41 **		°F
Heater Power Supply:		480 V, 3 Ph, 60 Hz		
Heater Information	**Fuel Oil**	**Demin****	**Fire**	
Number of Heaters Required:	*	*	*	
Heater Insertion Flange Size:	*	*	*	
Heater Immersion/Insertion Length:	*	*	*	Inches
Heater Power Density:	*	*	*	W / in^2
Heater Power Needs per Heater:	*	*	*	Kw

* Indicates information to be provided/confirmed by the Tank Fabricator. Provide indicated information with the quote.
** The heater(s) in the Demin Water Storage Tank shall be for freeze protection; water will be recirculated in this tank during cold weather operation.

3.16 Tank Cleaning and Final Closure

3.16.1 The Tank Fabricator shall comply with the Owner's Foreign Material Exclusion requirements as defined in Paragraph 2 of Appendix F – Piping, Welding, NDE and Excavation Requirements.

3.16.2 The Owner shall be notified 2 working days prior to final closure of the tank to allow for a final inspection of the interior cleanliness of the tank.

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API 650 STORAGE TANK
DATA SHEET

DESCRIPTION:						
Owner:	Ameren Missouri					
Erection Site:	Castle Bluff Energy Center 8200 Fine Road St. Louis, MO 63129					
Equipment Name:	Combustion Turbine Fuel Oil Storage Tank					
Application:	Fuel Oil Storage					
Fluid/Product Stored:	Ultra Low Sulfur Diesel Fuel					
Number Required:	2					
SERVICE CONDITIONS:						
Ambient Design Temperature:	Max:	125	°F	Min:	-20	°F
Process Design Temperature:	Max:	100	°F	Min:	30	°F
Pumping Rate:	In:	1,200	GPM	Out:	1,020	GPM
Tank Pressure Internal:	Design:	0	" H_2O	Operating:	0	" H_2O
Tank Pressure External:	Design:	0	" H_2O	Operating:	0	" H_2O
Density of Contents:	Design:	1.0	S.G.	Operating:	0.865	S.G.
Environmental Effects:						
Wind Load:	Velocity:	120	mph			
Precipitation:	Maximum Rainfall:	5.8	Inches / 24-hour			
	Total Snow Accumulation:	20	Pounds / ft^2			
Seismic Design:	Seismic Use Group (SUG):	I	Importance Factor:	1.25		
Per API-650, Annex E	Site Class:	E	Seismic Design Category:	D		
TANK DESIGN / CONSTRUCTION:						
Volume:	Working Volume:	2,300,000	Gallons			
	Free Board:	*	Gallons			
	Total Volume:	*	Gallons			
Tank Size:	Outside Diameter:	*	Feet			
	Straight Side Length:	*	Feet			
Corrosion Allowance:	Shell:	None	Inches	Roof:	None	Inches
	Bottom:	None	Inches	Structural:	None	Inches
Materials of Construction:	Shell:	ASTM A-36				
	Bottom:	ASTM A-36				
	Roof:	ASTM A-36				
	Bolting:	ASTM A193 Gr. B7 (carbon steel) studs with heavy hex nuts, ASTM A194 Gr. 2H, for 150# class with fluorocarbon coating				
	Gaskets:	ASME B16.21, Class 150, 1/16-inch-thick reinforced PTFE, Garlock Gylon Fawn (Style 3500)				
Number of Shell Courses:						
Course Height and Thickness (Including CA)	1.	*	2.	*		
	3.	*	4.	*		
	5.	*	6.	*		

Tank Bottom:					
Plate Thickness:	*	Inches		Joints:	Lap
Slope:	1" : 10'	Inches : Foot		From Center	
Foundation Type:	Concrete				
Tank Roof:	Type:	Supported Cone			
	Slope or Radius:	1" : 10"	Inches : Inches		
	Plate Thickness:	*	Inches		
	Roof Joint Type:	Butt			
	Frangible Roof Joint:	Yes			
Paint/Coating/Liner:	Reference Section 09900 – Paragraph 2.1.1 (3-coat system) for exterior coaring.				
Shell:	Exterior:	No		Interior:	Yes
Bottom:	Underside:	No		Interior:	Yes
Roof:	Exterior:	Yes		Interior:	Yes
Structural Steel:	Exterior:	Yes		Interior:	Yes
Insulation:	Shell:	2" thick polyisocyanurate panel system			
	Roof:	None			
Weld Examination:	Radiography:	Spot			
	Other:	Visual			
Leak Testing:	Shell:	Hydrotest			
	Bottom:	Vacuum Box Testing			
	Roof:	Soap bubble air test			

NOZZLE SCHEDULE:

Mark	Size	Flange Type / Rating	Location	Function
A	8"	150# - RFWN	Shell	Tank Inlet w/ Internal Dip Pipe
B	8"	150# - RFWN	Shell	Tank Outlet w/ Internal Floating Suction Line (See Note 6)
C	4"	150# - RFWN	Shell	Water Draw Off w/ Draw-Off Sump
D	4"	150# - RFWN	Shell	Level Switch / Level Transmitter
E	4"	150# - RFWN	Shell	Recirculation Inlet w/ Internal Dip Pipe
F	4"	150# - RFWN	Shell	Spare w/ Blind Flange
G	1"	NPT	Roof	Level Gauge (See Note 3)
H	8"	150# - RFWN	Roof	Vent (See Note 5)
J	8"	150# - RFWN	Shell	Tank Overflow w/ External Pipe to Berm Area
K	4"	150# - RFWN	Roof	Guage Hatch w/ Cover (See Note 4)
M1	30"	Paragraph 3.9.13	Shell	Shell Manway
M2	30"	Paragraph 3.9.13	Shell	Shell Manway
M3	24"	Paragraph 3.9.13	Roof	Roof Manway
N	24" x 12"	See Note 2	Shell	Flush-Type Shell Cleanout Opening, 2 Required

NOTES:

1. * Indicates information that shall be supplied and/or verified by the Fabricator.
2. Provide flush-type shell connections per API-650, Paragraph 5.7.7 and Figure 5.12.
3. Tank Fabricator to provide liquid level indicator (Shand & Jurs Model 92303 or approved equal).
4. Tank Fabricator to provide gauge hatch (Shand & Jurs Model 95014 or approved equal).
5. Tank Fabricator to provide vent cover (Shand & Jurs Model 94241 or approved equal).
6. Tank Fabrication to provide a floating suction assembly by OPW Engineered Systems or approved equal.
7. Reference Sketch CB-SPEC-000005-01 for tank layout.

API 650 STORAGE TANK
DATA SHEET

DESCRIPTION:						
Owner:	Ameren Missouri					
Erection Site:	Castle Bluff Energy Center 8200 Fine Road St. Louis, MO 63129					
Equipment Name:	Demin Water Storage Tank					
Application:	Demineralized Water Storage					
Fluid/Product Stored:	Demineralized Water					
Number Required:	1					
SERVICE CONDITIONS:						
Ambient Design Temperature:	Max:	125	°F	Min:	-20	°F
Process Design Temperature:	Max:	100	°F	Min:	32	°F
Pumping Rate:	In:	600	GPM	Out:	1,000	GPM
Tank Pressure Internal:	Design:	0	" H_2O	Operating:	0	" H_2O
Tank Pressure External:	Design:	0	" H_2O	Operating:	0	" H_2O
Density of Contents:	Design:	1	S.G.	Operating:	1	S.G.
Environmental Effects:						
Wind Load:	Velocity:	120	mph			
Precipitation:	Maximum Rainfall:	5.8	Inches / 24-hour			
	Total Snow Accumulation:	20	Pounds / ft^2			
Seismic Design:	Seismic Use Group (SUG):	I	Importance Factor:	1.25		
Per API-650, Annex E	Site Class:	E	Seismic Design Category:	D		
TANK DESIGN / CONSTRUCTION:						
Volume:	Working Volume:	2,300,000	Gallons			
	Free Board:	*	Gallons			
	Total Volume:	*	Gallons			
Tank Size:	Outside Diameter:	*	Feet			
	Straight Side Length:	*	Feet			
Corrosion Allowance:	Shell:	None	Inches	Roof:	None	Inches
	Bottom:	None	Inches	Structural:	None	Inches
Materials of Construction:	Shell:	ASTM A240-304L				
	Bottom:	ASTM A240-304L				
	Roof:	ASTM A240-304L				
	Bolting:	ASTM A193 Gr. B7 (carbon steel) studs with heavy hex nuts, ASTM A194 Gr. 2H, for 150# class with fluorocarbon coating				
	Gaskets:	ASME B16.21, Class 150, 1/16-inch-thick reinforced PTFE, Garlock Gylon Fawn (Style 3500)				
Number of Shell Courses:						
Course Height and Thickness (Including CA)	1.	*	2.	*		
	3.	*	4.	*		
	5.	*	6.	*		

Tank Bottom:				
Plate Thickness:	*	Inches	Joints:	Lap
Slope:	1" : 10'	Inches : Foot	From Center	
Foundation Type:	Concrete			
Tank Roof:	Type:	Self-Supporting Umbrella		
	Slope or Radius:	*	Feet	
	Plate Thickness:	*	Inches	
	Roof Joint Type:	Butt		
	Frangible Roof Joint:	No		
Paint/Coating/Liner:	Stainless steel tanks do not require a coating system.			
Shell:	Exterior:	None	Interior:	None
Bottom:	Underside:	None	Interior:	None
Roof:	Exterior:	None	Interior:	None
Structural Steel:	Exterior:	Yes	Interior:	None
Insulation:	Shell:	None		
	Roof:	None		
Weld Examination:	Radiography:	Spot		
	Other:	Liquid Penetrant and Visual		
Leak Testing:	Shell:	Hydrotest		
	Bottom:	Vacuum Box Testing		
	Roof:	Soap bubble air test		

NOZZLE SCHEDULE:

Mark	Size	Flange Type / Rating	Location	Function
A	6"	150# - RFSO	Shell	Water Inlet w/ Internal Dip Pipe
B	8"	150# - RFSO	Shell	Tank Outlet / Pump Suction (See Note 7)
C				Not used
D	4"	150# - RFSO	Shell	Level Switch / Level Transmitter (See Note 7)
E	4"	150# - RFSO	Shell	Water Recirculation w/ Internal Dip Pipe
F	4"	150# - RFSO	Shell	Spare w/ Blind (See Note 7)
G	1"	NPT	Roof	Level Gauge (See Note 3)
H	8"	150# - RFSO	Roof	Vent (See Note 5)
J	6"	150# - RFSO	Shell	Tank Overflow w/ External Pipe
K	4"	150# - RFSO	Roof	Guage Hatch w/ Cover (See Note 4)
M1	30"	Paragraph 3.9.13	Shell	Shell Manway
M2	30"	Paragraph 3.9.13	Shell	Shell Manway
M3	24"	Paragraph 3.9.13	Roof	Roof Manway
N	8"	See Note 2	Shell	Flush-Type Shell Connection/Drain, 1 Required

NOTES:

1. * Indicates information that shall be supplied and/or verified by the Fabricator.
2. Provide flush-type shell connections per API-650, Paragraph 5.7.8 and Figure 5.14.
3. Tank Fabricator to provide liquid level indicator (Shand & Jurs Model 92302 or approved equal).
4. Tank Fabricator to provide gauge hatch (Shand & Jurs Model 95014 or approved equal).
5. Tank Fabricator to provide vent cover (Shand & Jurs Model 94241 or approved equal).
6. Reference Sketch CB-SPEC-000005-02 for tank layout.
7. Nozzle shall extend into the shell 6".

STORAGE TANK
DATA SHEET

DESCRIPTION:						
Owner:	Ameren Missouri					
Erection Site:	Castle Bluff Energy Center 8200 Fine Road St. Louis, MO 63129					
Equipment Name:	Service / Fire Water Storage Tank					
Application:	Water Storage					
Fluid/Product Stored:	Water (from potable water source)					
Number Required:	1					
SERVICE CONDITIONS:						
Ambient Design Temperature:	Max:	125	°F	Min:	-20	°F
Process Design Temperature:	Max:	100	°F	Min:	40	°F
Pumping Rate:	In:	600	GPM	Out:	1,700	GPM
Tank Pressure Internal:	Design:	0	" H_2O	Operating:	0	" H_2O
Tank Pressure External:	Design:	0	" H_2O	Operating:	0	" H_2O
Density of Contents:	Design:	1.0	S.G.	Operating:	1.0	S.G.
Environmental Effects:						
Wind Load:	Velocity:	120	mph			
Precipitation:	Maximum Rainfall:	5.8	Inches / 24-hour			
	Total Snow Accumulation:	20	Pounds / ft^2			
Seismic Design:	Seismic Use Group (SUG):	I	Importance Factor:	1.25		
Per API-650, Annex E	Site Class:	E	Seismic Design Category:	D		
TANK DESIGN / CONSTRUCTION:						
Volume:	Working Volume:	???	Gallons			
	Free Board:	*	Gallons			
	Total Volume:	*	Gallons			
Tank Size:	Outside Diameter:	*	Feet			
	Straight Side Length:	*	Feet			
Corrosion Allowance:	Shell:	None	Inches	Roof:	None	Inches
	Bottom:	None	Inches	Structural:	None	Inches
Materials of Construction:	Shell:	ASTM A-36				
	Bottom:	ASTM A-36				
	Roof:	ASTM A-36				
	Bolting:	ASTM A193 Gr. B7 (carbon steel) studs with heavy hex nuts, ASTM A194 Gr. 2H, for 150# class with fluorocarbon coating				
	Gaskets:	ASME B16.21, Class 150, 1/16-inch-thick reinforced PTFE, Garlock Gylon Fawn (Style 3500)				
Number of Shell Courses:	Design Per AWWA D100 and NFPA 22					
Course Height and Thickness (Including CA)	1.	*	2.	*		
	3.	*	4.	*		
	5.	*	6.	*		

Tank Bottom:					
Plate Thickness:	*	Inches		Joints:	Lap
Slope:	1" : 10'	Inches : Foot		From Center	
Foundation Type:	Concrete				
Tank Roof:	Type:	Self-Supporting Umbrella			
	Slope or Radius:	*	Inches : Inches		
	Plate Thickness:	*	Inches		
	Roof Joint Type:	Butt			
	Frangible Roof Joint:	No			
Paint/Coating/Liner:	Reference Section 09900 – Paragraph 2.1.1 (3-coat system) for exterior coating.				
Shell:	Exterior:	No		Interior:	??
Bottom:	Underside:	No		Interior:	??
Roof:	Exterior:	Yes		Interior:	??
Structural Steel:	Exterior:	Yes		Interior:	Yes
Insulation:	Shell:	2" thick polyisocyanurate panel system			
	Roof:	None			
Weld Examination:	Radiography:	Spot			
	Other:	Visual			
Leak Testing:	Shell:	Hydrotest			
	Bottom:	Vacuum Box Testing			
	Roof:	Soap bubble air test			

NOZZLE SCHEDULE:

Mark	Size	Flange Type / Rating	Location	Function
A	6"	150# - RFSO	Shell	Tank Inlet w/ Internal Dip Pipe
B	10"	150# - RFSO	Shell	Fire Water Outlet
C	4"	150# - RFSO	Shell	Service Water Outlet w/ Internal Standpipe
D	4"	150# - RFSO	Shell	Level Switch / Level Transmitter
E	4"	150# - RFSO	Shell	Recirculation Inlet w/ Internal Dip Pipe
F	4"	150# - RFSO	Shell	Spare w/ Blind Flange
G	1"	NPT	Roof	Level Gauge (See Note 3)
H	8"	150# - RFSO	Roof	Vent (See Note 5)
J	8"	150# - RFSO	Shell	Tank Overflow w/ External Pipe
K	4"	150# - RFSO	Roof	Guage Hatch w/ Cover (See Note 4)
L	4"	150# - RFSO	Roof	Spare w/ Blind Flange
M1	30"	Paragraph 3.9.13	Shell	Shell Manway
M2	30"	Paragraph 3.9.13	Shell	Shell Manway
M3	24"	Paragraph 3.9.13	Roof	Roof Manway
N	8"	See Note 2	Shell	Flush-Type Shell Cleanout Opening, 1 Required

NOTES:

1. * Indicates information that shall be supplied and/or verified by the Fabricator.
2. Provide flush-type shell connections per API-650, Paragraph 5.7.8 and Figure 5.14.
3. Tank Fabricator to provide liquid level indicator (Shand & Jurs Model 92303 or approved equal).
4. Tank Fabricator to provide gauge hatch (Shand & Jurs Model 95014 or approved equal).
5. Tank Fabricator to provide vent cover (Shand & Jurs Model 94241 or approved equal).
6. Reference Sketch CB-SPEC-000005-03 for tank layout.

APPENDIX A
DEFINED TERMS

1.1. ARO means after receipt of order.

1.2. Asbestos Containing Material (ACM) means material that contains asbestos in concentration greater than 1% and must be handled according to Owner procedures and federal and state regulations.

1.3. Barricade means a physical obstruction such as barricade tape, chains, cones, concrete barriers, fencing, or "A" frame type wood and/or metal structures intended to warn and limit access to a work area. Barricade tape alone cannot be used to protect certain hazards such as unattended floor openings or fall hazards.

1.4. Change Order (CO) is defined in the Terms and Conditions.

1.5. Chemicals of Interest (COI) is defined in Appendix G, Paragraph 2.0

1.6. Clearance means the assurance to Holder that the system or equipment for which it is issued has been properly isolated from its normal energy sources (including any emergency back-up energy source(s) and will remain isolated as long as Clearance is in effect.

1.7. CMTR means Certified Material Test Report.

1.8. Competent Person means an individual engaged by Contractor who is trained and certified in applicable standards, is capable of identifying workplace hazards relating to specific operations, performs inspections of industrial and construction jobsite equipment, and has authority to take corrective actions when needed.

1.9. Computer Based Training (CBT) Computer Based Training is used for safety and job work rules orientation of new personnel before they are permitted unescorted access to Owner property.

1.10. Confined Space means an enclosed area that is not normally designed or intended for human occupancy, has a restricted entrance or exit by way of location or size, and can represent a risk for the health and safety of anyone who enters, due to atmospheric, engulfment, entrapment, mechanical, electrical, or any other recognized hazard. See OSHA 29CFR1910.146 and Power Operations Administrative Procedure AUE-ADM-2415.

1.11. Contract means collectively the Purchase Order to which this Specification is attached or incorporated, the Terms and Conditions, and the other Contract Documents (defined in the Contract).

1.12. ~~Contractor Cost Tracking Module (CCTM) means the system more particularly described in the "Ameren Supplier Billing Instructions" attached to or referenced in the Contract, and provides select contractors with the ability to maintain electronic rate cards with negotiated labor/equipment rates and submit timecards electronically detailing charges for labor, equipment, material and expenses~~. (Not used.)

1.13. Corporate Safety Department means Owner's Corporate Safety Department which sets standards for safety and health issues and monitors compliance with Owner's policies, as well as with federal, state and local regulations.

1.14. Critical Lifts is defined in Appendix B, Paragraph 7.3.

1.15. Critical Path is defined in Attachment D.1.2.

1.16. Custody Authority is defined in Appendix B, Attachment B.4.3.

1.17. Day is defined as a business day or working day.

1.18. Energy Center is defined in Division 1, Paragraph 1.1.

1.19. Equipment means the Materials apparatus, equipment, and machinery to be provided by Contractor as part of the Work and that become a permanent part of the Energy Center.

1.20. Extra Work shall be considered synonymous and refer to a Change Order.

1.21. Foreign Material Exclusion (FME) means the practice of preventing the contamination of components in energy center systems.

1.22. Functional Authority is defined in Appendix B Attachment B.4.3.

1.23. GASLC means Owner's Generation Approved Supplier List-Critical.

1.24. Hold Off Tag is defined in Appendix B, Attachment B.4.1, Paragraphs 2.2 and 2.3.

1.25. Holder means the individual signed on to a WPA tag.

1.26. Hot Work means work that will generate sparks, such as; cutting, grinding, welding, and brazing. A permit may be required for Hot Work that is hazardous due to location or other factors.

1.27. Incident/Accident means an incident is defined as a near miss, vehicle accident, or property damage to Owner-owned/leased equipment or facilities. Refer to OSHA 29CFR1904 for definitions of reportable incidents and injuries.

1.28. Job Working Rules means the rules of conduct for work performed at Owner facilities which are various types of prohibited behavior, off-limit areas, driving and parking instructions, and site safety information.

1.29. JR means Job Request.

1.30. Jurisdictional Authority is defined in Appendix B, Attachment B.4.3.

1.31. Key Personnel means the Contractor personnel identified in the organizational chart submitted with the Bid.

1.32. Law means or Laws means: (1) all applicable federal, state, and local laws, treaties, ordinances, codes, rules and regulations, judgments, decrees, injunctions, writs and orders of any court, arbitrator or governmental agency or authority; and (2) all applicable and generally recognized building and safety standards governing performance of the Work.

1.33. Level 2 Project Schedule is defined in Appendix D, Attachment D.1.1.

1.34. Level 3 Project Schedule is defined in Appendix D, Attachment D.1.1.

1.35. Local Control is defined in Appendix B, Attachment B.4.1, Paragraph 2.4.3.

1.36. Material means the supplies, goods, items, and materials to be provided by Contractor and consumed, used or incorporated in connection with or as a part of the Work.

1.37. Must Fix Guarantee is defined in Paragraph 1.4.1 of Section 1A, warranty items.

1.38. National Maintenance Agreement (NMA) is defined in Appendix C, Paragraph 2.1.

1.39. OSHA is defined as the Occupational Safety and Health Administration.

1.40. Operating Supervisor means the Owner's supervisor with control authority at the Site at the relevant time.

1.41. Owner means Union Electric Company, d/b/a Ameren Missouri.

1.42. Owner's Security is defined in Appendix C, Paragraph 1.0.

1.43. Out of Service means equipment under a Hold-Off Tag which is isolated from all normal sources and emergency back-up energy sources.

1.44. P&ID means piping and instrumentation diagram.

1.45. Privileged Users is defined in Appendix C, Paragraph 1.5.1.

1.46. Professional Engineer means the applicable professional engineer or structural engineer licensed in the State in which the Work is performed and qualified to seal and/or sign documents to the extent required by Law.

1.47. Project means the project identified on the cover page.

1.48. Project Execution Plan is defined in Appendix D, Attachment D.1.1.

1.49. Project Manager is the individual Contractor identifies to provide a full-time onsite management of the Work on behalf of the Contractor.

1.50. PPE means personal protective equipment.

1.51. Quality Management Plan or QMP – A document that applies Contractor's Quality Program to the Project. The QMP describes the quality standards, practices, resources, specifications, sequence of activities, and method of measurement particular to the Project.

1.52. Quality Program – means a coordinated, comprehensive, and systematic set of processes, procedures, instructions, and records designed to achieve work of the highest quality effectively and efficiently and to control, test and correct quality defects.

1.53. QMS means Owner's Quality Management System.

1.54. Professional Engineer (PE) means a duly licensed and skilled engineer engaged by Contractor for the Project.

1.55. Project Schedule means the schedule mutually approved by Owner and Contractor which delineates the dates by which the Work will be performed, as further described in Appendix D, together with all amendments thereto approved in writing by the Owner, if applicable.

1.56. Restraint is issued on a Functional Authority's Hold Off, and means an assurance given by the Functional Authority to the person to whom it is issued that the equipment it covers has been properly isolated from its energy sources and that normal voltage will not be applied while the Restraint is in effect.

1.57. Rules to Live By (RTLB) is defined in Appendix B, Paragraph 3.0.

1.58. RWP (Recommended Welding Practices) is defined in Appendix F, Attachment F.1.3.

1.59. Safety Data Sheet (SDS) means the sheets referenced in Appendix G, Paragraph 2.0.

1.60. Safety Director means the individual identified by Contractor as its Project director of safety, as further described in Appendix B, Paragraph 2.0.

1.61. Single Point of Contact (SPOC) is the individual identified by Owner as such, who is Owner's representative for the Project to act on behalf of Owner and with whom Contractor may consult.

1.62. Site means the Owner site on which the Work shall be performed.

1.63. Site Specific Safety Plan (SSSP) is the safety plan to be completed by Contractor in the form attached hereto as Attachment B.1.1 in Appendix B.

1.64. Specification means these Construction Specifications for the Project.

1.65. Terms and Conditions means the contract terms and conditions (which may be Owner's General Conditions of Contract or other legal agreement) which form a part of the Contract Documents, and which incorporate these Specifications.

1.66. Work is defined as all the services, labor, Materials and Equipment to be provided by Contractor for the Project.

1.67. Worker's Hold Off Tag is defined in Appendix B, Attachment B.4.1.

1.68. Worker's Protection Assurance (WPA) or Hold Card Procedure means Owner's equipment lock-out procedure that ensures equipment and systems are in a safe state prior to service or testing. WPA is the process used by Owner to ensure the safety of those who work on generation, transmission and substation equipment, and the procedure to tag equipment or systems that have been de energized or put in a specified state to allow for service or testing. The energy in a system may be electrical, mechanical, pneumatic, hydraulic, chemical, kinetic, or nuclear.

END OF APPENDIX A

APPENDIX B
SAFETY REQUIREMENTS

1.0 SITE-SPECIFIC SAFETY PLAN

The Contractor shall complete the Site-Specific Safety Plan attached as Attachment B.1.1. The Contractor is responsible for the safety of its personnel. The Owner reserves the right to bar any individual from the Site or its property.

2.0 SAFETY DIRECTOR

Contractor shall have a full-time corporate Safety Director who oversees and maintains the Contractor's safety program and a Site safety representative, unless waived in writing by Owner. This person must also be available for safety-related questions and concerns. A full-time corporate safety representative must also be onsite for each shift for the entire duration of the Project. The cost for the safety representative shall be broken out in the bids. Resumés of the safety representative who will be associated with the project must be submitted with the bid. Owner reserves the right to request the safety representative be removed from the project and be replaced with a more competent individual if they are not fulfilling expectations.

3.0 RULES TO LIVE BY ("RTLB")

3.1 Rules to Live By (RTLB) are activities that have the potential to produce a fatality or serious injury. The items listed below are so significant that a single violation warrants immediate intervention by the Contractor. Actions determined to be in violation of these RTLB may result in permanent barring from all Owner facilities. Owner may conduct an independent investigation as necessary.

- Fall Protection – Failure to use proper fall protection when there is a risk of a fall that is greater than 6 feet
- WPA (Lock Out / Tag Out) – Violation of a tag, lock or tag-out device that is used for personnel and contractor protection.
- Electrical Safety – Failure to follow proper procedures and wear proper personal protective equipment when working on energized equipment.
- Confined Space Entry – Failure to evaluate confined space and perform air monitoring checks prior to entry.
- Rigging / Hoisting – Walking or working under a suspended load.
- Trenching and Shoring – Entering excavation greater than 5 feet deep that has not been properly sloped or shored.

3.2 Contractor will enforce the RTLB and discipline the RTLB violators. All violators will be removed immediately from the Site, after which the Contractor will be required to formally submit on its letterhead a detailed report on the incident, noting internal meeting(s), additional training that was conducted, and what will be done to prevent a recurrence, prior to return of the personnel. Contractor will be assessed $2,000 per RTLB violation identified by Owner during performance of the work, to be donated by Contractor to a mutually agreed charity.

3.3 Safe Work Practices

3.3.1 Hard hats with bill facing forward and safety shoes **must be worn at all times in all locations** beyond the entrance to the project site. Safety shoes must be compliant with ANSI Z41-1999.

3.3.2 Foam-lined safety glasses, around the periphery or above the brow, **must be worn at all times**. Contractor personnel who wear prescription safety eyewear shall also have the foam-lined feature. Safety glasses must be compliant with ANSI Z87.1-2003 or equivalent.

3.3.3 Face shields must be worn over safety glasses when grinding, chipping, jack hammering, power sawing, handling hazardous chemicals, or performing other tasks that could result in face or eye injury.

3.3.4 Wear appropriate gloves to protect hands from cuts, burns, temperature extremes, chemicals, biological agents or other hazards.

3.3.5 Wear hearing protection when performing noisy work, such as jack-hammering, or where posted.

3.3.6 Hair must be cut or contained above shoulder length and must not interfere with protective headgear.

3.3.7 Shorts, shirts without sleeves or with sleeves rolled up above the shoulder are not permitted.

3.3.8 Reflective safety vests must be worn by all personnel who work on or near active highways, roads, or parking lots. Vests are also required for other work that places personnel near motor vehicles such as flaggers, riggers, survey crews, etc. ANSI / ISEA 107, Class III high visibility reflective safety vests shall be worn for maximum visibility.

3.3.9 Gas bottles must be secured to prevent tipping. Gas bottles must be capped or have a regulator installed. Oxy/acetylene bottles must be separated by at least 20-foot or a 5-foot barrier with a one-hour fire rating while in storage.

3.3.10 During welding or “burning”:

- Use temporary shielding to protect personnel beside, above and below the work; free falling of sparks below a cutter/welder’s feet is not allowed.
- Contain slag, sparks, etc.
- Place weld rod stubs in containers after removal from stingers, and place all other trash in appropriate containers.
- Wear a hardhat, safety glasses, leather gloves, and a welding helmet when welding.

3.3.11 Safety harnesses are required when working on surfaces over six (6) feet high that do not have guardrails or other fall protection. Attach lanyards and lifelines to structural members capable of supporting the load requirement (5000 lbs. anchor point).

3.3.12 On portable articulating man lifts, fall arrest is required per manufacturer’s specifications. Fall arrest is also required on scissor-type man lifts. The lift must be secure and stable prior to use.

3.3.13 For overhead work, rolling scaffolds and mechanical lift platforms are preferred over ladders.

3.3.14 If straight or extension ladders must be used, one worker must hold the ladder until another worker has tied the top to a substantial anchor point. Prior to working above 6 feet off the straight or extension ladder, and leaning beyond the side rails of the ladder, the worker is to don fall protection harness with lifeline, using or establishing an anchor point overhead for clip attachment.

3.3.15 If a step ladder must be used when worker’s feet are on or above the fifth rung, then top of ladder must be tied to a substantial anchor or a second worker must hold ladder. When working on step ladder adjacent to and above guard/handrail where there is risk of significant fall over the rail, worker is to don fall protection harness with lifeline, using or establishing an anchor point overhead for clip attachment.

3.3.16 Daily clean-up of the work area is required. Keep stairways and aisles clear at all times. Tie extension cords, welding leads, air hoses, etc., to middle rail of the handrail and/or route overhead.

3.3.17 Provide trash containers (cans and/or dumpsters) as required to keep areas clean. Dumpsters should not be overfilled by weight or by volume capacity, such that transport of the open container over public roads does not become a safety issue with weight regulations and/or windblown debris.

3.3.18 Prior to high wind events or leaving at the end of shift, "outdoor" roofs, elevated decks, and ground level pathways to be cleared of all loose material, equipment and/or debris, to mitigate the flight of objects during stormy weather. Material and equipment remaining on roofs, elevated decks, and ground level pathways to be tied to solid structure or weighted down, and reviewed with the Ameren SPOC, prior to leaving site on a daily basis.

3.3.19 Barricade at least 6 feet from hole or edge if grating or handrail sections are being removed or installed.

3.3.20 Barricade below lifting/hoisting activities, including both critical and non-critical lifts.

3.3.21 All electrical junction boxes, duct panels, etc., are to be kept closed whenever possible.

3.3.22 All fuel-powered equipment such as welders, generators, compressors and power tools must be used so that the engine exhaust does not present a hazard to personnel inside the building; if this is not possible, then the equipment must be exhausted outside of the facility. Equipment near doors must be positioned so the exhaust will not enter the facility when the doors are open. In areas where fuel-powered equipment is being used, verify that carbon monoxide levels are safe by using a direct reading instrument that is capable of monitoring for carbon monoxide.

3.3.23 Site fire hose stations and fire hydrants shall NOT be used for routine work unless specifically authorized by the SPOC.

3.3.24 If the Site permits Contractor personnel to use elevators, the following rules must be observed:

- No equipment on elevators may extend through the roof access opening.
- Transport bulk Materials in freight elevators and obey the posted weight limits.
- Only tools and Materials that can be carried by hand are allowed on passenger elevators.
- Contractor shall coordinate with SPOC before any Site elevator is used to transport asbestos.
- Construction elevator (when available) is the preferred transport system for asbestos.
- All asbestos shall be double bagged before transported.
- No Site personnel other than asbestos workers shall be on elevators when asbestos is transported.

3.3.25 Fire-retardant (FR) PPE is required when working on exposed, energized circuits. FR PPE must meet arc flash labels and be appropriate for tasks being performed.

3.3.26 Ground Fault Circuit Interrupters (GFCI) shall be used to protect all 120 VAC electrical equipment including electric hand tools & cord sets. Use of 480 VAC GFCI is required when working in wet locations.

3.3.27 Adding slugs within electrical devices requires written approval by Owner. Equipment rated fuses and/or circuit breakers shall not be removed and replaced with ones of different set parameters without written approval by an Owner representative.

3.3.28 For wires to be demolished, the Contractor shall verify that all wires are de-energized (and not live) before proceeding with demolition. If the Contractor discovers that any wire to be demolished is live, the Contractor shall de-energize any such wire and verify the wire is dead prior to terminating or cutting the wire.

3.3.29 Contractor shall follow safety requirements for working on elevated platforms per Elevated Platform Safety Requirements (Attachment B**.7.3**).

3.3.30 Explosives may only be used with written permission from the Owner.

3.3.31 We want this to be a SAFE job. YOU CAN HELP. Report all unsafe acts and conditions to your Supervisor. Consult a Contractor or Owner's Operating Supervisor if there are any questions about work rules or safety requirements.

4.0 WORKERS' PROTECTION ASSURANCE (WPA)/HOLD CARD PROCEDURES

WARNING: Violation of Workers Protection Assurance (WPA) procedures can cause serious equipment damage, personal injury or death.

When WPA is present, verify that equipment is actually de-energized or in the designated state. Always walk down the job, check voltages, temperatures, pressures, etc. to confirm status.

Note: Contractor personnel may be barred from Owner property for failure to comply with WPA procedures. Contract may be terminated or Contractor may lose future work for failure to enforce WPA. See Construction WPA Authorization (Attachment B.4.2) for sign-on access to the Owner automated WPA system at each energy center site.

4.1 General

It is necessary to assure the safety of Contractor's personnel and Owner personnel throughout construction of new system equipment and/or modification of existing system equipment. The following is a brief outline of procedures to guide Contractor's personnel in dealing with Owner operating authorities to obtain Worker's Protection Assurances (WPA).

4.1.1 All personnel, including supervisory personnel, shall receive and comply with site-specific WPA training including descriptions of the tags and their functions. Workers must sign on and off WPA protection as directed by their supervisor. See Attachment B.4.2 – Construction Workers' Protection Assurance Authorization.

4.1.1.1 The WPA system uses a series of Tags and a Sign-On procedure.

4.1.1.2 The reliability and integrity of the WPA process relies upon all persons on the Site understanding and honoring the WPA Tags and Sign-On procedure.

4.1.1.3 WPA is the Operating Authority's assurance to the person obtaining Worker's Protection Assurance that:

Either 1) The equipment covered by the WPA has been completely isolated from energy sources (see Out of Service below).

Or 2) The equipment is placed in a special status requested by the person receiving the WPA (see Local Control below).

4.1.2 Types of WPA Authorities are set forth in Attachment B.4.3 – Types of WPA Authorities.

4.1.3 WPA Isolation Point

4.1.3.1 A WPA Isolation Point may be any of the following energy-isolating devices:

- Switch
- Circuit Breaker
- Valve
- Coupling
- Drive Belt
- Chain

4.1.4 Boundary

4.1.4.1 A Boundary is a collection of energy-isolation devices that form a "zone of protection or control" around the equipment to be serviced.

- The status of equipment within a WPA Boundary can only be changed after the Holder has signed-off the WPA and the WPA tag(s) have been removed.

4.2 Specific Provisions of WPA for Tags. Specific descriptions of the WPA are set forth in Attachment B.4.1.

4.3 Commissioning

4.3.1 Commissioning Team Leader, Commissioning Engineer and Specialist shall ensure the following, once a Construction Turnover Acceptance Form is signed by Commissioning Team Leader:

Any activities on the turned over system not authorized by a member of the commissioning team will promptly cease.

Any Construction Cards within the boundaries of the turnover are promptly removed.

NOTE
Energy Center based WPA will be used if commissioning an existing system in the Site or if the new system is tied to existing Energy Center systems. The sole WPA authority would be the control room.

4.3.2 Request "System Under Test" card or applicable WPA based on boundaries turned over to commissioning (a sample System Under Test Card is set forth in Attachment B.4.1).

NOTE
In case the new system is independent of the existing Energy Center. "System Under Test" card will be used and administered by commissioning.

4.3.3 Maintain AUE-FRM-ADM-2155-07, *System Under Test Card Log.*

4.3.4 In the event that a positive isolation device does not exist in a system being turned over, that system's boundary will be extended into the adjacent system to the first point of positive isolation.

5.0 BARRICADE TAPE

NOTE: Do not rely on barricade tape and flags to prevent a fall that is more than 6 feet.

- **When attended, install barricade tape no less than 6 feet from opening.**
- **Use fall protection if personnel are working closer than 6 feet to the opening.**
- **When unattended, cover the floor opening with a temporary cover, or temporary handrails 42 inches in height that include a mid-rail and toe board. Temporary covers must be able to support at least twice the load to which they will be subjected (including people, equipment and/or vehicle traffic).**
  - **Temporary covers must be secured when installed in such a way as to prevent accidental movement by wind, traffic, or personnel.**

5.1. Barricade tape must be used to warn personnel about a hazard or restrict personnel's access to a hazardous area. Barricade tape must have an information tag listing the responsible person, date of erection, and purpose. Barricade signs shall indicate the Contractor, reason, and expiration date/time. Remove the barricade when work is completed. See Barricade Tags (Attachment B.5.1).

5.2 Any personnel may erect barricade tape. The person responsible for the barricade tape must remove it when the hazard no longer exists.

NOTE: Any time red barricade tape is to be used, the Contractor must inform Owner.

- **Red barricade tape** shall be used to warn personnel DO NOT ENTER dangerous areas. These areas may only be entered with authorization from the person who erected the barricade.
- **Yellow and magenta barricade tape** shall be used to warn personnel DO NOT ENTER an area because radiography is creating a radiation hazard.

- **Yellow barricade tape** shall be used to warn personnel of immediate hazards that have the potential to cause injury. Areas barricaded with yellow may be entered once the hazard is identified and can be avoided.

- **Green barricade tape** shall be used to warn personnel of possible exposure to hexavalent chromium. Respiratory protection is required in these areas.

Contractor shall comply with the OSHA Regulation on Hexavalent Chromium. "Regulated Areas" shall be clearly demarcated with **Green** barricade tape with a caution tag that clearly states the hazard in the work area (e.g., "Hex Chrome Exposure – Respiratory Protection Required"). In general, regulated areas shall be established a minimum distance from the activity as described below:

1. 5 Feet – Welding on boiler tubes, steam piping and other materials that contain 2.5% chromium or less

2. 10 Feet – Welding on Stainless steel and other materials that contain more than 2.5% chromium.

3. 20 Feet and/or Visible plume – Plasma arc cutting, air arc cutting, chamfer-trodes, cut-trodes and other processes lacking sufficient air monitoring data by Owner for the protection of our personnel.

Contractor is responsible for air monitoring as required for its personnel protection and validation of engineering controls. The guidelines for barricading are based on personnel exposures based on collection of data by Owner. These distances are guidelines and may be increased or decreased based on air monitoring data. Air monitoring data for each job shall be furnished to the Industrial Hygienist in the Owner Corporate Safety Department.

- A Nuclear Radiation Sign is used to warn unauthorized personnel not to tamper with or remove instruments or equipment.
- Flashing yellow lights may be used with barricades.
- Other barricades may be used for roadwork and for other special situations.

5.3 When determining and setting overhead load path barricade boundaries, Contractor shall include within the boundary the potential for dropping load during load swing (failed load path). All elevations affected per this potential 'failed load path' shall be barricaded.

6.0 SAFETY INCIDENTS

6.1 Incident/Accident Reporting

6.1.1 In the event of an Incident/Accident, including, but not limited to, personal injury or death of personnel or any member of the public, or damage to Owner's property, premises or adjacent property, to Contractor or subcontractor personnel, the SPOC shall be notified as soon as possible and an Incident/Accident Investigation Report (Attachment B**.6.1**) must be submitted to the SPOC and a written report via Safety1Source at: https://ameren.airsweb.net/home.aspx within 24 hours to document the investigation. Accident facts, causes, and corrective action shall be documented and communicated to personnel through safety and health meetings.

6.1.1.1 The Incident/Accident Investigation Report shall include a detailed description of the accident or injury, including the names of those involved. A signed Witness Statement (Attachment B**.6.2**) must be completed by each witness providing factual observations.

6.1.1.2 OSHA Recordable injuries and minor injuries requiring first aid must be recorded using the First Aid Register (Attachment B**.6.3**), which must be forwarded to the SPOC.

6.1.1.3 For any serious Incident/Accident:

- **First — Notify the site shift supervisor or designee immediately**. The shift supervisor will make the Emergency call and implement appropriate site emergency response procedures.

- **Second — Provide First Aid for the injured** as required until professional emergency responders arrive.

- **Third — Secure the area** to ensure safety of other personnel.
- **Fourth — Notify the SPOC** via phone, PA, radio, or in person.

6.1.2 The accident scene must be secured for accident investigation. Equipment or material can only be moved to prevent further injury until a review of the accident is completed.

6.1.3 Follow up verbal messages to the SPOC with written notifications within 24 hours.

6.1.4 Contractor shall make an immediate report by telephone to the SPOC of any accident involving injury, death, fire, spill, mishandling of oil, regulated/hazardous waste spill, or any other emergency.

6.1.5 In the event of an emergency, Owner has authorized the Operating Supervisor and the SPOC to act as emergency coordinators. Contractor shall proceed with appropriate emergency response measures as directed by site Operating Supervisor and the SPOC, and take full responsibility for clean-up and disposal of any wastes or materials.

6.1.6 Contractor shall indemnify Owner for all related costs and liabilities.

6.1.7 Contractor shall submit a Monthly Contractor Accident Statistics Report (Attachment B**.6.4**) by the second day of each month for the preceding month's activities.

6.1.8 Contractor shall investigate all types of events listed in above Section B.6.1 Incident/Accident Reporting, whether they result in an injury or not, and provide the results of said investigation to Owner. An accident investigation does not assign blame; the investigation seeks to determine how to eliminate similar accidents in the future. Owner reserves the right to monitor Contractor's investigation, and Contractor shall provide the SPOC with all necessary information to all required Owner personnel to perform this monitoring function.

6.1.9 Owner reserves the right to investigate any accidents that occur on its property or in completing work being performed by a Contractor's personnel whether they result in an injury or not. Owner will conduct further investigations for accidental environmental releases or spills, or other releases, as desired by Owner.

6.2 Safety and Health Adherence Policy

6.2.1 **Action Level One** – The SPOC will issue a written Notice of Safety and Health Non-Compliance (Attachment B**.6.5**) and Warning Letter of Safety and Health Non-Compliance (Attachment B**.6.6**) to Contractor's management and site Safety and health representative if Contractor fails to comply with an applicable safety and health standard.

6.2.2 **Action Level Two** – The SPOC will issue a Written Notice of Temporary Job Suspension (Attachment B**.6.7**) to Contractor if safety and health non-compliance is not corrected by Action Level One, or if Contractor repeatedly fails to comply with applicable safety and health regulations. The Owner's construction manager and Contractor's Division Manager, or equivalent, must meet and agree on corrective actions acceptable to Owner before Work may resume. Actions may include, but are not limited to:

- Removal of certain Contractor personnel from Project.
- Alteration of Contractor's job procedures.
- Having Owner implement corrective action and back-charge Contractor.

Contractor shall not resume Work until Owner accepts the proposed corrective actions. Owner will retain meeting minutes documenting the agreement.

6.2.3 **Action Level Three** – Owner Management may terminate the contract for cause, if **Action Level One** and **Action Level Two** do not result in Contractor's safety and health compliance.

7.0 SPECIALTY SAFETY PROCEDURES

7.1 Scaffolding

7.1.1 A Competent Person shall design, and a Competent Person shall erect scaffolding. Only the authorized scaffolding erector can make changes to scaffolding.

7.1.2 A Competent Person must inspect and tag scaffolding prior to initial use, before each work shift, and after any event that could affect its structural integrity. Untagged scaffolds must not be used.

7.2 Crane Operations

7.2.1 A third-party-certified Competent Person shall make a thorough annual inspection of cranes and powered hoisting equipment. Cranes shall be inspected and have deficiencies corrected prior to being put into service. Documentation of crane inspections must be maintained onsite by Contractor.

- Crane hooks shall be inspected by a Competent Person prior to use. Rigging shall be inspected by a Competent Person before each shift. Defective components shall be removed from service immediately. Anti-Two-Block devices, that automatically disengage crane hoist/boom functions when the hook or block approaches the jib or boom tip, shall be used on all cranes.

- All outriggers on mobile cranes must be fully extended and fully deployed when crane is used to lift or support a load.

- If, due to configuration or physical location, all outriggers cannot be fully deployed, calculations must be made from the “on-rubber” section of the load chart. A certified crane specialist must have written calculations and lift instructions reviewed by Owner. The SPOC may make an exception for light-weight, lift-and-carry operations.

7.2.2 Operators of cranes must be trained and certified by National Commission for Certification of Crane Operators (CCO), or Operating Engineers Certification Program (OECP). Crane operators must be qualified on each crane type and rating they operate.

7.2.3 Operators of cranes are responsible for completing the Crane Maintenance Safety Checklist (Attachment B.7.1).

7.2.4 Operators of cranes are responsible for providing documentation to Owner SPOC of required OSHA crane inspections.

7.2.5 Cranes shall not be used to hoist personnel without SPOC approval. Cranes should not be used to hoist personnel except where the Contractor can demonstrate that the erection, use, and dismantling of conventional means of reaching the work area, such as a personnel hoist, ladder, stairways, aerial lift, elevating platform, or scaffold, would be more hazardous, or is not possible because of the project's structural design or worksite conditions.

7.3 Critical Lifts

7.3.1 Critical Lifts: Contractor shall submit a Critical Lift Plan for any critical lift (see Attachment B.7.2 Critical Lifts Plan).

7.3.2 Critical Determination. Owner reserves the right to designate any lift as a “critical lift” if any one of the following conditions exist:

7.3.2.1 Lifting over 50 tons.

7.3.2.2 Lift exceeds 75% of the rated capacity of the crane.

7.3.2.3 Lift requires the use of more than one crane. (In no case shall a multiple crane lift be performed in excess of 75% of any one of the crane’s individual load rated capacity at the planned radius.)

7.3.2.4 Lifting a non-rigid object.

7.3.2.5 Lifting over equipment or material that could cause or result in a release of hazardous material to the environment.

7.3.2.6 The lifted item requires exceptional care in handling because it is being lifted above critical operating equipment or material and/or building structure.

7.3.2.7 The lifted item requires exceptional care in handling because of size, weight, close-tolerance installation, high susceptibility to damage or other unusual factor. The value or replacement delivery time of the item being lifted may warrant a "critical lift" designation. Examples may include: a generator exciter, rotor, or stator and turbine components such as the rotor.

7.3.2.8 Lift performed in proximity of live electrical connections.

7.3.2.9 Lifting of personnel in baskets and/or personnel harnesses. This shall be conducted in accordance with OSHA Standard 29CFR 1926.1431.

7.3.2.10 Lifting of equipment by helicopter.

Any lifts proposed by the Contractor that meet any of the above criteria or are determined to be critical by the Project Engineer will be subject to a Critical Lift Plan. Examples of lifts that are generally considered critical are: boiler tube panels, feedwater heaters, conveyor systems, coolers and pump skids, turbines, and generators.

7.3.3 With its bid proposal, Contractor shall submit a normal weather lay-down plan for each onsite lattice crane, wherein Contractor specifically outlines the manner in which the crane will be stored in normal weather conditions.

7.3.4 With its bid proposal, Contractor shall submit a severe weather lay-down plan for each onsite lattice crane, wherein Contractor specifically outlines the manner in which the crane will be stored in severe weather conditions.

7.3.5 Before construction begins, Contractor shall meet with Owner representatives and shall outline the means and methods of the Contractor's crane execution plan for each lattice crane expected to be utilized onsite. Execution plan shall include specifics about transition from normal to severe weather crane lay-down plans and critical wind speed for crane position. Cranes shall not be allowed onsite until after the crane execution plan(s) have been reviewed and approved by Owner representatives.

7.3.6 Crane loading shall typically be based on 2,000 pounds per square foot ground pressure, unless known ground conditions dictate/allow otherwise. Owner representatives shall review and approve planned crane ground loading.

7.3.7 When determining and setting load path barricade boundaries, Contractor shall include within the boundary the potential for dropping load during load swing (failed load path). All elevations affected per this potential 'failed load path' shall be barricaded.

7.4 Hoisting and Rigging

7.4.1 Contractor shall comply with applicable OSHA standards including 29 CFR 1926.251 and their own company safety policies and procedures for rigging and hoisting.

7.4.2 Contractor shall ensure any beam used for hoisting is equipped with a positive stop. This includes both existing beams permanently installed at the work site and temporary beams. Contractor shall provide and install stops prior to using the beam if not already present.

7.4.3 Perform a visual inspection of the lift travel path prior to each lift. Clear any obstructions or make necessary adjustments to be certain of a clear travel path before making each lift.

7.4.4 Contractor shall remove all rigging and hoisting equipment and beams installed once work is complete unless otherwise approved in writing by Ameren.

7.4.5 When utilizing trolleys, verification of proper trolley installation shall be performed by a Competent person prior to initial use.

7.4.6 Contractor shall tag any pneumatic or electric driven hoisting device to identify the Contractor who installed the device, the install date, the task being performed, and an expected completion date.

7.4.7 Ensure beams used for lifting and hoisting are rated for the load being lifted.

7.5 Elevated Platforms

7.5.1 The requirements for working on elevated platforms is set forth in Attachment B**.7.3** and must be followed by the Contractor to assure personnel safety while working on elevated platforms and scaffolding. Contractor shall submit a plan to implement safety requirements if its personnel will be working on elevated platforms.

7.6 Confined Space Locations.

7.6.1 The requirements for the Confined Spaces are set forth in Attachment B.7.4 - Confined Spaces Requirements.

7.7 Grinder Safety Plan

7.7.1 All grinder guards/handles must remain on grinders at all times. If a guard or handle is required to be removed because of a tight work area, a permit must be completed and maintained at work location. The Grinder Safety Plan (Attachment B**.7.5**) must be completed and formed for such work.

7.8 Power Operations Hot Work

7.8.1 Contractor shall coordinate Hot Work, (i.e., welding, brazing, heating, and cutting), with Owner personnel to assure that Owner safety requirements are met as outlined below.

7.8.2 The Power Operating Hot Work Checklist (Attachment B**.7.6**) must be completed by Contractor and utilized when performing Hot Work such as welding, cutting, grinding, or any other activity that produces sparks. Contractor may use its own forms or Owner's forms, but Work shall be coordinated through the SPOC. The Checklist/Permit shall be delivered to Owner.

7.9 Radiography Safety Requirements

7.9.1 Immediately upon entering the Site, the radiographer must report to the control room and notify the shift supervisor of his/her presence and intended scope of Work.

7.9.2 Radiography shall be carried out only during the time frame and at the locations stated on the Radiography Notification.

7.9.3 All restricted radiation area (2 mr) boundaries shall be established using barrier tape, rope, chain, or other suitable material. The use of duct tape, masking tape or other similar materials is **NOT** acceptable. When radiography is to be performed inside a boiler, the restricted radiation area boundary shall include, as a minimum, the stairways (both internal and external stairways) one elevation above and one elevation below the elevation where radiography will occur.

7.9.4 The radiographer must ensure that no unauthorized personnel are inside the radiographer's restricted area and positive control of the access is established prior to the use of the radiography camera.

7.9.5 Two (2) minutes prior to the initial start of radiography and every thirty (30) minutes throughout the duration of the radiography, the radiographer shall make an announcement over the Site public address system. The announcement shall identify where the radiography is occurring and expected duration, if the restricted radiation area is changed the radiographer shall make an announcement prior to commencement of radiography. When radiography is completed, an announcement shall be made over the Energy Site public address system.

7.9.6 When multiple radiation sources are used the radiographers shall coordinate their efforts. Two-way radios are available in the control rooms or from the various contractors on site.

7.9.7 Upon completion of the radiography, all barricades shall be removed, and all radiation hazard signs retrieved and accounted for. Any radiation hazard signs not removed or found lying on the ground will be considered a serious safety violation requiring a written corrective action plan prepared by the radiographer or his/her employer.

7.9.8 At the conclusion of all radiographic activities (equipment secured and the restricted area boundary removed), the radiographer must report to the shift supervisor to confirm the completion of the radiography.

8.0 WORKPLACE HAZARDS

8.1 Work near coal dust, fly ash, lime, or ferric/lead paint removal projects can create airborne contaminates. Do not use compressed air to clean surfaces or clothing. Use properly equipped vacuum, wet methods, or other approved methods for cleaning.

8.2 All Energy Centers have asbestos-containing insulation and building materials (ACM). Treat all suspect materials as if they are asbestos.

8.3 Asbestos abatement projects may be in progress. Barricades will restrict access to areas with abatement projects. Only trained personnel using Personal Protection Equipment (PPE) may handle asbestos.

8.4 Personnel who are medically required to use syringes shall take them home, properly packaged for disposal. Only trained personnel using PPE shall handle items contaminated with blood or other body fluids. Report any bloodborne related issues to the SPOC.

9.0 OTHER SAFETY REQUIREMENTS

9.1 If outages are required, Contractor shall coordinate with the SPOC to obtain lock-outs and releases in accordance with the Energy Center's WPA/Hold Card procedures and operating practices. Equipment with a WPA/Hold Card tag shall never be serviced or removed.

9.2 Only qualified and authorized persons shall work on energized electrical equipment per Owner procedure AUE-ADM-5002, Energized Equipment Electrical Safety Program. If applicable to specified work scope, the SPOC will supply a copy of AUE-ADM-5002.

9.3 Contractor shall not work on energized equipment without the express, written consent of the SPOC. In no case shall Contractor work on or near (within reach of) energized equipment without the use of appropriate insulated tools to perform the work.

9.4 All lifting/hoisting activities near overhead, high tension power lines must include awareness of and observance of the following safe working clearances:

Minimum Clearance Distance	
Voltage (kV)	**Clearance (feet)**
Up to 50	10
Over 50 to 200	15
Over 200 to 350	20
Over 350 to 500	25
Over 500 to 750	35
Over 750 to 1,000	45

9.5 Owner must review contractor qualifications before Contractor personnel may work in areas with high voltage equipment (over 600 volts).

9.6 Site equipment identified with a nuclear radiation symbol (as seen below) is NOT to be serviced by unauthorized personnel):

9.7 All equipment on the Project shall be used in accordance with Federal, State, and Local safety and handling requirements in addition to the manufacturer's instructions and guidelines. Equipment shall not be modified in any way for use other than as intended by the manufacturer.

9.7.1 Any alterations must be approved by the manufacturer in writing. Only trained and authorized persons shall operate machinery or equipment.

9.7.2 Use hand-held power tools only for their intended purpose. Do not use tools that are broken, have dull blades, dull bits, have damaged cords, or have damaged/missing guards. Hand-held power tool switches shall not be modified by any means to maintain power without constant trigger pressure. (Ref. OSHA 29CFR1910.243).

9.8 Imminent Danger Situations

9.8.1 Contractor must suspend Work immediately upon discovery of any situation that may, in its opinion, reasonably be expected to cause serious physical harm, illness, death, or significant environmental or equipment damage.

9.8.2 Safety and health concern(s) must be corrected, to the satisfaction of the Contractor and Owner, before Work may resume.

9.8.3 Examples of "imminent danger" situations may include, but are not limited to the following:

- Falls from elevations
- Excavations not properly sloped or shored
- Radiation hazards
- Electrocution hazards
- Injury to the public
- Unsafe operation of vehicles, machinery, or heavy equipment
- Improper or non-existent WPA/Hold Card equipment lockout
- Release of hazardous substances (OSHA 40CFR Part 302) into the environment in excess of the reportable quantity
- Release of asbestos outside of containment work areas

9.9 Contractor must comply with all applicable Owner, federal, state, and local health, safety and environmental regulations including, but not limited to, those concerning:

- Job Working Rules, Radiography Safety Requirements, and Safety Requirements for Elevated Platforms
- Public and worker health and safety
- Public's "Right to Know"
- Fire safety
- Air and water quality
- Flammable materials storage
- Spill control, response, and cleanup
- Hazardous and non-hazardous waste handling, identification, and disposal

9.10 Safety and Health Training Requirements

9.10.1 Documentation of OSHA training for Contractor craft workers and supervisors must be maintained onsite and made available to Owner. Effective September 1, 2006, the minimum training standard is OSHA 10 for Contractor craft workers and OSHA 30 for Contractor supervisors.

9.10.2 Contractor will maintain documentation of safety and health training on project and must provide requested documentation of training to Owner. Contractor shall retain verification of satisfactory training for as long as required by law or six months after completion of contract, whichever is greater.

9.10.3 Job safety awareness meetings will be held with Owner and applicable Contractor on a frequency determined by Owner. The meetings will address industrial safety issues from Contractor job safety reviews.

9.10.4 The SPOC and Owner personnel will conduct periodic safety and health surveys of the Project. Any discrepancies will be reported to Contractor management for immediate correction.

9.10.5 These surveys do not relieve Contractor of its responsibility to self-inspect its Work and equipment and to conduct its Work in a safe and environmentally compliant manner.

9.11 Respiratory Protection

9.11.1 Contractor must provide a copy of its Respiratory Protection Program to the SPOC before it uses respirators. The program must comply current Owner, federal, state and local requirements including OSHA 29CFR1910.134. The program must properly address the following:

Respirator selection

Respirator training and required test fit procedures

Respirator cleaning, sanitizing, inspection, and maintenance

Respirator user's medical clearance

Chemical cartridge change-out schedule when applicable.

9.11.2 Crystalline Silica Standard

Crystalline Silica is the basic component of soil, sand, granite, and many other minerals. Quartz is the most common form of crystalline silica, which is found in concrete, block, asphalt, and some paints. Exposures happen when these types of materials are either cut or pulverized, and the silica dust becomes airborne and is subject to inhalation. All operations involving possible exposure to respirable crystalline silica must comply with OSHA 1926.1153 Table 1. The Contractor shall maintain and provide all necessary documentation for compliance.

Attachments for Appendix B

Attachments for Appendix B
Attachment B.1.1: Site-Specific Safety Plan
Attachment B.4.1: Specific Provisions and WPA for tags
Attachment B.4.2: Construction WPA Authorization
Attachment B.4.3: Types of WPA Authorities
Attachment B**.5.1**: Barricade Tags
Attachment B**.6.1**: Incident/Accident Investigation Report
Attachment B**.6.2**: Witness Statement
Attachment B**.6.3**: First Aid Register
Attachment B**.6.4**: Monthly Contractor Accident Statistics Report
Attachment B**.6.5**: Notice of Safety & Health Non-Compliance
Attachment B**.6.6**: Warning Letter of Safety & Health Non-Compliance
Attachment B**.6.7**: Written Notice of Temporary Job Suspension
Attachment B**.6.8**: Contractor Safety and Health Data Form
Attachment B**.7.1**: Crane Maintenance Safety Checklist
Attachment B.7.2: Critical Lift Plan
Attachment B**.7.3**: Elevated Platform Safety Requirements
Attachment B.7.4: Confined Spaces Requirements
Attachment B**.7.5**: Grinder Safety Plan
Attachment B**.7.6**: Power Operations Hot Work Checklist

ATTACHMENT B.1.1
SITE-SPECIFIC SAFETY PLAN

This plan shall be completed in its entirety and submitted to Owner for review, comment and approval.
This plan shall be reviewed with the Corporate Safety Department before work commences.
Completed plans shall be maintained and kept on site with the project file.

Section 1: Contractor and Project Information	
Contractor Company:	
Contractor Address:	
Project Name:	
Project Address:	
Mobilization Date:	

Section 2: Contractor Info	**Name**	**Phone**	**Email**
Project Manager			
Superintendent			
Corporate Safety Representative			
General Foreman			
Site Safety Representative(s)			

Shifts working throughout project: 1st ☐ 2nd ☐ 3rd ☐	Maximum number of workers on site per shift: 1st 2nd 3rd	Number of safety representatives on site per shift: 1st 2nd 3rd

Job Responsibilities:	
Titles:	Description of Job Duties

Section 3: Site Emergency Information		
3.1	Identify the nearest medical facility (e.g., hospital, urgent care, occupational clinic etc.): Address: Phone # Note: Location and directions (including maps) to the nearest facility are required to be on this jobsite.	
3.2	List the local Fire & Rescue Squad Phone #	List the Police Phone #
3.3	Describe your emergency action plan for the project (e.g., response to fire, severe weather, etc.):	

Section 4: Company Safety Mission Statement
Section 5: Scope of Work

Describe the activities your company will be performing while on this project. Ensure that all activities are referenced on the AHA of this plan, see Section 13.

Section 6: Subcontractor Information

Will subcontractor(s) be used on this project? ☐ Yes ☐ No

If yes, please provide the information below (add extra copies of this page as needed):

Note: All subcontractors are required to submit a Site Specific Safety Plan.

Subcontractor(s) Name:	Contact Person	Scope of Work	Phone	Email

Section 7: General Information

7.1	Describe how you will secure your jobsite, equipment, and Materials to protect public safety and to prevent theft.
7.2	Will there be persons onsite trained in First Aid and CPR? ☐ Yes ☐ No
7.3	Will there be ANSI Z308.1 compliant First Aid Kit(s) and Bloodborne Pathogens Kit(s) located in strategic areas on this project: ☐ Yes ☐ No
7.4	Will restrooms and wash facilities be brought on site? ☐ Yes ☐ No
7.5	How will housekeeping be managed? Describe the control measures to be used and how often they will be performed.
7.6	Do you have a map of the worksite location that includes roads, waterways, railways, bridges, etc.? ☐ Yes ☐ No *Please provide a copy of the map when submitting this document*

Sections 8: Project Safety Management	
Owner shall have the authority to immediately stop contractor's work indefinitely for operations which, in the opinion of owner, constitute a safety concern. It is the responsibility of the contractor to adequately satisfy owner of any remediation necessary to provide a safe and healthful workplace. Contractor must have qualified and competent supervision at the site at all times to direct and observe the work.	
8.1	Do you require your supervision to successfully complete the OSHA 30-Hour for Construction Training?
8.2	Do you require your personnel to successfully complete the OSHA 10-Hour Construction Training?
8.3	Outline the initial personnel orientation on the job site:
8.4	Describe the process that you will use to verify that training within your scope of work has successfully been completed. *Note: Personnel training records do not have to be submitted. Owner reserves the right to review training records which must be readily available upon request.*
8.5	Describe your procedures for Contractor Event Reporting (CER) to Owner.
8.6	Describe your Job Observation Process in detail:
8.7	Describe your Job Briefing Process in detail:
8.8	Will you have a Hazard Communication Program with a chemical inventory list and Safety Data Sheets (SDS) for chemicals used onsite? ☐ Yes ☐ No NOTE: Chemical inventory list must be onsite at the beginning of the work and Safety Data Sheets (SDS) shall be kept on file at the site by the contractor. SDSs must be available for the contractor and subcontractor personnel's review and for review by the owner upon request.

Section 9: Rules To Live By Hazards and Controls	
9.1	Explain how you will communicate Owner "Rules to Live By" to your personnel on this project and describe the procedures you will follow when a violation occurs.
9.2	Explain your company's disciplinary action protocol as it relates to jobsite safety rules:

Section 10: Personnel Engagement and Communication	
10.1	Identify steps your company is going to take to engage your workforce in safety:
10.2	Explain how your company is going to communicate safety information and expectations to your personnel?

Section 11: Personal Protective Equipment (PPE)
List the minimum PPE required to access the job site:

Section 12: Safety and Health – Describe how hazards are controlled in the AHA for each 'Yes' answer (see Section 13):			
Will the work scope require any traffic or pedestrian disruptions?	☐ Yes	☐ No	☐ N/A
Will your work require you to penetrate into any surface at any depth?	☐ Yes	☐ No	☐ N/A
Will your work involve any excavations/trenches?	☐ Yes	☐ No	☐ N/A
Will the work scope require work at heights greater than 6 feet?	☐ Yes	☐ No	☐ N/A
Will wire rope guardrail systems be used on this project to protect workers from fall hazards and will an inspection program be implemented to verify safe installation/condition?	☐ Yes	☐ No	☐ N/A
Will the project involve electrical line construction, maintenance or repair activities?	☐ Yes	☐ No	☐ N/A
Will the project involve substation or switchyard construction, maintenance or repair activities?	☐ Yes	☐ No	☐ N/A
Will there be worksite obstructions that may create a hazard to workers such as railroads, bridges, power lines or waterways?	☐ Yes	☐ No	☐ N/A
Will the work scope involve the need to control hazardous energy sources?	☐ Yes	☐ No	☐ N/A
Will the project include work on pressurized vessels or pipes that may affect the integrity of the system such as welding, cutting, brazing, etc.?	☐ Yes	☐ No	☐ N/A

Section 12: Safety and Health – Describe how hazards are controlled in the AHA for each 'Yes' answer (see Section 13):	
Will steel erection be part of the scope of this project?	☐ Yes ☐ No ☐ N/A
Will there be potential impalement hazards such as protruding reinforcing steel (rebar)?	☐ Yes ☐ No ☐ N/A
Will any roofing be performed on this project?	☐ Yes ☐ No ☐ N/A
Will earthmoving or drilling equipment be used on this project?	☐ Yes ☐ No ☐ N/A
Will cranes, derricks, or other equipment be used on this project?	☐ Yes ☐ No ☐ N/A
Will a helicopter be used on this project?	☐ Yes ☐ No ☐ N/A
Will the work scope require the need for a critical lift plan that will include the safe rigging practices and prohibit work under suspended loads?	☐ Yes ☐ No ☐ N/A
Will hoists, elevators or conveyors be used on this project?	☐ Yes ☐ No ☐ N/A
Will personnel be involved in erecting, disassembling, moving, operating, repairing, maintaining, or inspecting a scaffold system?	☐ Yes ☐ No ☐ N/A
Will the work scope include diving?	☐ Yes ☐ No ☐ N/A
Will the work scope require you to work in a confined space?	☐ Yes ☐ No ☐ N/A
Will welding, cutting, or brazing be performed on this worksite?	☐ Yes ☐ No ☐ N/A
Will the work involve the use of chemicals such as paints, solvents, adhesives, epoxy coatings, corrosives, fuels or other hazardous materials?	☐ Yes ☐ No ☐ N/A
Will lead based materials be used or disturbed on this project?	☐ Yes ☐ No ☐ N/A
Will asbestos containing materials be disturbed on this project?	☐ Yes ☐ No ☐ N/A
Will you be working in or generating a hazardous atmosphere?	☐ Yes ☐ No ☐ N/A
Will appreciable levels of dust be generated that will require control measures?	☐ Yes ☐ No ☐ N/A
Will abrasive blasting be performed on this project?	☐ Yes ☐ No ☐ N/A
Will the work scope involve any environmental hazards that generate flying debris, excessive noise levels, or any other air contaminants not mentioned above?	☐ Yes ☐ No ☐ N/A
Do you have a heat stress prevention program in place?	☐ Yes ☐ No ☐ N/A
Will radioactive materials/sources be used on this project?	☐ Yes ☐ No ☐ N/A
Will hazardous waste (e.g., lead, asbestos, contaminated soils) be generated and properly disposed of on this project?	☐ Yes ☐ No ☐ N/A

Section 13: Risk Management

ANTICIPATED HAZARD ANALYSIS (AHA)

Use this form to identify activities that will occur on this project. List all potential hazards associated with that activity. Use the Risk Assessment Code table to determine the risk level of the activity/hazards. Lastly, list all of the controls that will be implemented to control those hazards. When a Job Hazard Analysis is needed, it must be performed, documented, and communicated to workers prior to the start of that activity, see footnote 2.

Contractor Name:	Project Name/Number:		Project Location:
	Date Prepared:	Prepared By:	Reviewed By:

Risk Assessment Code (RAC) Color Ratings – *include color & numeric alpha characters for rating* **Red** =Extremely High Risk (Critical), e.g., Red IA **Orange** = High Risk (Serious), e.g., Orange 2B **Yellow** = Moderate Risk (Moderate), e.g., Yellow 3C **Blue** = Low Risk (Minor), e.g., Blue 3D **Green** = Extremely Low Risk (Negligible), e.g., Green 3E		**PROBABILITY (how often the activity occurs)**				
		Frequent (A) Occurs very often, known to happen regularly.	Likely (B) Occurs several times, a common occurrence.	Occasional (C) Occurs sporadically, but is not uncommon.	Seldom (D) Remotely possible, could occur at some time	Unlikely (E) Can assume it will not occur, but it is not impossible
Severity	Catastrophic (1) – Imminent and immediate danger of death or permanent disability to the public,, personnel or property.	Red (IA)	Red (IB)	Red (IC)	Orange (ID)	Yellow (IE)
	Critical (2) – Permanent partial disability, hospitalized injury, temporary total disability.	Red (2A)	Orange (2B)	Orange (2C)	Yellow (2D)	Blue (2E)
	Significant (3) – Reversible injury that would need ER care, reversible illness.	Orange (3A)	Yellow (3B)	Yellow (3C)	Blue (3D)	Green (3E)
	Negligible (4) – First aid or minor medical treatment	Yellow (4A)	Blue (4B)	Blue (4C)	Green (4D)	Green (4E)

Activity Category	Potential Hazards	RAC Rating[1]	JHA Required[2]	Controls

1 RAC Rating – Risk Assessment Code Rating. Use the Risk Assessment Matrix to list the color and numeric alpha code

2 JHA required if red or orange RAC color (See sample JHA; JHA is not required to be submitted with this plan)

JOB HAZARD ANALYSIS (JHA) FORM

JOB HAZARD ANALYSIS	COMPANY NAME:	JOB:	DATE
	JOB TITLE OF WORKERS WHO DO THIS JOB:		ANALYSIS BY:
LOCATION:		REQUIRED PERSONAL PROTECTIVE EQUIPMENT:	

Sequence of Basic Job Steps	Critical Task	Potential Accidents or Hazards	Recommended Safe Job Procedures
	☐		
	☐		
	☐		
	☐		
	☐		
	☐		
	☐		
	☐		
	☐		
	☐		
	☐		
	☐		
	☐		
	☐		
	☐		
	☐		
	☐		
	☐		

FOR AMEREN USE ONLY	
SAFETY HAZARDS CONTROL REVIEW OF CHECKLIST:	
DATE SUBMITTED:	
REVIEW STATUS:	
☐ UNSATISFACTORY, RESUBMITTAL REQUIRED	☐ SATISFACTORY
This plan is considered satisfactory if there are no comments below.	
AMEREN CORPORATE SAFETY REVIEW COMMENTS:	
Sections	**Comments**
Section 1:	
Section 2:	
Section 3:	
Section 4:	
Section 5:	
Section 6:	
Section 7:	
Section 8:	
Section 9:	
Section 10:	
Section 11:	
Section 12:	
Review Date:	
Resubmit Date:	
Approved Date:	
Ameren Project Manager and Date:	

ATTACHMENT B.4.1
SPECIFIC PROVISIONS AND WPA FOR TAGS

1.0 EQUIPMENT COVERED BY WPA

1.1 All system equipment under the jurisdiction of an Operating Authority must be covered by WPA when it is to be worked on or tested.

1.2 The only equipment that can be covered by WPA is equipment under an Operating Authority's jurisdiction.

1.2.1 Equipment connected to energy sources but not released to the jurisdiction of an Operating Authority can only be protected by WPA on the isolating device (or devices) between the energy source and the equipment.

In this case it is only possible for the Operating Authority to assure the person receiving WPA that the isolating device(s) connecting the new equipment to his/her energy sources is protected and he/she cannot assure the person receiving the WPA that the equipment is completely isolated. Therefore, it is better for all new equipment to be released to the jurisdiction of an Operating Authority as soon as possible.

1.3 Contractor/Subcontractor personnel shall observe all WPA rules and comply with WPA tags at all times. Never use an elevator that has a WPA card on the call button.

2.0 DESCRIPTION AND PURPOSE OF TAGS

2.1 General Notes

2.1.1 When Contractor sees a WPA tag on equipment, Contractor shall stay clear of the equipment and keep hands off (violating WPA tags will result in disciplinary action up to and including termination).

2.1.2 Only the Functional Authority of the equipment may order tags to be placed or removed.

2.1.3 Tags will ordinarily be executed and attached by an Operator or his agent.

2.1.4 Tags, record sheets and WPA sheets will have the equipment name, etc., along with the serial number of the WPA record.

2.2 Functional Authority's Hold Off Tag

2.2.1 Definition – The Hold Off is an inviolable order of a Functional Authority that the disconnect device(s) which it is intended to cover must not be closed (or opened in the case of valves) under any circumstances unless definitely ordered or approved by the Functional Authority and then only if the Hold Off tag is first ordered removed.

2.2.2 Issued to only to the Functional Authority (never to a worker).

2.2.3 Usage

2.2.3.1 The Hold Off is an Operating Authority's tool which such person may choose to use any time such person feels it would contribute to a safer working environment.

2.2.3.2 To properly isolate equipment from all sources of normal energy and tag them with Hold Off tags so the Functional Authority may issue an Out of Service or Restraint to a supervisor or workman so work on designated equipment may proceed.

2.2.4 Equipment Status – Operator must obtain the approval of, or be acting under the orders of, the Functional Authority before changing the status of, or working on any equipment bearing a Hold Off tag.

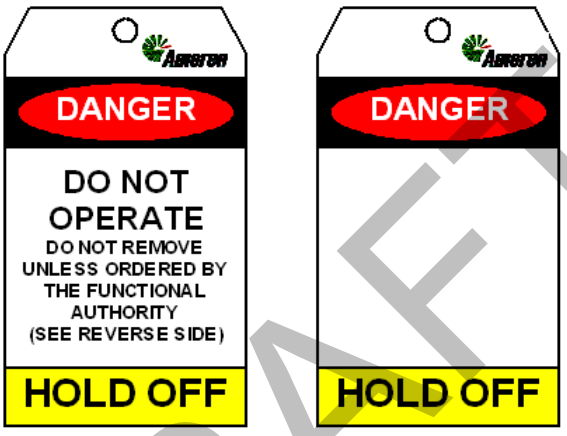
2.3 Worker's Hold Off Tag

2.3.1 The Worker's Hold Off is the method by which the Holder of a Local Control isolates equipment such worker is working on under the Local Control.

2.3.2 Workers will create their own Worker's Hold Off tag by legibly signing a blank site Hold Off Tag. If the holder of a Local Control wants to work on the equipment, it must first be isolated from its energy supplies. The holder would open the breaker, close the valves, etc. to isolate the equipment. The holder must then hang a Worker's Hold Off on top of the Local Control to ensure the breaker or valves remain in the de-energized position. A Worker's Hold Off tag when placed has the same meaning as a Functional Authority's Hold Off. The Holder would need to remove the Worker's Hold Off prior to closing the breaker or opening the valves and operating the equipment.

2.3.3 A Worker's Hold Off can only be placed over a Local Control Tag. It cannot be placed by itself.

EXAMPLE OF HOLD OFF TAG



EXAMPLE OF WORKER'S HOLD OFF TAG

Worker's Hold Off

Worker's Hold Off tag to be placed over

2.4 Types of Workers' Protection Assurances

The following types of Workers' Protection Assurances are issued during construction at the Site:

2.4.1 Out of Service (Issued under Hold Off Tag)

2.4.1.1 Energy Status

- Isolated from all normal sources and emergency back-up energy sources.

- This does not relieve the person obtaining the protection of the responsibility for making prescribed tests or observations to assure such person that the equipment is safe to work on. Points of isolation and points not to be changed are tagged, where possible, and those points cannot be changed while the Out of Service is in effect. However, equipment inside the zone of protection and not tagged, may be manually operated or tested, since it is in a de-energized state.

2.4.1.2 Usage: Maintenance, including complete removal and disassembly.

2.4.1.3 Issued to Supervisors or workers when authorized by Custody Authority.

2.4.1.4 Persons Covered: Holder and anyone working directly for or with the Holder.

2.4.1.5 Physical Location of Holder: Does not have to remain on Site property.

2.4.1.6 Duration: No time limitations. Remains in effect until equipment is ready to be restored to service.

2.4.1.7 Predominance: Unlimited number of Out of Services may be issued on a single piece of equipment by various people for various reasons. Multiple tags may be required for isolation.

2.4.2 Restraint

2.4.2.1 Energy Status: Isolated from all normal sources and emergency back-up energy sources.

2.4.2.2 Usage

- The person to whom the Restraint is issued shall have control of the application of test energy in that such person's consent must be obtained before applying external energy of any magnitude, and such person must be informed when the test is completed. The person shall be familiar with the status of the equipment at all times, and to the extent the person shall be responsible for seeing that other persons working on equipment with such person or under such person's specific direction are protected against the application of test energy.
- The operator of the high-energy source will direct test and connections required, following established standards or procedures or in special cases, specific instructions of the Functional Authority. The operator of the high-energy test source will communicate directly with the person who has the Restraint, but the operator may at no time apply energy until the Holder of the Restraint has given the operator permission to proceed.

2.4.2.3 Issued to: Supervisors or workers when authorized by Custody Authority. In cases where several workers will work on the equipment tested, a qualified worker or supervisor shall be designated to act as coordinator on the job, and such person shall obtain the Restraint.

2.4.2.4 Persons Covered: Holder and anyone working directly for and with the Holder.

2.4.2.5 Physical Location of Holder

- Must remain on Site property and in control of the job. If the Holder leaves the site of the test, such person must remain "on-call." The Holder shall not release the Restraint until all persons are removed from the equipment and informed of the intended release.
- The performance of maintenance will be permitted simultaneously with testing on equipment, provided that adequate safety can be maintained between the two jobs.
- If electrical testing is required, the procedures set forth in the System Operating Manual under Restraint, Item 207, will be followed.

2.4.2.6 Duration: Released before Holder goes off duty for the day.

2.4.2.7 Predominance: Only one Restraint and no other WPA.

2.4.3 Local Control

2.4.3.1 Definition: The authority granted to a person (other than a regular operator) that permits such person to operate or direct operation of equipment and gives such person the assurance that no operations will be performed on the equipment unless requested or personally approved by such person.

2.4.3.2 Energy Status: May or may not be de-energized. This is why different tags are used. The Functional Authority's Hold Off is not in place for this type of WPA.

2.4.3.3 Usage: Short duration maintenance or troubleshooting.

2.4.3.4 Issued to: Supervisors or workers when authorized by Custody Authority. Worker must give the reason for the request. Worker must specify if equipment is to be energized or isolated for such person.

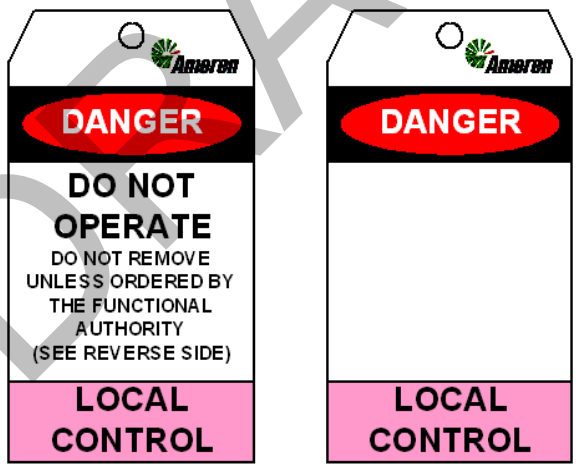
2.4.3.5 Persons Covered: Holder and anyone working directly for or with the Holder.

2.4.3.6 Physical Location of Holder: Must remain on site property and in direct control of the job since such person is responsible for the safety of such person's workers.

2.4.3.7 Duration: Released before Holder goes off duty. New equipment before acceptance has no time limit.

2.4.3.8 Predominance: Only one Local Control and no other WPA.

EXAMPLE OF LOCAL CONTROL TAG



2.4.4 Clearance

2.4.4.1 Usage: Used whenever it is necessary to completely isolate a system or piece of equipment from its normal energy sources (including any emergency back-up energy sources) to perform the desired work.

2.4.4.2 Issued to: Supervisors or Workers when authorized by Custody Authority.

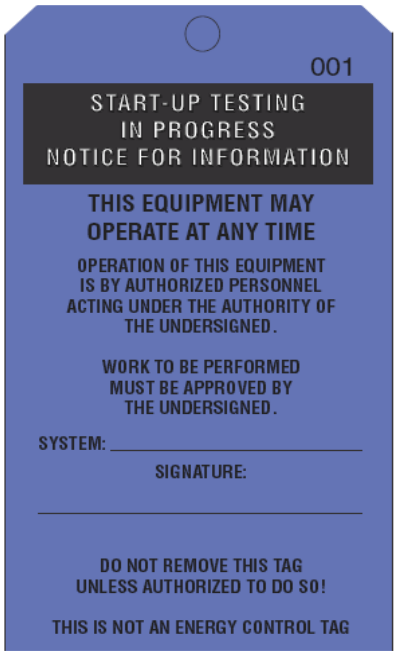
2.4.4.3 Persons Covered: Holder and anyone working directly for or with the Holder.

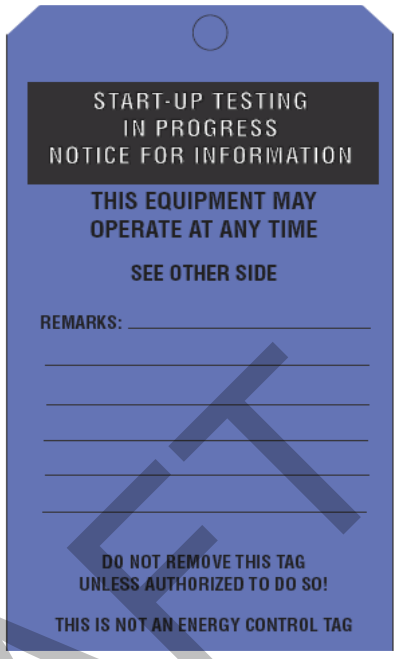
2.4.4.4 Physical Location of Holder: Must remain on site property and in direct control of the job since such person is responsible for the safety of such person's workers.

2.4.4.5 Duration: Released before Holder goes off duty.

2.4.4.6 Predominance: None. An unlimited number of Clearances may be issued concurrently on a system or piece of equipment. Clearances may also be issued concurrently with Out of Services.

2.5 System Under Test





2.6 Exception

2.6.1 If a person holding WPA on a piece of equipment is not available and it is necessary because of a site or system emergency to place that piece of equipment in service, the WPA can be released to the Operating Authority by a person designated by the Holder of the WPA provided that:

2.6.1.1 Every attempt has been made to contact the holder of the WPA

and

2.6.1.2 A thorough examination by the person releasing the equipment reveals the equipment to be in proper operating order.

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ATTACHMENT B.4.2

CONSTRUCTION WORKERS' PROTECTION ASSURANCE AUTHORIZATION

Date: _____

Operating Supervisor: _____

The following person(s) has authorization to receive W.P.A.: _____

Project Name: _____

Company Name: _____

Company Address: _____

Name	Title	Office	Cell	Home	E-Mail

	Beginning		Ending	
	Date	Time	Date	Time
Expected Duration:				

Training is Required for Automated WPA System.

_____
Energy Center Manager or Designee

(Designee: Admin. Supt., Operations Supt., Maintenance Supt., Planning/Scheduling, or Operations Supv. {Watch})

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ATTACHMENT B.4.3

Types of WPA Authorities

1.0 CUSTODY AUTHORITY

1.1 Custody Authority is the person responsible for and "in charge" of all equipment in a system or site (usually the site manager).

2.0 JURISDICTIONAL AUTHORITY

2.1 Jurisdictional Authority is the individual or group of individuals responsible for the overall direction and coordination of Owner system equipment.

2.2 Jurisdictional Authority of Energy Center Equipment (coal pile to turbine) is the Energy Center Operating Supervisor.

2.3 Jurisdictional Authority (generator to Electrical System) is the Transmission Dispatcher / Power Dispatcher.

3.0 FUNCTIONAL AUTHORITY

3.1 Functional Authority is the individual or group of individuals who perform or direct someone else to perform detailed operations, such as switching or valving.

3.2 Functional Authority of most site equipment (coal pile to turbine) is the Operating Supervisor.

3.3 Functional Authority (Electrical System) is the Transmission Dispatcher.
In a site, only the Operating Supervisor present in the Control Room, will approve and issue a WPA.

4.0 FUNCTIONAL AGENTS

4.1 One type of Functional Agent is the Unit Operating Engineer (UOE) who creates the documentation.

4.2 Another type of Functional Agent is the site Operating Engineer (POE) who performs the work and hangs the tags.

The UOE and POE always perform the above duties – never Contractor personnel.

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ATTACHMENT B.5.1

Barricade Tag

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ATTACHMENT B.6.1

INCIDENT/ACCIDENT INVESTIGATION REPORT

Date of Accident: _____ Time of Accident: _____ Job Number: _____

Contractor Company Name: _____ Date of Investigation: _____

Location of Accident: _____

Did injury result? Yes/No,: _____ Involved Employee Name(s): _____
Involved Employee SS Number _____

Employee Job Classification or Skill: _____ Years In this Skill: _____ Years With Company: _____

Describe Type of Injury: _____

Body Part(s) Involved, If applicable: _____

Injury Classification per OSHA 29CFR1904: _____

Was property damaged? Yes/No _____ Describe damage/owner: _____

Is damaged property secured/maintained? Yes/No _____ Person Maintaining _____

Names of Witnesses/Co-workers (With Social Security No.): _____

Weather/Wind Conditions: _____

List/Describe Personal Protective Equipment (PPE) in use by person exposed or injured.

_____

Chemicals Involved:

Name(s) of Chemicals Encountered: _____

_____

Form of Chemicals (Solids, Liquid, Dust, Mist Fume): _____

Describe Radiological Materials (if any): _____

Volume or Quantity Released: _____

Description of Accident: _____

_____

_____

_____

(continued on next page)

INCIDENT/ACCIDENT INVESTIGATION REPORT (continued)

Contributing Factors: _____

What **Corrective Actions** Were Taken to Secure the Scene? _____

Corrective Actions Being Taken to Prevent Recurrence:

Action Item:	List Responsible Person & Target Date for Implementation Name:	Date:

Job being performed at time of incident/accident: _____

Was permit required for task being performed? Yes/No _____

If so, was permit issued? Yes/No _____ If yes, attach a copy of permit in effect at time of accident.

Indirect cause of accident: _____ _____ _____

Investigation Team Members:

Injured/Involved:	Name		Signature
Supervisor:	Name		Signature
Owner SPOC	Name		Signature
S&H Representative	Name		Signature
Name (Others)	Title		Signature
Name (Others)	Title		Signature

Contractor Representative(s) Contacted: _____

Owner Representative(s) Contacted: _____

*Attach additional sheets and supplemental data & information as necessary.

**Distribution: Original must be filed on-site; 1 copy must be sent promptly to the Corporate S&H Dept.
Must Notify: CCMI and Huntleigh McGehee

ATTACHMENT B.6.2

WITNESS STATEMENT

Name: _____ Title: _____

Social Security Number: _____ Date: _____ Time: _____

Temporary Address: _____ Phone: _____

_____

Permanent Address: _____ Phone: _____

_____

Location at Time of Accident: _____

Your statement shall include, to the best of your knowledge, detailed facts relative to the following five categories:

5.1 What happened just before, during, and just after the incident?
5.2 When did it happen?
5.3 Where did it happen?
5.4 Why do you think it happened?
5.5 Who was involved?

_____
Signature

ATTACHMENT B.6.3

FIRST AID REGISTER

Company: _____ Project Name /Number: _____ Jobsite Location: _____

Month /Year: _____ Site Manager: _____ Page: _____ of _____

Date	Time	Name	Supervisor/Foreman	Type of Injury, Body Part, and Brief Description of Accident	*Class

***Class** = Classification **FAV** = First Aid Visit **E1**= Doctor's Visit **REC** – OSHA Recordable **Other**:

ATTACHMENT B.6.4

MONTHLY CONTRACTOR ACCIDENT STATISTICS REPORT

Month: _____ Project Name: _____

Contractor Name: _____

Work hours for the month: _____ Work hours year-to-date: _____

Number of First Aid only cases: _____

Number of injuries & illnesses that received treatment by a physician: _____

Total number of OSHA Recordable injuries & illnesses for the month: _____

Number of restricted duty cases: _____ Number of lost time (days away) cases: _____

Number of motor vehicle accidents: _____ Number of miles driven: _____

Please list injuries and illnesses, which have occurred to personnel of your company on the above project this month. Include accident cause, injury/illness suffered and current disposition of injured/ill personnel (i.e., returned to work, still off work, awaiting surgery, etc.):

_____

_____

_____

_____

_____

_____

_____

_____

_____

Person completing report: _____ Title: _____

Date: _____ Signature: _____

Please submit this report to the SPOC on above project by the second business day of each month, for the preceding month's work activities.

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ATTACHMENT B.6.5

NOTICE OF SAFETY & HEALTH NON-COMPLIANCE

To: _____ Site Representative for: _____

Your company has been found to be in non-compliance with one or more Federal, State, or Owner S&H requirements as specified below. This S&H con-compliance must be corrected immediately for your company to meet the requirements of your contract.

Item # Item of non-compliance

_____ _____

_____

_____

Applicable S&H Requirement _____

_____ _____

_____

_____

Applicable S&H Requirement _____

_____ _____

_____

_____

Applicable S&H Requirement _____

_____

Issued By: _____ _____
Signature of the SPOC Date

Received By: _____ _____
Signature of Representative Receiving Notice Date

cc: Superintendent-Construction Management Services
Safety Supervisor
Energy Center Outage Manager

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ATTACHMENT B.6.6

WARNING LETTER OF SAFETY & HEALTH NON-COMPLIANCE

Project Name and Number _____

Your firm, _____, has been found to be in violation of your contract by non-compliance with applicable Federal, State, or Owner S&H requirements.

On _____ , in accordance with the Owner S&H Adherence Policy, your representative, _____ , was given a Notice of S&H Non-Compliance (copy attached). This notice specifies areas where your company does not comply with Federal, State, or Owner S&H requirements, and requests that these items be corrected immediately. If they are not corrected, more stringent measures will be taken in accordance with Owner S&H Adherence Policy.

Thank you for your prompt attention to this matter.

_____ _____
Signature of the SPOC Date

cc: Superintendent-Construction Management Services
Safety Supervisor
Energy Center Outage Manager

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ATTACHMENT B.6.7

WRITTEN NOTICE OF TEMPORARY JOB SUSPENSION

Your company, _____, while working on the _____ project, has been notified of S&H performance deficiencies in accordance with Owner's S&H Policy. Despite these written notifications requesting that immediate corrective action be taken to improve your S&H performance, improvement has not occurred.

Therefore, in accordance with Action Level Two of the Owner S&H Adherence Policy, we are hereby notifying you that after securing your equipment, job activities on the project named above are to cease. Activities on this project may be resumed only after your company meets requirements set forth in the Owner Adherence Policy.

_____	_____	_____
Signature of the SPOC	Time	Date

cc: Superintendent-Construction Management Services
Safety Supervisor
Energy Center Outage Manager

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ATTACHMENT B.6.8

CONTRACTOR SAFETY & HEALTH DATA FORM

1. S&H PERFORMANCE HISTORY

A. Interstate or Intrastate Worker's Compensation Experience Modification Rate (EMR), as shown on Workers Compensation Insurance Policy for three most recent years.

Year	EMR	*WH/CL

*If self-insured, provide employee Work Hours per Claim. (WH/CL)

THE FOLLOWING DATA FOR LAST THREE (3) YEARS FROM CONTRACTOR'S OSHA LOG

		Year		
B-1.	Employee hours worked			
B-2.	Fatalities (Column G of OSHA 300 log). Attach explanation for any fatalities.			
B-3.	Cases involving days away from work (Column H of the OSHA 300 Log)			
B-4.	Job transfer or restricted duty cases (Column J of OSHA 300 log)			
B-5.	Cases defined as other recordable cases (Column J of OSHA 300 Log)			
B-6.	Total # of cases for B-2, 3, 4 & 5 above.			
B-7.	"OSHA Incidence Rate" – Formula: Total Recordable Cases x 200,000 / Total # of work hours.			
B-8.	Citations by OSHA and/or other S&H regulatory agencies in past 3 years (provide details of each)			
C-1.	Motor vehicle accidents.			
C-2	Miles driven per year, total fleet.			

(continued on next page)

		Yes	No
2.	Do you have a written hazard communication program?	☐	☐
	Do you have a written S&H program?	☐	☐
	Do you have a written company substance abuse program?	☐	☐
	Do you have a written respiratory protection program?	☐	☐
3.	Do you have one or more full time:		
	A. Physicians	☐	☐
	B. S&H Professionals	☐	☐
	C. Industrial Hygienists	☐	☐
4.	Do you have a new employee orientation program?	☐	☐
	I it include the following?		
	A. Company S&H Policy	☐	☐
	B. Company S&H Rules	☐	☐
	C. S&H Meeting Attendance	☐	☐
	D. Company S&H Record	☐	☐
	E. Hazard Recognition	☐	☐
	F. Hazard Reporting	☐	☐
	G. Injury Reporting	☐	☐
	H. Personnel Protective Equipment	☐	☐
	I. Respiratory Protection	☐	☐
	J. Fire Protection	☐	☐
	K. Housekeeping	☐	☐
	L. Toxic Substances	☐	☐
	M. Electrical Safety	☐	☐
	N. Safety Harnesses and Lifelines	☐	☐
	O. First Aid	☐	☐
	P. Driving Safety	☐	☐
	Q. Lockout/Tagout	☐	☐
	R. Ladder/Stairway Safety	☐	☐
	S. Hearing Conservation	☐	☐
	T. Trenching and Excavation	☐	☐
	U. Asbestos Awareness	☐	☐
	V. Lead Awareness	☐	☐
5.	Do you have a training program for newly hired or promoted first line supervisors?	☐	☐
	I it include the following?		
	A. Hazard Recognition	☐	☐
	B. Safe Work Practices	☐	☐
	C. S&H Supervision	☐	☐
	D. New Employee Orientation	☐	☐
	E. Tailgate/Toolbox S&H Meetings	☐	☐
	F. First Aid Procedures	☐	☐
	G. Emergency Procedures	☐	☐
	H. Incident Reporting	☐	☐
	I. Accident Investigation	☐	☐

(continued on next page)

6. How often do you hold periodic S&H meetings for your foremen/supervisors?

   A. Weekly ☐ C. Bi-Weekly ☐

   B. Monthly ☐ D. Less Often, As Needed ☐

7. Do you conduct field S&H inspection of work in progress? Yes ☐ No ☐

   A. If yes, who conducts the inspection? _____

   B. How often? _____

		Yes	No
8.	Are accident reports circulated to your management?	☐	☐
9.	Is S&H a (documented) weighted factor in evaluating the performance of:		
	A. Foreman	☐	☐
	B. Supervisor	☐	☐
	C. Management	☐	☐
10.	Does your firm hold “Toolbox S&H Meetings?	☐	☐

How often?

A. Weekly ☐

B. Bi-Weekly ☐

C. Monthly ☐

D. Less Often, As Needed ☐

11. List the most senior staff S&H professional at your company.

Name: _____ Title: _____ Phone: _____

12. List the person to contact to discuss the details of the information contained in this document.

Name: _____ Title: _____ Phone: _____

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ATTACHMENT B.7.1

CRANE MAINTENANCE SAFETY CHECKLIST

DATE: _____ CRANE: _____

JOB NUMBER/ LOCATION: _____

TASK: _____

☐ Has a Total Hazard Analysis (THA) been completed today? YES ☐ NO ☐

Comments: _____

_____

☐ Is access to work area established? YES ☐ NO ☐

Comments: _____

_____

☐ Is all safety equipment on hand and functioning properly? YES ☐ NO ☐

Comments: _____

_____

☐ Have lines of communication between operator and affected personnel been established (visual &/or verbal)?

Comments: _____

_____

☐ When servicing the crane (including crane lubrication), the operator must lower all loads to the ground, and move all controls to OFF. The engine MUST be stopped before the crane is serviced. The operator is to attach a WARNING sign to the engine start control to warn personnel that crane is being serviced and must not be started.

Comments: _____

_____

☐ Do not operate crane until all safety guards and covers are securely reinstalled and all maintenance equipment is removed.

Comments: _____

_____

☐ Before operator enters cab of crane, the affected personnel must be at a minimum safe distance of two feet from any moving parts.

Comments: _____

_____

Additional Comments: _____

_____

CREW SIGNATURES:

_____ _____

_____ _____

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ATTACHMENT B.7.2
CRITICAL LIFT PLAN

1.0 Contractor shall provide a detailed lifting and rigging plans for all lifts identified as critical. All critical lifts will require a Professional Engineer's seal. Prior to executing lift, lift plans must be submitted to the Project Engineer, reviewed, and accepted by a structural engineer in the POS Civil/Structural Group. Owner will review submittals for general design features. Contractor is responsible for accuracy of calculations. Prior to executing lift, any changes made in the field to the approved lift plan must be approved by the Contractor's engineer and accepted by the Owner POS Project and Structural engineers. A copy of the lift plan must be onsite during the lift and must have been reviewed with all personnel involved with the lift, including the Owner Construction Supervisor. Owner's Construction Supervisor shall be provided sufficient notice to allow the Supervisor to witness the critical lift.

2.0 A critical lift plan shall contain the following, as applicable:

2.1 Identify the items to be lifted.

2.2 Weight of the lifted item and total weight of the load (for mobile cranes, see the manufacturer's instructions regarding components and attachments that must be considered as part of the load).

2.3 Center of gravity location.

2.4 Documented step-by-step instructions.

2.5 Special precautions, if any (such as outrigger or track cribbing for mobile cranes).

2.6 Evaluation of hazards associated with the lift that include ground support, soil conditions, allowable soil bearing capacity, underground utilities that could be damaged or suddenly collapse, maximum permissible wind speed and any other physical obstruction.

2.7 A list of each piece of equipment (e.g., crane, hoist, fork truck), accessory, and rigging component (e.g., slings, shackles, spreader bars, yokes) to be used for the lift. (This list shall identify each piece of equipment by type and rated capacity).

2.8 Designated checkpoints, hold points and estimated instrument readings, as relevant, so that job progress can be checked against the plan.

2.9 Rigging sketch(es), which include the following:

2.10 Lift point identification

2.11 Method(s) of attachment

2.12 Load vectors

2.13 Sling angles

2.14 Accessories used

2.15 Other factors affecting the equipment capacity

2.16 Rated capacity of equipment in the configuration(s) in which it will be used. (For cranes, many factors affect rated capacity, including boom length, boom angle and work area.)

2.17 Percentage of the total weight of the lift to the rated capacity of the equipment in the configuration(s) in which it will be used (see above). Owner best practices recommend limiting this percentage to less than 90% and shall not exceed 95%.

2.18 If rigging points are attached to existing structural steel, it is the responsibility of the contractor's engineer to confirm that the additional loads do not overstress the existing structure, and to design additional

bracing/reinforcement if required. Supporting calculations sealed by a Missouri Professional Engineer shall be included with the critical lift plan.

2.19 A load-path sketch that shows the load path and height at key points in the job. (For lifts with mobile cranes, include the crane position(s) relative to the load and relative to surrounding obstructions.) Where appropriate, include floor-loading diagrams.

2.20 A sketch indicating lifting and travel speed limitations. (This may be noted on the load path sketch or on a separate sketch.)

2.21 A sign-off sheet to verify that all inspections/tests required by OSHA are current for all equipment and rigging.

2.22 The lift plan shall provide specific information for each lift when multiple items of varying weights and/or shapes are included in the lift plan unless an exception is approved by the Owner structural engineer.

ATTACHMENT B.7.3
ELEVATED PLATFORM SAFETY REQUIREMENTS

1.0 Contractor Superintendent shall place special emphasis on two areas to address guardrail safety.

1.1 Conduct periodic walk-downs and inspections of elevated platforms to ensure proper guardrails are in place.

1.1 Apply additional measures to designated areas within 6' of guardrails with a potential fall distance of greater than 6' to a lower level where or when work is taking place that could result in being struck or otherwise result in falling over or between rails of guardrail.

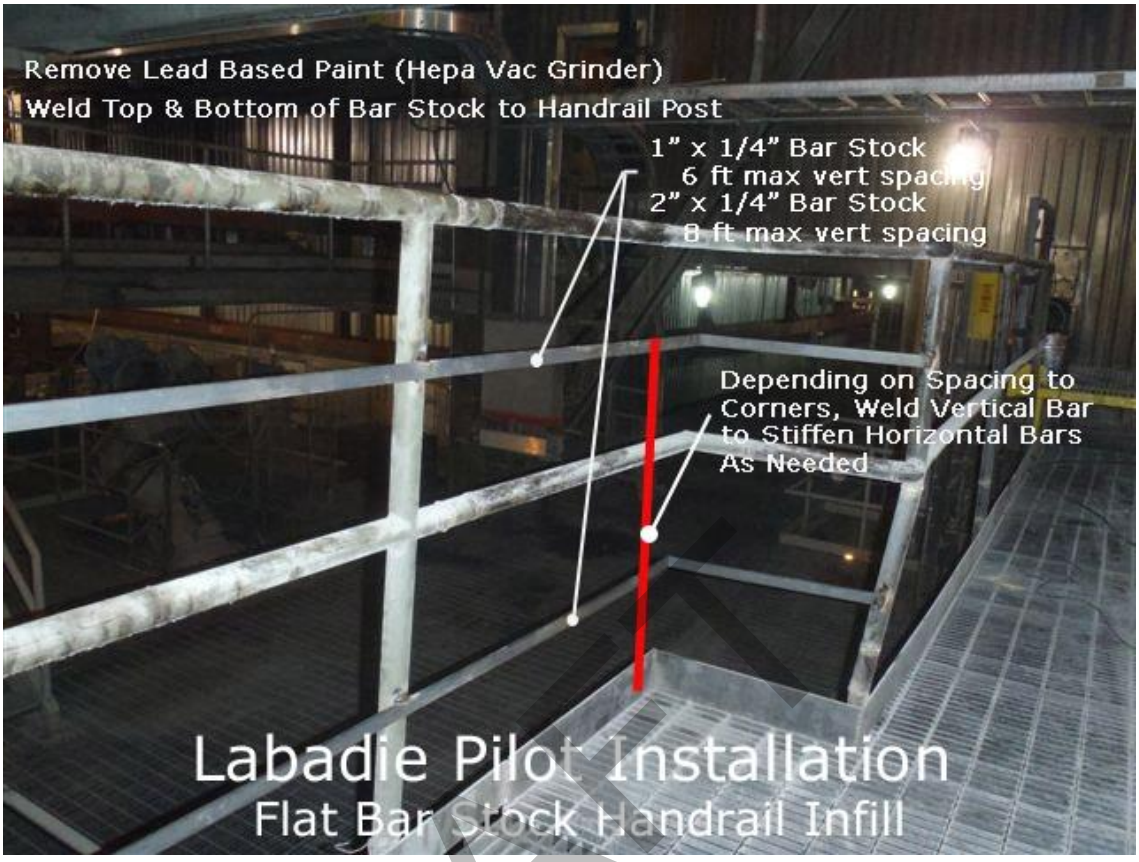
2.0 Barriers shall be provided to prevent materials from falling from the platform.

3.0 Contractor, Construction Supervisor or Owner's Engineer can identify areas where additional measures on a permanent basis are to be implemented. Target areas include:

- Stair landings
- Crosswalks between units
- Areas as identified by engineering/Site safety personnel where work activities are performed that could result in being knocked through or falling over a guardrail
- Ladders where the base is within 6' of a guardrail and a potential fall to a lower level exists, (install railing/cage to prevent fall to lower level)
- Areas where ladders lead to a platform and a swing gate does not currently exist (ensure swing gates are installed in these areas)
- Other specified areas within 6' of a guardrail as approved by engineering/site safety personnel where work is performed that involves probability of sudden movement impact, or where forces are exerted that could result in falling through a guardrail (e.g., some long lance platforms and some large valve locations)

4.0 Various permanent solutions may be acceptable. Owner's engineer may specify permanent solutions in scope of work section of the specification. Contractor may also submit for approval permanent alternatives based on the best application. The Construction Supervisor or Project engineer will review and approve the temporary and alternative permanent solutions submitted by the Contractor. Examples of permanent solutions are:

- Welding flat stock horizontally midway between the top & mid rail and midway between the mid rail and top of toe plate. Size of the flat bar stock is based on max spacing of the vertical guardrail/handrail posts.
- Max 6'-0 spacing between vertical guardrail/handrail posts (Labadie) Use 1" x ¼" flat carbon steel bar stock (refer to photo below)
- Max 8'-0 spacing between vertical guardrail and handrail posts Use 2" x ¼" flat carbon steel bar stock (refer to photo below)



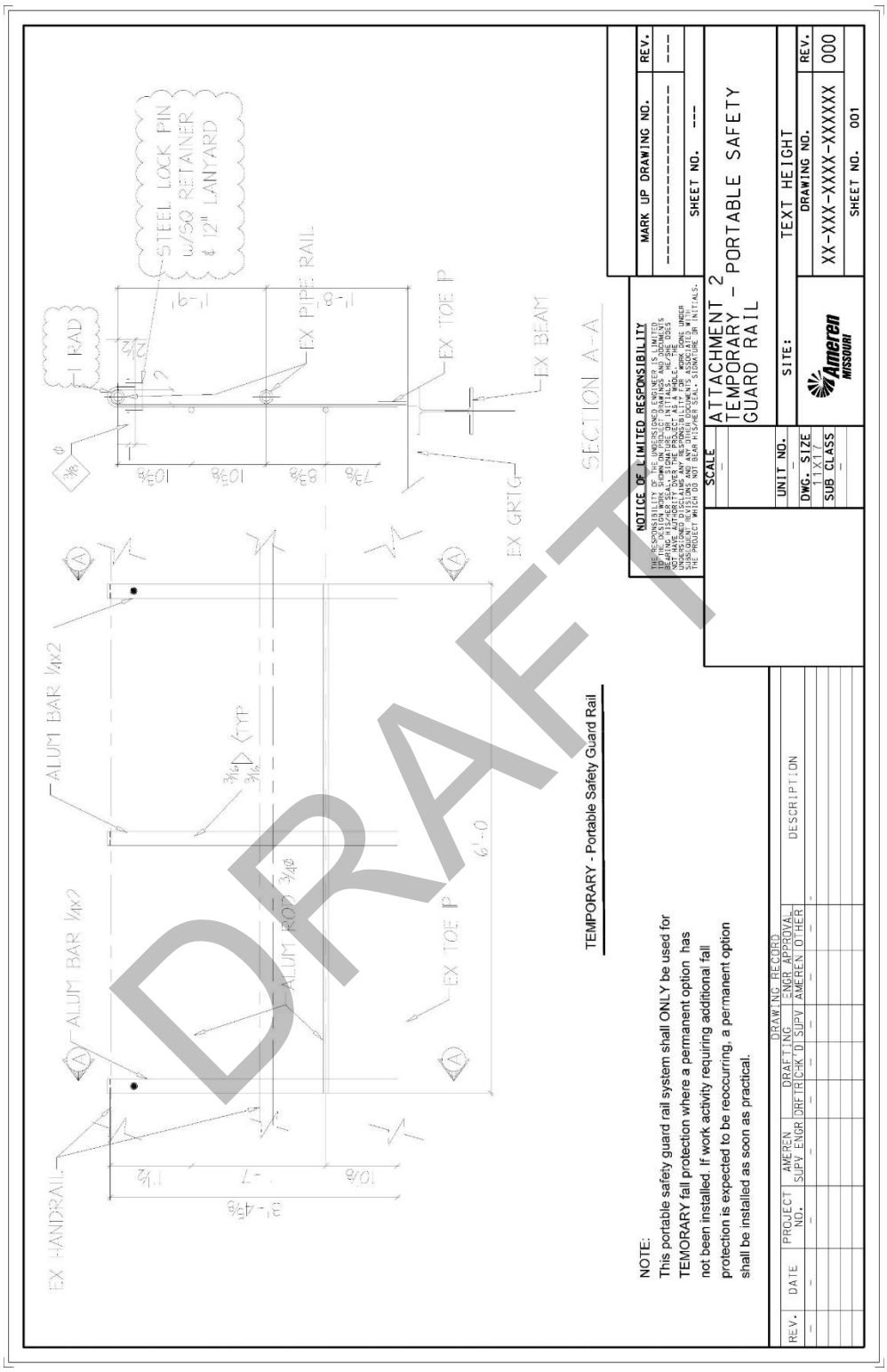
NOTE: Several installation issues were encountered during a trial application of this option, at Labadie. This option is NOT RECOMMENDED.

- Flat or smooth expanded metal
- Other designs as approved by the Construction Supervisor or SPOC.

5.0 In cases where permanent solutions are not installed, Contractor must apply temporary solutions per its plan to address identified elevated platform hazards while conducting work.

Examples of temporary solutions include:

- Pre-fabricated portable safety guard rail (refer to drawing on page 3 of this appendix)
- "J" Clamp-on flat stock design, providing an additional lower-middle and upper-middle rail
- Cargo or "snow" fence
- Netting consisting of the 3/8" approximate mesh
- Clamp-on type solutions, such as flat stock clamped on with U-type clamps
- Utilizing fall protection opposed to barriers, as determined by local safety personnel


STEEL LOCK PIN
W/SQ RETAINER
& 12" LANYARD
EX PIPE RAIL
EX TOE P
EX BEAM
EX GRTG
SECTION A-A
ALUM BAR 1/4X2
ALUM ROT 3/4ø
EX HANDRAIL
EX TOE P
TEMPORARY - Portable Safety Guard Rail
NOTE:
This portable safety guard rail system shall ONLY be used for TEMORARY fall protection where a permanent option has not been installed. If work activity requiring additional fall protection is expected to be reoccurring, a permanent option shall be installed as soon as practical.
NOTICE OF LIMITED RESPONSIBILITY
MARK UP DRAWING NO.
SHEET NO. ---
SCALE
ATTACHMENT 2
TEMPORARY - PORTABLE SAFETY GUARD RAIL
UNIT NO.
SITE:
TEXT HEIGHT
DWG. SIZE 11X17
DRAWING NO. XX-XXX-XXXX-XXXXXX
SUB CLASS
SHEET NO. 001
REV. 000
DRAWING RECORD
REV. DATE PROJECT NO. DRAFTING ENGR APPROVAL DESCRIPTION
SUPV ENGR DFTR CHK'D SUPV AMEREN OTHER

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ATTACHMENT B.7.4
CONFINED SPACES REQUIREMENTS

1.0 Contractor shall comply with all OSHA requirements for work in permit-required Confined Spaces. Contractor shall obtain information from the SPOC on the location and other pertinent information regarding Confined Space entry. Any entry involving both Contractor and Owner personnel shall be coordinated through the SPOC. Below is a representative list of identified Confined Spaces at Owner sites. The below list shall be used as a guide and not be considered a complete list.

2.0 Confined Spaces shall be considered permit-required Confined Spaces until the space has been properly evaluated and the space can be downgraded to a non-permit space. Any Confined Space has the potential to become a permit-required Confined Space based on work activities occurring in the space, or as conditions change throughout the course of any work activity.

Accumulator Air/Oil Tanks	Combustion Turbine Inlet/Exhaust Duct Work	Manholes, electrical
Accumulator Acid Tank	Compressed Air Receivers	Manholes, sewer/drains
Air Heaters	Condenser (steam side, waterboxes, Hotwell) Condensate Tanks	Nitrogen Storage Tanks
Air Heater Hoppers	De-aerators	Oil Circuit Breaker
Ammonia Tanks	Demineralizer Tanks	Oil Separator Tanks
Ash Hoppers	Diesel Fuel Oil Tank	Penstock
Blow-off Tank	Draft Tube	Precipitators
Boiler Drums	Ductwork	Pits
Boiler – Auxiliary, Main	Dust Collector Bag House Structure	Rail Receiving Silos
Boiler - Upper and Lower Dead Air Space	Dust Suppression Storage Tanks	Scroll Chambers
Cable Vaults	Economizer Hoppers	Sewage Treatment Pump Station
Carbon Dioxide Storage Tank	Elevator Pits Fans	Silos
Caustic Tank	ID and FD	Stack, annulas between grating levels
Chemical Cleaning Surge & Waste Tanks	Feedwater Heaters	Strainer, basket (if working inside)
Chutes (when working inside)	Flash Tanks	Sumps - clean, dirty
Circulating Water Intake Wells	Flyash Silo	Surge Bins
Circulating Water Pipes	Generator Enclosure	Surge Bin Feeders
Circulating Water Pump Discharge Room	Gypsum Slurry Tank	Tanks
Clarifiers	Hoppers (when working inside)	Transformers (when entered)
Coal Handling Transfer Chutes	HPBFP Turbine Exhaust Duct	Tunnels, conveyor (when ventilation is not on)
Coal Handling Feeders	HPBFPT Oil Reservoirs	Turbine
Coal Mill Exhauster	Hydrogen Storage Tanks	Turbine Oil Reservoir
Coal Mill Reject Area	Intake Cells	Turbine Steam Piping
Coal Mills	Lime Silos/Storage Domes	Urea Tank
Coal Bunkers/Silos	Lime Slurry Storage Tanks	Water Tanks

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ATTACHMENT B.7.5

GRINDER SAFETY PLAN

Grinder Guard and Handle Removal PRE-PLAN

Date:	**Job #:**
Customer/Site:	**Location of Work/Unit:**
Description of Task:	**Equipment Identification:**

SCOPE OF WORK AND SCHEDULE (Please list complete description of task)

HAZARD ASSESSMENT TO DETERMINE ALTERNATE TOOL

procedures require a pre-plan whenever personnel remove the guard and handle on a grinder.

Reason:

- Grinding wheel cannot access point of work with guard and handle attached due to narrow gap for welding.

Alternate Methods to Removing Guard and/or Handle:

- Rotary file and die grinder?
- Conical grind stone and pole grinder?
- Other?

SAFETY PRECAUTIONS

- ❑ Cutting wheel CANNOT be used while guard and handle are detached.
- ❑ Grinder must be unplugged when removing guard and handle and when re-attaching.
- ❑ Guard and handle are only to be removed for this specific point of work. All other grinding in the work area must have safety devices attached.
- ❑ Pre-plan will only apply until the weld depth improves to allow for standard grinding operation, i.e. all safety devices attached.
- ❑ Wear face shield and sealed eyewear.
- ❑ Maintain control of grinder at all times, use two hands when operating the grinder.
- ❑ Keep hands/fingers clear of upper portion of the grinder near the wheel.
- ❑ Be aware of body positioning.

AFFECTED PERSONNEL INVOLVED IN WORK MUST READ AND SIGN THIS PRE-PLAN

PRE-PLAN REVIEW SIGN-IN

Employee Classification/Craft	Name (Print)	Signature	Date
1.			
2.			
3.			
4.			
Supervisor/Foreman			
Safety Representative			

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ATTACHMENT B.7.6

POWER OPERATIONS HOT WORK CHECKLIST *(EXAMPLE)*

1. DESCRIPTION – JR# _____

Location _____ Elevation _____
Work to be done: Welding _____ Brazing _____ Open Flame Cutting / Heating _____
Equipment _____

NOTE: Before authorizing welding, cutting, heating, and brazing, this checklist must be completed.

2. PRE-WORK INSPECTION

Hot Work shall not be performed in the following situations:

a. In areas not authorized by Management.

b. In sprinklered buildings while such protection is impaired, unless authorized by Management.

c. In the presence of explosive atmospheres or explosive atmospheres that may develop inside unclean or improperly prepared tanks, pipes or equipment.

d. In areas near the storage of large quantities of exposed, readily ignitable materials.

Prior to welding, cutting heating, and brazing (W/C/H/B), you shall perform these basic precautions:

a. Move the object to be W/C/H/B to an area free of hazards.

b. If the object to be W/C/H/B cannot readily be moved, then you shall remove all movable fire hazards within the vicinity to a safe place.

c. If the object to be W/C/H/B cannot be moved and if all the fire hazards within 35 feet cannot be removed (including cable trays), then, immovable fire hazards shall be shielded and a fire watch provided.

IF THESE BASIC PRECAUTIONS ARE NOT FOLLOWED, WELDING, CUTTING HEATING AND BRAZING SHALL NOT BE PERFORMED. COMPLETE CHECK LIST.

3. ADDITIONAL FIRE WATCH PROVISIONS

N/A	YES	NO		
			a.	Can more than a minor fire develop?
			b.	Are combustible materials closer than 35-ft. to the point of operations?
			c.	Are combustible materials more than 35-ft. but easily ignitable by sparks?
			d.	Do wall or floor openings with a 35-ft. radius expose combustible materials in adjacent areas, including concealed spaces in walls or floors?
			e.	Are combustible materials adjacent to the opposite side of metal partitions, walls, ceilings, or roofs and are they likely to be ignited by conduction or radiation?

NOTE: If you answered yes to any of the above, a fire watch is required. Complete checklist. All of the following conditions must be met, if applicable.

(continued on next page)

4. PRECAUTIONS

N/A	YES	NO		
			a.	A fire watch will be provided during and for 60 minutes following welding, cutting, heating and brazing.
			b.	The fire watch shall be supplied with a proper portable fire extinguisher in addition to installed operable Energy Center equipment.
			c.	Cutting and welding equipment is in good condition.
			d.	Combustible materials are protected with covers, guards, or metal shields, or material is removed prior to start of work.
			e.	Nearby workers are suitably protected against heat, sparks, slag and flash.
			f.	Wall or floor openings are covered or enclosures provided. For elevated work, covers are suspended beneath to collect sparks or area below is free of combustibles.
			g.	Enclosed equipment is cleaned of all combustible material and purged of flammable vapors.
			h.	Ducts and /or conveyors are suitably protected or shutdown.
			i.	For work near walls, partitions, ceiling or roofs, proper precautions have been taken to prevent ignition of combustibles inside the barrier of adjacent areas.
			j.	For work on pipes or other metal in contact with combustible walls, partitions, ceilings, or roofs, precautions have been taken to prevent ignition by conduction of heat.
			k.	Other

PRE-WORK INSPECTION

Supervisors Initials	_____	Date	_____	Time _____
Supervisors Initials	_____	Date	_____	Time _____
Supervisors Initials	_____	Date	_____	Time _____
Supervisors Initials	_____	Date	_____	Time _____
Supervisors Initials	_____	Date	_____	Time _____
Supervisors Initials	_____	Date	_____	Time _____
Supervisors Initials	_____	Date	_____	Time _____

POST-WORK INSPECTION

Supervisors Initials	_____	Date	_____	Time _____
Supervisors Initials	_____	Date	_____	Time _____
Supervisors Initials	_____	Date	_____	Time _____
Supervisors Initials	_____	Date	_____	Time _____
Supervisors Initials	_____	Date	_____	Time _____
Supervisors Initials	_____	Date	_____	Time _____
Supervisors Initials	_____	Date	_____	Time _____

DEFINITIONS

1. Combustible Material: Any material that, if in the form and under the conditions used, could ignite and burn.

2. Minor Fire: A fire which, if no action is taken to extinguish it, will self-extinguish (burn out), will not propagate (spread to other materials through the continuity of combustibles), and will not damage any permanent Energy Center equipment.

END OF APPENDIX B

APPENDIX C
CONTRACTOR SITE ENTRY PREREQUISITES / JOB WORKING RULES

1.0 SITE ACCESS, PARKING, SECURITY AND REDUCTION IN FORCE

1.1 Contractor's Employee/Personnel Identification

1.1.1 Owner's security personnel ("Owner's Security") will direct Contractor personnel to Job Working Rules for computer-based training (CBT), as further described below, the first-time personnel report to the Site.

1.1.2 Contractor ID badges containing Contractor employee's name and Contractor ID number are issued when Job Working Rules training is completed. Badges must be visible at all times while on the site.

1.1.3 Security will re-activate an existing badge if the employee has completed the site Job Working Rules orientation within the last 12 months.

1.1.4 Owner's Security will de-activate badges at the end of each job.

1.1.5 Daily gate logs will be used to validate invoices and may be provided to Contractor upon request. If the Energy Center has an electronic badge reader, a green LED light indicates that arrival/departure times have been recorded and the gate is unlocked. If a badge reader is not available, personnel must sign the gate register when arriving or departing.

1.1.6 Contractor shall provide personnel with hard hats of the same color. The hard hats must have Contractor's name or company logo on either the sides or the front of the hard hat.

1.1.7 Owner's Security will apply labels with employee's first and last names to the front and back of each hard hat.

1.1.8 Contractor may provide a hard hat storage container at the Construction gate. Proper PPE is required to access the site.

1.19 At mobilization, Contractor shall supply to the SPOC the frequencies of all walkie-talkies 2-way radios it intends to use. Frequencies must be listed to four (4) decimal places. (See Attachment C.1.1 Authorization for Contractor Two-Way Radios)

1.2 Vehicles Beyond the Security Gate

1.2.1 Only Contractor work vehicles with an Owner issued mirror tag are permitted beyond the security gate. Contractor can request a mirror tag for vehicles necessary to complete the Work by submitting an Authorization for Site Vehicle Pass form.

1.2.1.1 Vehicles must have Contractor name or Logo on each side and must have an insurance certificate verifying $1,000,000.00 minimum liability coverage.

1.2.1.2 Contractor work vehicles, commercial vehicles, or contract carrier vehicles without a mirror tag will be held at the gate until cleared by the SPOC.

1.2.2 Vehicle drivers and all passengers must swipe/sign-in at the construction gate.

1.2.3 Contractor vehicles leaving the Site will be inspected by Owner's Security.

1.2.3.1 Tools and Materials being removed on Contractor vehicles must have an Owner Material Pass (Form 5532NS) signed by the SPOC and a Contractor supervisor for Security to retain.

1.2.4 The site speed limit is 10-MPH unless otherwise posted.

1.2.5 Contractor personnel may not ride in the back of a truck on the Site or to/from/between job sites unless properly seated with a seat belt.

1.3 Contractor Visitor Access

1.3.1 Business agents, vendor/sales representatives, contractor executives and other Contractor visitors shall park in the construction parking lot and be escorted on site.

1.3.2 Consultant badge holders may park in either the construction parking lot or the Owner employee parking lot visitor space, depending on the purpose of the visit.

1.3.3 A Contractor employee who has completed Job Working Rules training may escort visitors and ensure Job Working Rules are followed.

1.3.4 Contractor visitors are issued a Visitor's badge and are required to wear a hard hat and safety glasses.

1.4 Owner's Security can:

- De-activate / activate a badge when changing Site locations
- Replace a damaged badge or lost badge
- Update the employee's name, Contractor company, or craft.

1.5 Use of Site Facilities

1.5.1 Contractors who have Owner issued computers, phones and fax machines are "Privileged Users" and must comply with the following policies.

- Electronic Mail Policy
- Facsimile Machine Usage Policy
- Information Resources Acceptable Use Policy
- Internet/Intranet Usage Policy
- System Access Control Policy
- Wireless Communication Policy

1.5.2 Work areas must be restored to a condition that is approved by the SPOC.

1.6 General Requirements

1.6.1 Contractor personnel must enter the Site only at the entrance where its company name is posted. Security cameras monitor entrances and inform supervisors of violations.

1.6.2 Contractor employee vehicles must park in construction parking lot or in areas designated for Contractor use.

1.6.3 Contractor personnel must enter and leave through the designated construction gate.

1.6.4 Contractor personnel must check in and out of the Site with their immediate foreman or general foreman.

1.6.5 Lunch boxes, toolboxes, coolers, and other containers are subject to inspection when entering or leaving Owner premises.

1.6.6 All Contractor/Subcontractor personnel must not leave their work areas during assigned work periods. Any reasonable break periods will be established by the Contractor/Subcontractor.

1.6.7 Certain Site locations, including cafeterias, locker rooms, and washrooms, may be posted as OFF LIMITS to construction or Contractor personnel.

1.6.8 Written permission is required before using Owner equipment or tools.

1.6.9 Radios or "boom boxes" are not allowed because they can disrupt communication and distract workers.

1.6.10 Daily cleanup of the work area is required. Owner reserves the right to clean up Contractor's area if Contractor is not fulfilling their housekeeping requirements. Any and all costs associated with the cleanup will be deducted from Contractor's base contract.

1.6.11 Cameras and video recording devices are prohibited unless specifically authorized by Owner management.

1.6.12 Contractor must hold daily job briefings.

1.7 Contractor, Contractor's Site supervisor and all subcontractors are required to sign and deliver a Contractor Agreement of Understanding (See Attachment C**.1.2**).

1.8 Reduction in Force. Contractor shall inform the SPOC when personnel will complete their work on the Site using the Reduction in Force Report (Attachment C.1.3).

2.0 LABOR CONDITIONS

2.1 Contractor's Work shall be performed under the National Maintenance Agreement (NMA), unless an exception is agreed upon in writing by the on-Site Owner, Contractor must furnish a copy of the site extension approval(s) granted by the international union(s). Site extension requests for the NMA may be filed online at www.nmapc.org.

2.2 There shall be no limit on the work output of any worker, and no restrictions on what tools or equipment may safely be used to increase productivity. There shall be no minimum, other than what may be required by safety regulations, on the number of personnel assigned to any crew or to any service.

2.3 Featherbedding practices of any kind will not be tolerated.

2.4 Actual work hours will be agreed upon during pre-job conferences; lunch breaks will be an unpaid one-half hour. No additional organized breaks are allowed. There shall be no non-working stewards. If a steward is included in the labor force, the steward must be a qualified worker and shall exercise no supervisory functions.

2.5 Contractor's personnel must be rested and fit for duty when they report to the Owner's site. Contractor personnel must not work in excess of 16 consecutive hours without prior approval of Contractor's Superintendent and Owner, and then only when additional steps have been taken to ensure worker safety.

2.6 Contractor shall provide break/lunch facilities at a location in close proximity to the majority of the Work, such locations to be approved by the SPOC or other authorized Owner personnel.

2.7 There shall be no slowdowns, illegal strikes, or unauthorized work stoppages of any kind. Contractor understands that its work must be completed in a timely fashion notwithstanding the presence of a labor strike or any pickets at or around the job site.

2.8 In the event that Owner's personnel, another contractor's or subcontractor's personnel or Contractor's personnel engage in a strike or established pickets, Contractor is expected to continue to meet its obligations under the terms of the Contract. Any such picketing activity is not an excuse for non-performance or delay in completing the Project.

3.0 PERSONNEL TRAINING – COMPUTER BASED TRAINING: SPECIFIC EQUIPMENT

3.1 Upon admittance into the Site, Contractor (including each and every personnel or Subcontractor personnel) shall complete the CBT program on the Job Working Rules. The training lasts approximately ¾ hour for the average worker. Personnel cannot begin work until the training is completed.

3.1.1 Personnel must document completion of site specific Job Working Rules training before being allowed unescorted access to the Site.

3.1.2 CBT is typically used for Job Working Rules orientation and to document training. Contractor personnel must read and sign a hard-copy of the Job Working Rules if an orientation video or oral presentation is used for training and take the CBT training when the system is restored.

3.1.3 Contractor shall administer appropriate disciplinary action if its personnel violate Job Working Rules.

3.2 Operators of forklifts, boom lifts, buses, and other mobile equipment must be trained and certified on the operation of the specific equipment.

4.0 DRUG TESTING AND SUBSTANCE ABUSE

ATTENTION: Personnel who refuse to take a drug test or have been found to be non-compliant will be escorted off-site immediately and may be subject to permanent barring from Owner facilities.

4.1 Possession, and/or use of alcohol or drugs, is STRICTLY PROHIBITED.

4.2 Drugs, stimulants, “pep pills,” tranquilizers, and similar substances are allowed only if prescribed by a doctor.

4.3 Owner’s Contractor’s Substance Abuse Policy requires pre-employment and random drug testing of Contractor personnel.

4.4 Contractor must comply with the Drug Testing and Substance Abuse Policy attached as Attachment C.4.

5.0 OWNER'S SMOKING POLICY

In keeping with Owner's corporate values, Owner strives to provide a work environment that promotes and ensures the health and safety of all personnel. Smoking presents known health risks to smokers and non-smokers alike. This policy applies to cigarette, pipe, and cigar smoke, as well as e-cigarettes.

5.1 Persons Affected. This policy applies to all vendors, contractors, and visitors at any Owner facility.

5.2 Policy. Smoking is prohibited in all Owner buildings and any outside posted areas where hazards may exist. Smoking is prohibited within 25 feet from all entrances, exits, windows that open, and ventilation intakes that serve an enclosed area for all Owner locations. Smoking is not permitted in a multi-occupant Owner vehicle or while operating motorized equipment.

5.3 Enforcement. Any violation of this policy may result in the individual being removed or barred from Owner property.

6.0 PERMITS AND LICENSES

6.1 Operations may require an Owner permit. Such activities may include but are not limited to:

- Hot work
- Confined space / vessel entry
- Excavations
- Asbestos and/or lead abatement

Contractor shall determine from the SPOC if any of Contractor’s activities require an Owner permit or Contractor permit.

6.2 Some states and local authorities require permits for activities such as: excavations, heavy lifts, asbestos/lead abatement, air permits, water permits, hazardous waste generation, etc. Contractor shall be responsible to secure and comply with these permits, unless the SPOC has delegated this to others in writing.

7.0 AMEREN WORKPLACE POLICIES

Contractor must comply with **EQUAL EMPLOYMENT OPPORTUNITY AND ANTI-HARASSMENT POLICY** (Attachment C.6.1) and **WORKPLACE VIOLENCE POLICY** (Attachment C.7.2) attached.

8.0 EVACUATION PLAN

8.1 If there is an emergency, an evacuation announcement may be made over the Site's public address system. The evacuation assembly area shall be communicated during orientation training.

8.2 In the event of severe weather, an announcement to seek shelter may be made over the public address system. The location of the Site tornado shelter shall be communicated during orientation training.

Attachments for Appendix C
Attachment C.1.1: Authorization for Contractor Two-Way Radio
Attachment C**.1.2**: Contractor Agreement of Understanding
Attachment C.1.3: Contractor Reduction in Force Report
Attachment C.4: Drug Testing and Substance Abuse Policy
Attachment C.6.1: Equal Employment Opportunity And Anti-Harassment Policy
Attachment C.7.2: Workplace Violence Policy

ATTACHMENT C.1.1

AUTHORIZATION FOR CONTRACTOR TWO-WAY RADIOS (SAMPLE)
All frequencies must <u>NOT</u> fall between the two ranges of frequencies: 463.5500 to 463.5700 MHz (Energy Center-Specific) 464.5500 to 464.5700 MHz (Energy Center-Specific) • When reporting the frequency, you must include digits four places past the decimal point (e.g., 123.4567). • If a repeater is being used, you must report both transmit and receive frequencies. • If no repeater is being used, receive and transmit frequencies will be the same. • You must submit all frequencies to be used.

CONTRACTOR	
CONTRACTOR REPRESENTATIVE	Print Name
RADIO MANUFACTURER OR MAKE	
HOW MANY CHANNELS BEING USED?	
FCC License “Call Sign” e.g. WPUP269	

CHANNEL		RECEIVE FREQ (MHz)	TRANSMIT FREQ (MHz)
1			
2			
3			
4			
5			
6			
7			
8			

Owner SPOC: _____ Contractor Rep: _____

Date: _____ Date: _____

ATTACHMENT C.1.2
CONTRACTOR AGREEMENT OF UNDERSTANDING

(Form CONMGT0)

All Contractors and subcontractors will be required to sign and submit this form prior to entering and/or starting work on any Owner property.

- I have been informed of all expectations regarding Owner Safety / Work rules and ZERO TOLERANCE policies and will immediately investigate and enforce all such rule and policy violations when they are reported or observed.
- I will cooperate to the fullest extent with any Owner management or security person in investigating ZERO TOLERANCE policy violations.
- I am aware that Owner Energy Centers contain asbestos, lead and fly ash. Where necessary, I will abide by all Owner, OSHA, State and Local policies, procedures and ordinances in all abatement, containment, waste-disposal, employee protection and reporting activities.
- I will obtain and promptly submit all of the required permits to the Owner-designated Station Point of Contact (SPOC) prior to starting work.
- I will promptly forward all of the required submittals to the Owner SPOC.
- I will not allow any employee to enter and / or start work on Owner property before first conducting a Safety / Work Rules orientation and ensuring they have all required personal protective equipment.
- I will report all violations / actions taken to the Owner SPOC, on form CONMGT1, each Friday before 9:00 AM.
- I will inform the Owner SPOC of any sub-contractors in my employ and ensure that they are aware of and meet the conditions of this agreement before they enter and / or start work on Owner property and will have them complete this Contractor Agreement of Understanding Form.
- Any personnel found to have violated a ZERO TOLERANCE policy may be removed and barred immediately from Owner property and will not be allowed to return to any Owner property in the future.
- I understand that repeated violation of the Work / Safety rules or ZERO TOLERANCE policies may result in my company's removal from Owner property.

Contractor Company (Print) _____

Contractor Representative (Print) _____

Representative's Signature _____ Date _____

ATTACHMENT C.1.3

CONTRACTOR REDUCTION IN FORCE REPORT

Contractor Name:	
Contractor Supervisor:	
Date Submitted:	
Time Submitted:	

Name of Employee (Please Print)	Badge #	Date of Reduction	Time of Reduction

ATTACHMENT C.4

DRUG TESTING AND SUBSTANCE ABUSE POLICY

1.0 INTRODUCTION

1.1 In an effort to provide a drug-and-alcohol-free workplace, Owner establishes the following policy for Contractors.

2.0 SCOPE

2.1 Working on an Owner work site and being under the influence of drugs or alcohol creates safety risks for all personnel who work on our work sites.

2.2 The term "Contractors" refers to all non-Owner personnel hired to perform a service for Owner who will be on Owner property and includes all Contractors, their subcontractors and all other non-Owner persons who are employed by them with active badges for site access. Visitors and delivery drivers are excluded from these requirements.

3.0 IMPLEMENTATION

3.1 Contractors shall establish and maintain a confidential drug and alcohol testing program for each of their personnel assigned to work on Owner property, which shall meet the following minimum requirements.

3.1.1 All personnel of a Contractor who are assigned to an Owner site shall be subject to Contractor's drug and alcohol testing program. Contractor's program shall prohibit personnel from buying, selling, consuming, or distributing alcohol or drugs while working for Owner or while on Owner property. The program shall also prohibit Contractor personnel from reporting to an Owner site or being on Owner property while under the influence of alcohol or drugs.

3.1.1.1 Contractor's program shall provide for drug testing for the substances listed in Section 3.1.4 of this Policy under the following circumstances: pre-assignment testing; random testing; testing for reasonable cause based on observations by an Owner or Contractor supervisor (including, without limitation, any violation of the Rules to Live By); and testing after any accident or incident that involves injury to personnel or damage to property and for which drug use could reasonably be a contributing factor.

3.1.2 Contractor shall require pre-assignment drug testing, or will assure that each person who will be assigned to an Owner location has been tested for drug use within the 120-day period immediately prior to the start of work on Owner premises. Contractor shall provide written documentation from the testing authority to Owner Construction Supervisor or the Energy Center Point of Contact that its personnel are either compliant or non-compliant with this Policy. Contractor personnel, who are not in compliance with this Policy, will be subject to Section 3.1.6 of this Policy. To maintain confidentiality, Owner will not accept actual test results. A previous random drug test or a drug test conducted for another reason is sufficient to satisfy the pre-assignment testing requirement if the test was conducted during the 120-day period prior to working on Owner premises and otherwise satisfies the drug testing requirement in Section 3.1.4 of this Policy. Contractor personnel who have taken a pre-assignment drug test will be allowed to work pending the test results for no more than 5 working days. Testing may be waived pending Owner management approval for contractor personnel who are working less than 40 hours annually providing site labor.

3.1.2.1 In lieu of pre-assignment testing, Contractor may accept a certificate signed by a Department of Health and Human Services (DHHS), Substance Abuse Mental Health Service Administration (SAMHSA) DHHS/SAMHSA-certified drug testing laboratory indicating the results of drug test performed within the 120-day period immediately prior to working on Owner premises. Identification cards, which indicate the employee's name and date of his/her most recent drug test, may also be accepted if they are traceable to the certification from the DHHS/SAMHSA -certified drug-testing laboratory, which performed the test, and are attested to by Contractor management.

3.1.3 Contractor shall provide site specific random substance abuse testing for each of its personnel and its subcontractors' personnel assigned to be on Owner premises. The random testing shall be conducted at a frequency such that a minimum of one test is performed for hours up to the first 2,000 man-hours worked and one additional test for every 2,000 man-hours worked by Contractor, or any of its subcontractors, on Owner premises. Contractor shall establish a random selection process to ensure that each individual will have an equal chance of being selected and tested each time a random test is scheduled. The random testing pool will include all crafts under the direction of the prime Contractor, including subcontractors. Personnel selected for the random testing shall not be informed of the test until immediately prior to the test and shall be accompanied to the testing site by a responsible Contractor supervisor as soon as practical on the same day selected. Contractor shall notify the Construction Supervisor or the Energy Center SPOC of the random selection results and an Owner representative may exercise the option of being present during the selection process.

3.1.4 Samples used to comply with this policy shall be analyzed by a NIDA-certified laboratory or quick cup and/or instant cup method. The tests must screen at a minimum for the following substances and levels, however some labor consortium testing programs will be accepted for initial site access only pending Owner approval. A confirmed positive drug testing will be considered a violation of this policy

Substance	Initial Level	Confirmed Level
Amphetamines (AMP)	1000 ng/ml	500 ng/ml
Buprenorphine (BUP)	10 ng/ml	10 ng/ml
Benzodiazepines (BZO)	300 ng/ml	300 ng/ml
Cocaine (COC)	300 ng/ml	150 ng/ml
Marijuana(THC)	50 ng/ml	15 ng/ml
Methadone (MTD)	300 ng/ml	200 ng/ml
Opiates(MOP)	2000 ng/ml	2000 ng/ml
Oxycodone (OXY)	100 ng/ml	100 ng/ml
Methylenedioxymethamphetamine (MDMA)	500 ng/ml	250 ng/ml
Methamphetamine (MET)	1000mg/dl	500mg/dl

3.1.5 Contractor's program shall provide for alcohol testing under the following circumstances: random testing; testing for reasonable cause based on observations by an Owner or Contractor supervisor (including, without limitation, any violation of the Rules to Live By);; and testing after any accident or incident that involves injury to personnel or damage to property and for which alcohol use could reasonably be a contributing factor. Pre-assignment alcohol testing shall not be required. A test result of .04% blood alcohol concentration or greater as indicated by a breathalyzer or similar test will be considered a violation of this Policy.

3.1.6 Individuals who fail a test, refuse to test or otherwise violate this Policy will be denied site access from all Owner premises. In addition, Contractor shall notify the applicable consortium to remove the employee from the active pool. A Contractor employee who is determined to have violated this policy will be denied site access for a period of one year. After a period of one year, if the individual can demonstrate successful completion of a required treatment program based on Contractor's consortium policy, the individual will be given a last chance opportunity. However, site access will not be permitted unless the individual has a satisfactory return-to-duty drug test. If at any time an individual is found to have a second violation of this Policy, the individual will be permanently denied site access to all Owner premises. Contractor shall document all non-compliance on a reduction force report and forward the report to the Construction Supervisor or the Energy Center Point of Contact. The reduction force report shall include the person's name, craft and reason stated "Non-Compliance with Owner Substance Abuse Policy".

3.1.7 Contractors shall require all of their subcontractors to comply with all provisions of this Substance Abuse Policy. Failure of Contractor or any of its subcontractors to comply with the requirements of this Policy shall be grounds for removal from consideration for any future work and/or termination of the current contract at the discretion of Owner. Owner reserves the right to audit Contractor's drug and alcohol testing program at any time to verify compliance with this policy.

3.1.8 Owner will not be responsible for any expenses or loss of wages due to non-compliance with this Policy.

3.1.9 Owner retains the right to change or modify this Policy at any time. Owner also retains the right to waive this Policy for any Contractor that is badged as a visitor.

3.1.10 Any documents relating to this Policy will be maintained in confidence and will not be released without written authorization unless otherwise required by law.

ATTACHMENT C.6.1

EQUAL EMPLOYMENT OPPORTUNITY AND ANTI-HARASSMENT POLICY

PURPOSE

Owner strives to maintain a culture and working environment free from discrimination and harassment for all personnel, applicants, customers, vendors, contractors, and visitors to Owner. Consistent with Owner's corporate values of Integrity, Respect, Accountability, Stewardship, Teamwork, and Commitment to Excellence, every Owner employee is expected to demonstrate behaviors consistent with this policy.

PERSONS AFFECTED

This policy applies to all Owner personnel, applicants, customers, contractors, vendors and any person visiting any Owner facility. This policy applies to personnel while on Owner property, on Owner worksites, in an Owner vehicle, or wherever an employee is performing a function of his/her job, participating in an Owner sponsored event on or off Owner property, or engaging in activity related in any way to employment with Owner.

POLICY

Owner is an equal opportunity employer and is committed to the fair and equal treatment of all personnel. It is a fundamental policy of Owner and its subsidiaries and affiliates to maintain a workplace that is free from discrimination or harassment of any kind in compliance with all applicable federal, state, and local laws. **Owner prohibits all forms of discrimination and harassment, whether based on race, color, religion, sex, national origin, ethnicity, age, disability, genetic information, military service or status, pregnancy, marital status, sexual orientation, gender identity or expression, or any other class, trait, or status protected by law, hereinafter collectively referred to as "protected factors".** Owner also prohibits unwelcome and/or inappropriate conduct that is directed at a person because of any protected factors. It should be noted that Owner maintains zero tolerance with regard to the fair and equal treatment of all personnel and thus prohibits inappropriate conduct that, while not rising to a level that violates the law, may still be prohibited by this policy. Furthermore, conduct that is not based on protected factors but is considered inappropriate with regard to the treatment of personnel is prohibited by this policy, and such conduct may also be a violation of other Owner policies, performance expectations, and Owner's corporate values and accordingly may still be subject to corrective action. All complaints or allegations of potential discrimination or harassment or other violations of this policy should be immediately reported. Complaints of this nature will be promptly investigated. In the event discrimination or harassment or other conduct in violation of this policy is found to have taken place, appropriate action will be taken, up to and including discharge.

ANTI-DISCRIMINATION

Owner will not discriminate in hiring, promotion, training, pay, benefits, or other terms and conditions of employment because of any protected factors. Owner complies with all applicable equal opportunity laws and regulations. The Owner is committed to administering personnel action in compliance with such laws and regulations, and to taking affirmative action measures as required of federal contractors. Employment decisions at Owner are based on appropriate job-related factors, including, but not limited to, individual merit, skills, qualifications, prior job experience, and demonstrated work performance. Owner will attempt to provide reasonable accommodations to personnel who inform the Owner of known medical conditions that impact major life activities, provided the employee is able to perform the essential functions of his/her position, with or without a reasonable accommodation. The Owner will also attempt to provide reasonable accommodations for religious expression when an employee makes the need known, provided the religious expression is not coercive or demeaning to another individual's sincerely held religious beliefs, or lack of such beliefs.

It is the responsibility of every employee to ensure that discrimination or harassment based on any protected factors does not occur in the workplace. Personnel who experience problems in the area of equal employment opportunity should discuss the matter with a supervisor, manager, director, or the appropriate HR Services & Employee Relations representative who supports their business segment, or any Human Resources leader.

ANTI-HARASSMENT

Owner prohibits all forms of unlawful harassment. Unlawful harassment generally includes, but is not limited to, unwelcome or unsolicited conduct based upon or directed at a person because of any protected factors. Harassment can be physical, verbal or visual in nature, and includes behavior that is demeaning, offensive and/or indicates hostility toward persons in the workplace based on any protected factors. Conduct is in violation of this policy when it is sufficiently severe or pervasive that it has the purpose or effect of unreasonably interfering with an individual's work performance or creates a hostile, intimidating, or offensive work environment for the individual.

PROHIBITED CONDUCT

Owner also prohibits all forms of inappropriate conduct by anyone subject to this policy as it pertains to the treatment of personnel. Inappropriate conduct prohibited by this policy may not always rise to the level of discrimination or harassment. Rather, inappropriate conduct is often demeaning or offensive or indicates hostility towards others even if the conduct is not based on or directed at a person because of a protected factor. The following examples are provided to assist in the interpretation of what Owner views as prohibited conduct under this policy.

This list is not meant to be all-inclusive. Other conduct not specifically identified below may also be prohibited by this policy. Certain conduct need not be "unwelcome" or observed by others for it to violate this policy (e.g. inappropriate use of the Internet).

Physical conduct, such as:

1. Rape, sexual battery, molestation or attempts to commit such assaults.

2. Unwelcome and/or inappropriate conduct that is sexual in nature or attempts to engage in such conduct.

   Examples may include unwelcome sexual advances, touching, pinching, poking, patting, grabbing, or brushing against another person's body; kissing or fondling another person against his/her will; impeding or blocking a person's movement; sitting on someone's lap; massaging neck, shoulders or other parts of a person's body.

3. Unwelcome and/or inappropriate physical conduct or attempts to engage in such conduct that is not sexual in nature but is offensive, intimidating and/or potentially harmful and/or is based on any protected factors.

Verbal conduct, such as:

1. Offensive, derogatory, intimidating, persistent or otherwise inappropriate remarks, jokes, comments, references, or slurs.

2. Demeaning, offensive, or otherwise inappropriate remarks, jokes, comments, or references about a person's sex, sexuality, sexual orientation or sexual experiences or about a person's body. Examples may include requests for sexual activity; lewd or explicitly sexual language; gestures that are typically judged to be sexual in nature; inappropriate references about an individual's sexual activities, experiences, deficiencies or prowess; repeated and/or unwelcome comments regarding a person's physical appearance; and repeated requests for dates.

Other inappropriate or offensive behavior or actions (both implied and explicit), such as:

1. Subjecting, or threatening to subject, others to intimidating, unwelcome or unsolicited conduct including expressing excessive unwanted romantic attention toward another individual, or intentionally making performance of the employee's job more difficult.

2. Unwelcome and/or inappropriate communications, including notes, faxes, phone calls, text messages, voice mail, electronic mail (e-mail), or Internet/Intranet medium, and/or displaying, possessing, viewing or bringing into the workplace (including lockers, offices, cubicles, restrooms and Owner vehicles) graffiti, pictures, posters, calendars, objects, promotional materials, reading materials, or computer graphics, Internet sites (including attempting to access or display inappropriate Internet websites that are blocked or restricted), e-mail or other materials that are:

a) sexually suggestive, demeaning or pornographic;
b) racially, ethnically or religiously derogatory; and/or
c) intimidating or offensive on the basis of any protected factors.

Examples of unwelcome and/or inappropriate communications may include posting racially motivated jokes, cartoons or symbols; displaying promotional calendars that are sexually suggestive; accessing sexually suggestive or pornographic Internet sites; and distributing or posting jokes or cartoons about a person because of any protected factors.

An item may be considered "sexually suggestive" if, for example, it depicts a person of either sex who is not fully clothed or who is posed in a manner that is sexually provocative and/or who is posed for the purpose of displaying the private portions of his/her body.

Such actions and items may violate this policy whether or not the items are readily accessible or easily viewed by others. Accordingly, Owner reserves the right to inspect Owner property (e.g., lockers, offices, cubicles, restrooms, voicemail, vehicles, computers and other Owner property) to ensure that no inappropriate items are brought into the workplace.

3. Making employment decisions based on inappropriate, discriminatory or protected factors, including but not limited to:

a) Preferential treatment or promises of preferential treatment to any employee for submitting to sexual conduct, including soliciting or attempting to solicit any employee to engage in sexual activity for compensation or reward; or making employment decisions based on sexual favoritism in a consensual relationship; or
b) Taking or threatening to take adverse employment action based on an employee's refusal to submit to sexual advances or to participate in sex-related conduct.

COMPLAINT PROCEDURES

Personnel who believe they have been subjected to discrimination, harassment, or other conduct in violation of this policy, or who observe such discrimination, harassment, or other conduct directed at others, should immediately report the incident to a supervisor. If they feel it would be inappropriate to discuss the incident with their supervisor, or if their supervisor is the subject of the complaint, they should contact a manager or director, the appropriate HR Services & Employee Relations representative who supports their business segment, or any Human Resources leader. All reports of alleged harassment, discrimination, or other prohibited conduct will be promptly investigated and addressed, to the extent possible, in a confidential manner. Disclosure regarding such matters will be on a need-to-know basis, consistent with the rights of all persons involved, and with the obligation of Owner to investigate the allegation and, when necessary, to take prompt and appropriate action.

All personnel are expected to act responsibly and honestly when they present allegations they suspect violate this policy. Any employee identified as a potential witness is expected to fully cooperate during an investigation and maintain the confidentiality of investigation information. Personnel who fail to fully cooperate during an investigation or to maintain the confidentiality of investigation information will be subject to disciplinary action, up to and including discharge. Any leader who becomes aware of conduct or a situation that may violate this policy must report this to HR Services & Employee Relations and failure to report the conduct or situation to HR Services & Employee Relations will be subject to disciplinary action, up to and including discharge.

Accusations of discrimination, harassment, or other prohibited conduct made in bad faith have a serious effect on innocent persons and Owner and significantly disrupt the working environment. Bad faith accusations do not refer to complaints made in good faith that cannot be proven. If, however, an investigation results in a determination that an individual knowingly or maliciously made bad faith accusations under this policy, he/she will be subject to appropriate disciplinary action, up to and including discharge.

PROHIBITION AGAINST RETALIATION

Owner will not tolerate any form of retaliation against anyone making a good faith report or complaint about actual or potential acts of discrimination, harassment, or other prohibited conduct or cooperating during a related investigation. Any employee who is found to be engaging in such retaliation will be subject to appropriate disciplinary action, up to and including discharge.

ENFORCEMENT

If it is determined that an Owner employee has engaged in discrimination, harassment, retaliation, or other prohibited conduct in violation of this policy, Owner will take appropriate disciplinary action. Discipline may include counseling, written warning, suspension, transfer, demotion, discharge, or any other action deemed appropriate under the circumstances.

CORPORATE RESPONSIBILITY

For additional information, personnel should contact the appropriate HR Services & Employee Relations representative who supports their business segment, any Human Resources leader, or the Sr. Director, HR Services & Employee Relations at 314-554-4116.

ATTACHMENT C.7.2

WORKPLACE VIOLENCE POLICY

PURPOSE

Owner strives to provide a safe working environment in which personnel, customers, vendors, contractors, and visitors utilizing our facilities and services are not threatened or harmed by any individual's deliberate actions, presence, conduct, or communication. Consistent with Owner's corporate values of Integrity, Respect, Accountability, Stewardship, Teamwork, and Commitment to Excellence, every Owner employee is expected to demonstrate behaviors consistent with this policy.

PERSONS AFFECTED

This policy applies to all Owner personnel, applicants, customers, contractors, vendors and any person visiting any Owner facility. This policy applies to personnel while on Owner property, on Owner worksites, in an Owner vehicle, or wherever an employee is performing a function of his/her job, participating in an Owner-sponsored event on or off Owner property or engaging in activity related in any way to employment with Owner.

POLICY

Owner is committed to providing a safe environment for all personnel, customers, vendors, contractors, and visitors. It is a fundamental policy of Owner and its subsidiaries and affiliates to maintain a workplace that is free from actual or threatened violence of any kind. This is a zero-tolerance policy. Conduct by or against an employee, customer, vendor, contractor, or visitor that may reasonably be considered threatening, intimidating, or aggressive is considered to violate this policy and will not be tolerated. Such behavior may violate this policy regardless of whether it occurs in person, by use of any communications medium, through Owner mail, verbally, in writing or in recorded form. Physical confrontations, violent actions, or threats, as well as threatening remarks, gestures or insinuations, are strictly prohibited, particularly those likely to provoke or elicit a violent response. Unwanted persistent behavior or contact of a violent or threatening nature is strictly prohibited. Personnel who engage in any such conduct will be subject to disciplinary action, up to and including discharge and/or prosecution. Vendors, contractors, or visitors who engage in such behavior on Owner's property or Owner worksites, or while performing work for the Owner, will immediately be removed and may be subject to criminal prosecution.

PROHIBITED CONDUCT

The Owner will not tolerate any type of workplace violence or intimidation. Owner considers the following to represent examples of conduct that violate this policy. This list is not meant to be all-inclusive:

- Causing or attempting to cause physical injury to another person by such actions as punching, striking, shoving, pushing, or other physical contact;
- Stalking or threatening another individual or threatening, talking or joking about engaging in behaviors that harass, intimidate or inflict harm upon another individual;
- Wearing clothing or other items (e.g., pins, hats) with symbols or slogans or viewing, displaying or bringing into the workplace pictures, publications or videos that incite or depict violence, whether directed toward a living or inanimate object;
- Sending threatening or intimidating messages, or messages that incite violence, including but not limited to, messages sent via e-mail, voicemail, Owner mail, radios, public address systems, the telephone system, Internet/Intranet medium, and/or conveyed through graffiti or symbols;
- Exhibiting aggressive or hostile behavior that creates a reasonable fear of injury (physical or emotional) to another person; or
- Intentionally damaging Owner property or the property of an employee, customer, vendor, contractor, or visitor.

ALL UNAUTHORIZED WEAPONS BANNED

Owner prohibits the possession of unauthorized weapons by any employee, customer, vendor, contractor, or visitor while on Owner property including in vehicles located on Owner parking lots, on Owner worksites, in an Owner vehicle, or wherever an employee is performing a function of his/her job, performing duties on behalf of the Owner, participating in an Owner-sponsored event on or off Owner property, or engaging in activity related in any way to employment with the Owner. "Unauthorized weapons" include, but are not limited to, guns, knives, explosives, and other items that may be used to inflict harm, other than tools properly used to perform the essential functions of a job. Authorized weapons are those sanctioned for use by the Owner, after segment leadership receives approval from Corporate Security, including those used for security purposes and for other purposes as authorized by business segment leadership (e.g., tools used for food preparation or weapons used for hunting on Owner property).

ADDITIONAL WORKPLACE SECURITY MEASURES

Other security measures taken by Owner to help provide a safe work environment for personnel, customers, vendors, contractors, and visitors include:

- Limiting access to Owner property to those with a legitimate business interest and
- Requiring all personnel, customers, vendors, contractors, and visitors to display Owner identification while on Owner property.

REPORTING PROCEDURES

It is everyone's responsibility to prevent violence in the workplace. Anyone who becomes aware of conduct or a situation that may violate this policy must report it to a supervisor, manager, or director, the appropriate HR Services & Employee Relations representative who supports their business segment, any Human Resources leader, Corporate Security at 314-554-2100, or local emergency responders. Corporate Security may be contacted on a 24-hour basis through hotline reporting numbers: 314-554-4655 (Illinois) or 314-554-4888 (Missouri). Reports may be made anonymously, and all reported incidents will be promptly investigated. Any employee identified as a potential witness is expected to fully cooperate in the investigation and maintain the confidentiality of investigation information. Any employee who fails to fully cooperate in an investigation or to maintain the confidentiality of investigation information will be subject to disciplinary action, up to and including discharge.

Any leader who becomes aware of conduct or a situation that may violate this policy must report this to HR Services & Employee Relations and failure to report the conduct or situation to HR Services & Employee Relations will be subject to disciplinary action, up to and including discharge.

EMPLOYEE ASSISTANCE PROGRAM

Owner provides a free and confidential Employee Assistance Program (EAP) for all personnel, which may be contacted by calling 1-800-289-1109. An employee who displays violent, abusive, or threatening behavior may, when deemed appropriate, be referred to the EAP for counseling or to an Owner-designated physician or other medical provider. An employee for whom a mandatory EAP referral is made must fully comply with the referral and all treatment recommendations made by EAP or the Owner-designated physician or provider. Failure to do so may result in disciplinary action, up to and including discharge.

As permitted by state and federal law, EAP personnel will warn and/or report to the appropriate Owner representatives and/or law enforcement agency when it is known or reasonably foreseeable that an individual poses a threat of serious harm to an identified victim. Upon receiving such notification, Owner will take whatever actions it deems appropriate and necessary to minimize the threat of harm or violence and will fully cooperate with any investigation or activity conducted by law enforcement personnel.

PROHIBITION AGAINST RETALIATION

Owner will not tolerate any form of retaliation against anyone making a good faith report or complaint about actual or potential violent conduct or cooperating during a related investigation. Any employee who is found to be engaging in such retaliation will be subject to appropriate disciplinary action, up to and including discharge.

ENFORCEMENT

Owner reserves the right to inspect its property (e.g., lockers, offices, cubicles, restrooms, voicemail, vehicles, computers and other Owner property) to ensure that no items in violation of this policy are brought into the workplace. If the Owner determines that a violation of this policy has occurred, appropriate disciplinary action will be taken, up to and including discharge.

CORPORATE RESPONSIBILITY

For additional information, personnel should contact the appropriate HR Services & Employee Relations representative who supports their business segment, any Human Resources leader, the Sr. Director, HR Services & Employee Relations at 314-554-4116 or Corporate Security at 314-554-3359.

END OF APPENDIX C

APPENDIX D
CONTRACTOR SCHEDULING REQUIREMENTS

1. OVERVIEW

1.1. This Appendix identifies Contractor's requirements for developing, executing, and reporting the Project Schedule.

1.2. Schedule Level definitions are set forth on Attachment D.1.1; other defined terms used in this Appendix and not defined elsewhere are set forth on Attachment D.1.2.

1.3. The Work shall be completed in compliance with the milestone dates specified in the Contract, except to the extent any such dates are adjusted by Owner via a written Change Order.

1.4. The requirements set forth in this Appendix are the Owner's minimum schedule requirements. Contractor, at its option and at no cost to Owner, shall develop all additional schedule procedures it deems necessary to control and manage its Work.

2. PRE-BID / AWARD – PROPOSED LEVEL 2 PROJECT SCHEDULE

2.1. Contractor bids will be rejected if not accompanied by a proposed Level 2 Project Schedule in sufficient detail to demonstrate the general sequence of Contractor's Work in accordance with Contractor's Project Execution Plan. This includes, but is not limited to, all engineering, procurement, installation, turnovers, commissioning, startup, and performance testing required to complete Contractor's Work.

2.2. Contractor's preliminary schedule shall identify key Project interface points between Contractor and its subcontractors and others, such as Owner and its other contractors and vendors.

2.3. The Contractor shall specify the Calendar of its proposed Project Schedule.

2.4. The Contractor shall identify its plan for staffing the Project with scheduling personnel as required to support the Project. The individual responsible for maintaining Contractor's schedule ("Contractor's Scheduler") shall be identified in the bid and a resume provided. Contractor shall provide with its bid an organizational chart showing the Contractor's Scheduler's reporting relationship to Contractor's Project Manager. Contractor's Scheduler will be considered one of Contractor's Key Personnel.

2.5. Contractor's bid shall describe, with specificity, any exceptions to these Schedule requirements. No such exceptions shall be binding on Owner unless agreed to by Owner in writing.

3. POST AWARD – LEVEL 3 PROJECT SCHEDULE

3.1. Contractor shall develop a Level 3 Project Schedule incorporating any Owner outage planning milestones and deliver such Schedule to Owner for its review and approval within four weeks following the Contract award date. Contractor and Owner's Project Scheduler will collaborate to develop a mutually acceptable Level 3 Project Schedule. Contractor's Level 3 Project Schedule must be complete and approved by Owner no later than the date Contractor mobilizes on the Site.

3.2. The Project Schedule shall be developed in Critical Path Method (CPM), precedence diagram form using Primavera Enterprise (P6) Project scheduling software, unless otherwise authorized by Owner in writing.

3.3. The working copy of the Project Schedule shall be developed and maintained in Owner's network, unless otherwise authorized by Owner in writing. All Project scheduling performed directly by Contractor shall be performed in Owner's integrated environment, using Owner's Primavera in the Ameren WebDesk environment.

3.4. Contractor's Scheduler shall develop, maintain, update, and analyze the Project Schedule within Owner's network the Project's full life cycle. Owner will provide network access to Contractor's Scheduler(s) and others, as designated by Contractor's Project Manager and approved by Owner, who require access to the Project Schedule.

3.5. The Contractor will be back charged for the cost of any labor and other expenses incurred by Owner as a result of Contractor's non-compliance with these schedule requirements.

4. SCHEDULE SUBMITTAL, REVIEW, AND APPROVAL

4.1. Owner's Project Scheduler (unless designated otherwise by Owner) is Owner's primary point of contact for Contactor's Schedule submittals.

4.2. Contactor shall submit Schedules to Owner's Project Scheduler for review and approval as set forth herein.

4.3. Contractor's approved Project Schedule shall be installed on Owner's network. Contractor shall also provide a PDF version of the Project Schedule to Owner's Project Scheduler. Owner will assist Contractor's Scheduler as reasonably required in its installation of the Project Schedule on Owner's network; the PDF version will be used to validate such installation. To assist with validation, a baseline is typically created to establish a snapshot of the version of the Project Schedule installed on Owner's network and to troubleshoot potential issues with schedule calculation settings, logic, and other schedule settings.

4.4. The Project Schedule shall be of sufficient detail that Owner is able to reasonably determine that Contractor has adequately planned its execution of the Work, and that the Project Schedule will provide an adequate basis for Contractor and Owner to monitor and evaluate Contractor's progress of the Work.

4.5. All Schedules required by this Specification shall be subject to Owner's review and approval. Any Project Schedule failing, in Owner's judgment, to reasonably demonstrate Contractor's ability to timely achieve the Project requirements or that otherwise indicates unrealistic planning or performance may be rejected by Owner. In such event, Contractor shall promptly prepare and submit to Owner a revised Project Schedule acceptable to Owner.

4.6. Owner's review and approval of the Project Schedule shall not relieve Contractor of its responsibility for accomplishing the Work in accordance with the Contract requirements, make Owner an insurer of the Project Schedule's successful implementation, or make Owner liable for Contractor's time or cost overruns. Omissions and errors in the approved Project Schedule shall not excuse Contractor's non-performance of any Contract requirement.

4.7. Upon approval by Owner, the approved Project Schedule is to be preserved and designated as the Project Baseline Schedule.

5. SCHEDULE INTEGRATION (see Section 9 for Outages)

5.1. The Project Schedule shall completely integrate all Activities necessary to coordinate Contractor's Work including, but not limited to: engineering, procurement, vendor, and Subcontractor Activities, Owner Activities, permitting, construction, commissioning, startup, and performance testing as applicable. Owner Activities are expressly limited to those set forth in the Contract and may include: Owner furnished equipment, document reviews, permitting Activities, regulatory decisions, operational dependencies, and site availability.

5.2. Owner will assist Contractor with its integration of the Project Schedule with the schedules of Owner and other contractors as appropriate.

5.3. Contractor shall demonstrate completeness in schedule definition and integration, by conducting horizontal and vertical reviews of the Project Schedule with Owner's Project Scheduler and other key stakeholders.

6. SCHEDULE FORMAT

6.1. Work Breakdown Structure ("WBS")

6.1.1. Prior to its preparation of the Project Schedule, Contractor shall meet with Owner to confirm the Work Breakdown Structure organization. Contractor shall work with Owner's SPOC to ensure that the WBS organization meets Owner's Project reporting requirements.

- WBS is typically defined based upon the Contract deliverables and organized to define the total Project scope using a hierarchical structure of work packages. The Project Schedule WBS shall be developed in conjunction with a Cost Breakdown Structure or other methodology (such as progress payment milestones) as determined by Owner, to enable coordinated assessment of the time and cost management performance on the Project.

6.2. Code Structure

6.2.1. Global Project and Activity codes will be used by Contractor for grouping, sorting, reporting and analysis of the Work. Owner will either assign global codes to the Project Schedule or require Contractor to assign codes based upon Owner-specified criteria.

6.2.2. The Contractor may use "Project Activity Codes" independent of Owner's requirements; however, global codes, other than those approved by Owner pursuant to Section 6.2.1 of this Appendix, are not permitted.

6.3. Activity Definition and Durations

6.3.1. The working copy of the Project Schedule will be the approved Level 3 Project Schedule.

6.3.2. The Project Schedule's planning unit shall be days, unless otherwise required by Owner or provided in this Specification.

6.3.3. As a general rule, Activity duration estimates shall not exceed the applicable updating cycle (i.e., Activities performed during Project phases requiring a weekly update should have duration estimates of 5 days or less). Contractor shall provide justification to Owner for Activity durations exceeding twice the length of the update cycle, or otherwise at Owner's request.

6.3.4. Activity definition shall include the following requirements, characteristics, and attributes:

6.3.4.1. Level of detail sufficient to clearly communicate understanding of the action to be taken and the scope of the task to be performed.

6.3.4.2. Clear and concise descriptions, broken down by: “who, what, where, when and how”.

6.3.4.3. Clearly defined starting and ending points, enabling easy measurement of the Activity's progress within the applicable required update period

6.3.4.4. Activity names that refer specifically to the associated equipment/component. Generic terms or descriptions shall not be used.

6.3.4.5. Separately defined Activities at the point where one craft or resource hands off Work to another. Activities shall not include multiple resource assignments of differing skills unless performance of the specific task requires coordination of such resources.

6.3.4.6. Ability to measure task performance based on physical percent complete (measurable units of Work).

6.3.4.7. Hold, decision or action points by Owner or others.

6.3.4.8. All critical schedule events such as: Contract Milestone Dates, Outage Milestone Dates, Permits, Hold Points, Witness Points, Risk Triggers, start–up and commissioning, testing, turnover, and training.

6.3.5. An Activity identifier system shall be defined by Contractor as required by Owner.

6.3.6. Schedule contingency shall be clearly defined by Contractor as applicable to the Project and shall be incorporated into the Project Schedule. The Contractor shall review its Project Schedule contingency plan with the SPOC. Contingency examples include, but are not limited to: material delivery delays, labor availability or productivity concerns, weather considerations, risk triggers from risk register(s), and such other risk identification and mitigation measures necessary to ensure Contractor's performance of the Work in accordance with the Project Schedule. Owner's review and approval of the Project Schedule contingency does not remove Contractor's responsibility for meeting the Project Schedule.

6.4. Activity Calendars

6.4.1. Owner will prescribe Contractor's use of global and/or Project Activity Calendars as required to address errant and inconsistent schedule calculations.

6.4.2. Unless Owner instructs otherwise, Contractor will use Project Activity Calendars with standard naming to reflect the Work pattern, i.e., 620 = 6 day Work week, 2 shifts per day, 10 hours per shift.

6.4.3. Holidays shall be incorporated into Contractor's Project Activity Calendars as applicable.

6.4.4. Activity Calendar assignments shall be consistent, at all times, with Contractors Project Execution Plan, including start and stop clock times.

6.5. Open Ends, Activity Constraints, and Relationships

6.5.1. There shall be no open ends, except for the Project start and finish milestones.

6.5.2. Activity constraints (start on, finish on, finish on or before, start on or before, as late as possible) shall be used minimally and discretely, to ensure accurate schedule Float calculations. There shall be documentation to support the use of date constraints. Mandatory constraints shall not be used except for situations that require recovery plans as agreed by the Owner's SPOC. Contractor use of constraints shall be subject to Owner approval.

6.5.3. The majority of Activity relationships shall be FS relationships. SF relationships are not allowed, unless approved by Owner. All task dependent Activities must have successor relationships that include a FS relationship and/or FF relationship. Activities with only SS successor relationships create open ends and are not acceptable.

6.5.4. Activity relationships shall not be defined with excessive lag durations; instead, Activities shall be added to represent the lag period as much as possible. Contractor shall have documentation to justify the rational for using lags.

6.5.5. Negative relationship lags shall be avoided. If used, Contractor shall have documentation to justify the rational for using negative relationship lags.

6.6. Resource Loading and Leveling

6.6.1. All Activities requiring identifiable labor shall be resource loaded, consistent with verifiable estimates, and include specific resource assignments (skill, craft, discipline) for each resource type. Owner will assist Contractor to properly define resource roles in Owner's Primavera system, for Contractor use to perform analysis of Work demands (crafts, trades, disciplines).

6.6.2. Each Activity resource assignment shall establish a budgeted man-hour estimate for the Activity.

6.6.3. The Contractor shall validate resource loading as required to support the Project, using its resource-leveled schedule as its basis. The Contractor shall submit histograms by each craft and/or discipline from the Project Schedule compared to its staffing plan to validate its resource requirements.

7. BASELINE SCHEDULE

7.1. A Baseline Schedule shall be established per the dates defined in the Specification and shall be reviewed and approved by Owner. Changes to the Baseline Schedule will be managed in accordance with the requirements set forth herein and shall be made only with the approval of Owner's SPOC.

7.2. As required by Owner, Contractor shall establish weekly or monthly "status" baselines for additional reporting, analysis, and trending.

7.3. After the Baseline Schedule is established, Activity identifiers shall not be changed, nor shall Activities be deleted, unless approved in writing by Owner, so that the then current Schedule can be traced to the Baseline Schedule.

7.4. Contractor shall update the Baseline Schedule in accordance with Owner's change management process to include or exclude Activity scope as approved by Owner, to maintain traceability of the Project baseline.

8. SCHEDULE EXECUTION AND UPDATES (see Section 9 for Outages)

8.1. The Project Schedule shall at all times represent the Project's current status, progress, and variance history from Baseline Schedule, and shall be consistent with Contractor's Project Execution Plan. Activities that impact progress shall be added to the Project Schedule, to provide traceability as to such Activity's cause and its effect.

8.2. If at any time Owner reasonably believes that any Project Schedule Milestone Date will not be met; Contractor shall participate with Owner in a re-evaluation of the remaining Work and shall prepare a recovery Schedule as set forth in Section 13.1 of this Appendix.

8.3. Schedule updates shall include remaining duration estimates, actual start and finish dates, progress reporting based upon the physical percent complete, the actual labor units expended, and Contractor's forecast of remaining labor units.

8.3.1. Production assessments shall be performed during Schedule updates, based upon analysis of labor units expended and remaining, including an assessment of available resources applied to the Project. Contractor shall proactively identify risk to the Project associated with equipment, material or labor resource availability, productivity or any other material risk.

8.3.1.1. If the Project Schedule does not report labor units, an alternative process shall be used to assess and validate productivity. This alternative process must be inherently traceable to Work Activities in the Project Schedule and coordinated with the Project Schedule update and reporting cycle.

8.4. The update cycle and cut-off times for Schedule progress reports shall be in accordance with this Appendix unless Owner specifies otherwise.

8.5. At each Schedule update, Contractor shall incorporate any known changes to its Work scope or planned sequence of events to ensure the accuracy of the look-ahead schedule.

8.6. Owner will perform an integrated analysis of Contractor's Project Schedule at each Project Schedule update in accordance with Owner's Schedule Management Plan. Contractor shall not make Schedule changes while Owner is performing such integrated analysis.

8.7. Negative total Float shall be addressed and eliminated during each update cycle. If Contractor is unable to resolve negative Float within an update cycle, Contractor shall promptly notify Owner and provide Owner with correction recommendations.

9. OUTAGE REQUIREMENTS

9.1. Contractor's Project Schedule installed on Owner's network will be used as the pre-outage, outage execution and post outage working schedule.

9.2. Owner will make milestone to milestone and other appropriate relationship ties between Contractor's Project Schedule and Owner's integrated outage schedule.

9.3. Contractor shall prepare a baseline outage schedule incorporating Owner's planned outage schedule milestones at such time prior to the start of the applicable outage as Owner's Project Scheduler may require. Contractor's baseline outage schedule shall be submitted to, and reviewed and approved by, Owner's Project Scheduler. During the course of the outage, Contractor's Baseline Outage Schedule shall be compared to its actual Schedule progress and Owner's outage milestones.

9.4. Contractor's Scheduler shall analyze and update Contractor's outage Schedule on a daily basis to provide accurate reflection of Contractor's progress throughout the outage. Schedule analysis should include risk management strategies to assure that Contractor achieves all applicable outage milestones.

9.5. Contractor shall provide such updates to Owner's Project Scheduler each working day by 9:00 a.m. Owner's Project Scheduler may require several iterations of edits and updates to Contractor's outage Schedule before it may be incorporated into Owner's integrated outage schedule. Owner's Project Scheduler will analyze its and all contractor schedules against and with Owner's integrated outage schedule. Contractor may normally access its incorporated schedule after 12:00 p.m. on the day of submittal.

9.6. Owner's Project Scheduler will inform Contractor's Scheduler, Owner's SPOC, Owner's engineering, responsible Site personnel and any other persona of any high-risk Activity that may impact Owner's integrated outage schedule as required.

9.7. If Contractor's progress prior to or during an outage indicates that it may not timely meet an applicable outage milestone, Owner will require Contractor to promptly re-evaluate its remaining Work and to prepare and deploy a Recovery Plan sufficient to ensure that Contractor meets such outage milestone.

10. PROTOCOLS

10.1. The Project Schedule calculation settings shall be configured to produce consistent and reliable CPM calculations as specified by Owner. At a minimum, Owner will clarify and specify the required settings for the following options:

10.1.1. Define "critical Activities" as Total Float less than or equal to 0 (or agreed value).

10.1.2. The basis to "Compute Total Float as" (Finish or Start dates to be specified).

10.1.3. The "Retained logic" setting is recommended for "progressed Activities".

10.1.4. "Calculate start-to-start lag" from ___ (Early Start or Actual Start to be specified).

10.1.5. "Calendar for scheduling Relationship Lag" (Predecessor or Successor to be specified).

10.1.6. The setting to "Level resource during scheduling" shall not be selected. Recommended duration type is "Fixed duration and units/time" or "Fixed duration and Units" dependent upon how actual labor and remaining labor is updated.

10.1.7. Percent complete type shall be "physical percent," unless approved otherwise.

10.1.8. Percent Complete and Remaining Duration shall not be linked.

10.1.9. Forecasts and remaining estimates shall not be calculated by "auto compute" settings, or by duration percent complete changes.

10.1.10 Available Float in Owner's integrated program belongs to Owner.

11. SCHEDULE CHANGES

11.1. All Project Schedule changes shall include a Fragnet showing all added Activities, and predecessor and successor dependencies. All approved Schedule changes shall be added to Contractor's Project Schedule within the then current update cycle, including, without limitation, resource loading, applicable relationships, and Activity codes, and shall be flagged or coded in a manner that provides traceability to the approved Schedule change.

12. SPECIAL UPDATES

12.1. Special intermediate updates may be required when:

12.1.1. a previously submitted update is deemed to be unacceptable (i.e. out of sequence progress). Owner may direct changes in schedule logic to be made to correct all out of sequence Work.

12.1.2. unforeseen circumstances arise that appear to adversely impact an otherwise acceptable schedule. The nature or responsibility of the circumstance will not relieve Contractor of this requirement.

13. RECOVERY PLANS

13.1. Owner will require Contractor to participate in a re-evaluation of the remaining Work if at any time Owner reasonably believes that Contractor's Work will fall behind the Baseline Schedule, or it becomes apparent that any Contract milestone will not be met.

13.1.1. At no additional cost to Owner, Contractor shall prepare and submit to Owner's SPOC a formal written Project Schedule recovery plan. Such plan will be submitted to Owner within three (3) working days of Owner's request (five (5) hour(s) during an outage).

13.1.2. Contractor shall identify its plan to recover the Project Schedule, including Contractor actions to increase manpower, Project Work periods, and/or concurrency of Work.

13.1.3. Recovery plans shall be reviewed and approved by Owner prior to implementation.

13.1.4. The recovery schedule, once approved by Owner, shall be incorporated into the Project Schedule, and maintained by Contractor in accordance with this **Error! Reference source not found.**. If the then-current Work sequencing and estimates are no longer valid for realistic performance measurement against the Baseline Schedule, the Baseline Schedule shall also be updated to reflect the approved recovery plan so as to restore Owner's control of the remaining effort.

14. REPORTING (see Section 9 for Outages)

14.1. All Schedule updates and reporting shall be weekly, unless identified otherwise herein or required by Owner. Contractor's Schedule updates shall include the following, at a minimum:

14.1.1. Gantt chart schedule with Activity ID, Activity description, start and finish dates, Activity percent complete (physical % for Activities with measurable units of Work), total Float, baseline start and finish variance, and other fields as appropriate (labor hours, Work calendars, etc…).

14.1.2. Critical path, near critical path schedule (TF criteria for near critical path to be defined by Owner).

14.1.3. Resource histograms (by discipline, role and/or craft) showing budget requirement, actuals, and forecasted remaining versus availability.

14.1.4. One week look-back on completed Work and three weeks forward looking; such information, to be used by Contractor to report progress and concerns to Owner during progress meetings.

14.2. The Contractor shall participate in progress meetings at a frequency established by Owner. At each such meeting Contractor shall provide:

14.2.1. Narrative reports summarizing major achievements, significant upcoming milestones or Activities, Critical Path issues, status of corrective action plans regarding negative Float paths, significant trends and Schedule variance (variance threshold to be established by Owner), labor availability issues, productivity issues, risks, coordination issues, and other potential Schedule issues as may be determined by Owner.

15. CLOSEOUT

15.1. Contractor shall ensure that all Activities are completed and accurately recorded in the Project Schedule. The Contractor shall attend post-Project critique meetings, including a review of Contractor's Schedule performance and lessons learned. Contractor shall provide an “as built” copy of the Schedule for Owner's records. The “as-built” Schedule shall include a PDF copy of the Project Schedule and an XER copy of the source file. The PDF version shall include:

15.1 All Activities grouped by WBS (or other applicable code system as agreed by Owner)

15.2 Actual start and finish dates

15.3 Baseline variance on start and finish dates

15.4 Baseline labor units and "at completion" labor units.

15.5 Activity Work Calendars

Attachments for Error! Reference source not found.
Attachment D.1.1: Schedule Level Definitions
Attachment D.1.2: Other Schedule Definitions

ATTACHMENT D.1.1

SCHEDULE LEVEL DEFINITIONS

1.0 **LEVEL 1 PROJECT SCHEDULE:** A Level 1 schedule is for high level planning and communication, and generally depicts the overall duration of the Project with summary of the major phases of work (Engineering, Procurement, Construction, etc.) and major deliverables (milestones).Level 1 Schedule includes:

- Milestones scheduled to reflect timing of major deliverables, key events and interface points, known permits, and schedule milestone dates.
- Relatively broad activity definitions for engineering, procurements, construction, commissioning and closeout that communicate the high level work scope, contingent upon further planning, yet sufficiently defined to represent the overall duration of the project as presently known.
- Includes a high-level Work Breakdown Structure (WBS) as appropriate to provide clarity in the organization of activity work scope.

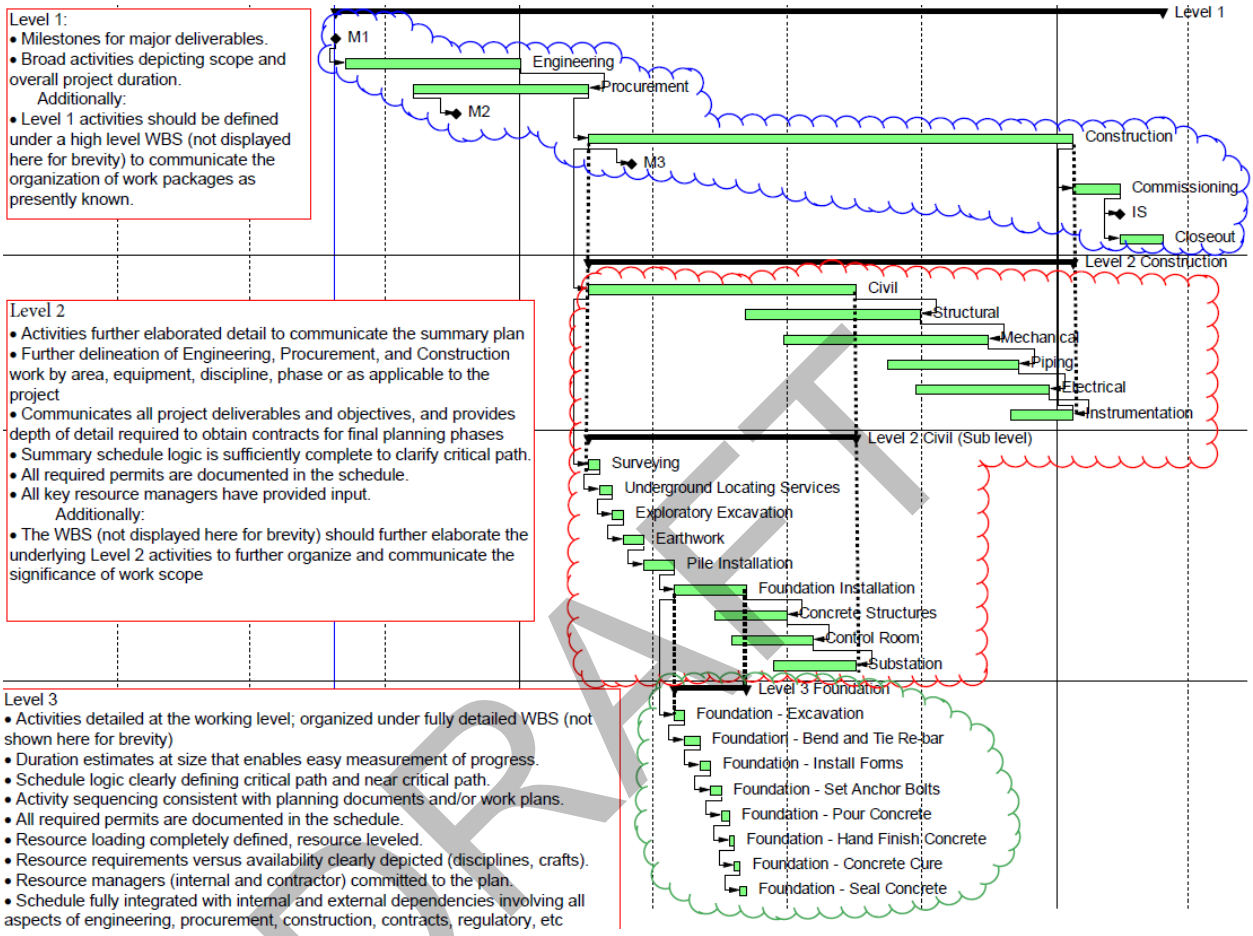
2.0 **LEVEL 2 PROJECT SCHEDULE:** A Level 2 schedule essentially summarizes scope of work for the Project. It typically includes a summary by work package or key elements of the project and includes sufficient detail to reflect key interface points and contractual commitments. It is used to finalize duration, work scope and budget, and defines critical path. Level 2 Project Schedule includes Level 1 detail plus the following:

- Activities further elaborated in sufficient detail to communicate the plan in the form of planning packages. Planning packages represent known future work, shown at a high level in the Project Schedule, which will be detailed at a later time when the additional information becomes available. This includes further delineation of engineering, procurement, and construction by work area, major equipment, discipline, or phase as applicable to the project.
- Communicates all project deliverables and project constraints, key to providing the necessary depth of detail needed to prepare contractor bid packages or to self-perform.
- Work associated with high level of confidence to execute work within the project time and cost constraints.
- Project logic is sufficiently complete to clarify the critical path and validate the overall project duration.
- All necessary permits, regulatory Activities and approvals are documented in the Project Schedule.
- Includes a WBS elaborated to communicate work scope in the form of planning packages at the level of detail presently known, developed in correlation with the structure of the project cost estimate.

3.0 **LEVEL 3 PROJECT SCHEDULE:** A Level 3 schedule is the working level of the Project Schedule. It is the final detail plan for the Project which includes detailed activity estimates, resources, and logic. Includes a Work Breakdown Structure (WBS) developed in conjunction with a Cost Breakdown Structure or other methodology (such as progress payment milestones) as determined by Owner, to enable coordinated assessment of time management and cost management performance. Work progress is reported and monitored at the activity level and is rolled up to Level 2 or Level 1 for summarization. Level 3 Project Schedule includes Level 2 detail plus the following:

- Activities planned at the working level (lowest level of detail), with durations estimated in periods enabling easy measurement of progress.
- Schedule logic clearly defining critical path and near critical path sequences.
- Activity sequencing consistent with planning documents, specifications, contractor work plans, and/or Project Execution Plans (PEP). A PEP is a written description of the manner of carrying out the work, typically associated with relatively large, complex projects.
- Activities resource loaded (with verified estimates) when the Project Schedule is dependent upon labor performance. If justified rational is provided where the Project Schedule is deemed not dependent upon resource labor performance, other measures of performance (metrics) should be attributed to the Project Schedule to monitor and control performance.
- Activities are resource leveled when availability has the potential to impact the outcome of the Project Schedule.
- Resource/role assignments clearly identify discipline/craft/trade staffing requirements.
- Validated resource requirements.

- Completely integrated schedule, including internal and external dependencies and project constraints involving all aspects of engineering, procurement, construction, contracts, deployments, regulatory requirements, closeout, etc.…
- Includes complete definition of the WBS; hierarchically integrated and elaborated to lowest level of detail in the form of detail work packages developed in correlation with the structure of the project cost.



ATTACHMENT D.1.2

OTHER SCHEDULE DEFINITIONS

Activity: An element of Work performed during the course of a Project normally having an expected duration, expected cost and expected resource requirements, all measurable and controllable. An Activity is an individual Work task that is the basic component of a Project and can be subdivided into tasks. Activities can also be called Work packages, tasks, or deliverables.

Activity Duration: Activity duration specifies the length of time (planning units, hours, days, weeks, months, etc.) that it takes to complete an Activity.

Actual Finish Date: The point in time that Work actually ended on an Activity.

Actual Start Date: The point in time that Work actually started on an Activity.

Backward Pass: The backward pass is the term applied to the finish-to-start analysis in calculating a schedule's late dates. The backward pass calculates the latest possible start and finish dates for each Activity. It is calculated after the forward pass, using the latest Activity's early finish as a starting point or a mandatory finish date if imposed.

Baseline Schedule: The Schedule Baseline is the set of approved scheduled Activities derived from and consistent with, the Project scope. The Project Schedule Activities are traceable to elements within the WBS. Activity logic should depict all Work scope, constraints and decision points. Time durations should be estimated and assigned to Activities representing Work accomplishments.

Calendar: A Project Calendar lists time intervals in which Activities or resources will be performed (days/week, shifts/day, hours/day, hours/shift) and can or cannot be scheduled. A Project usually has one default calendar for the normal workweek (Monday through Friday) but may have other Calendars as well. Each Calendar can be customized with its own holidays and extra Workdays.

Critical Path: The chain of Activities that controls overall Project completion with total Float that equals zero. It is normally the longest continuous sequence of Activities in the Project with zero total Float. However, a Project may contain more than one Critical Path. A delay in any Activity on the Critical Path causes a delay in the completion of the Project. Critical Activities that are behind schedule may have negative total Float.

Critical Path Method Schedule: The Critical Path Method (CPM Schedule) is a modeling process that calculates the start and finish dates of Activities in the Project in two passes and defines the Project's critical Activities. The first pass (forward pass) calculates early start and finish dates from the earliest start date forward. The second pass (backward pass) calculates the late start and finish Activities from the latest finish date backwards. The difference between the pairs of start and finish dates for each task is the Float.

Early Finish Date: In the Critical Path method, the earliest possible point in time on which the uncompleted portions of an Activity (or the Project) can finish, based on the network logic and any schedule constraints. Early finish dates can change as the Project progresses and changes are made to the Project plan. (The Early Finish date is defined as the earliest calculated date on which an Activity can end. It is based on the Activity's Early Start, which depends on the finish of predecessor Activities and the Activity's duration. Early dates are calculated with a forward pass from the beginning of the Projects to the end.)

Early Start Date: In the Critical Path method, the earliest possible point in time on which the uncompleted portions of an Activity (or the Project) can start, based on the network logic and any schedule constraints. Early start dates can change as the Project progresses and changes are made to the Project plan. (The Early Start date is defined as the earliest calculated date on which an Activity can begin. It is dependent on when all predecessor Activities finish. Early dates are calculated with a forward pass from the beginning of the Project to the end.)

Finish-To-Finish Relationship: A Finish-to-Finish relationship (FF) is a relationship between Activities in which a successor Activity cannot finish until its predecessor Activity has finished.

Finish-To-Start Relationship: A Finish-to-Start relationship (FS) is a relationship between Activities in which a successor Activity cannot be started until its predecessor Activity has finished.

Float: The amount of time that an Activity may be delayed from its early start without delaying the Project finish date.

Forward Pass: The forward pass is the term applied to the start-to-finish analysis in calculating a schedule. The forward pass calculates the earliest possible start and early finish dates for each Activity. It begins with the start Activity, assumes all preceding Activities are completed by their early dates and starts the calculation from the data date.

Fragnets: Fragnets are network/block drawings, step breakdowns, Worksheets, drawings or sketches, which portray necessary coordination and physical Work-steps associated with accomplishing a job or Activity. They may include, but are not limited to: prerequisite Activities, system status, manpower, duration, milestones, target date constraints, turnovers and testing requirements.

Lag: The amount of time after one scheduled task is started or finished before the next task can be started or finished. (Lag is the time delay between the start and finish of an Activity and the start or finish of its successor(s).)

Late Finish Date: In the Critical Path method, the latest possible point in time that an Activity may be completed without delaying a specified milestone (usually the Project finish date). (Late Finish dates are defined as the latest dates by which an Activity can finish to avoid causing delays in the Project. Late dates are calculated with a backward pass from the end of the Project to the beginning.)

Late Start Date: In the Critical Path method, the latest possible point in time that an Activity may begin without delaying a specified milestone (usually the Project finish date). (Late Start dates are defined as the latest dates by which an Activity can start to avoid causing delays in the Project. Late dates are calculated with a backward pass from the end of the Project to the beginning.)

Near Critical Path: An Activity that if not Worked on schedule, and within the Project Scheduled duration, has the potential to become Critical Path.

Negative Float: Negative Float indicates Activities must start before their predecessors finish in order to meet a Target Finish date. Negative Float occurs when the difference between the late dates and the early dates (start or finish) of an Activity are negative. In this situation, the late dates are earlier than the early dates.

Schedule Variance: Any difference between the Project Scheduled completion of an Activity and the actual completion of that Activity.

Scheduling: Scheduling is the process of determining when Project Activities will take place depending on defined durations, relationships and constraints.

Start-To-Finish Relationship: A Start-to-Finish relationship (SF) is a relationship between Activities in which a successor Activity cannot be completed until its predecessor Activity starts.

Start-To-Start Lag: Start-to-Start Lag is the minimum amount of time that must pass between the start of one Activity and the start of its successor(s).

Start-To-Start Relationship: A Start-to-Start relationship (SS) is a relationship between Activities in which a successor's start depends on its predecessor.

Total Float: Total Float (TF) is the amount of time that a schedule activity can be delayed or extended from its early start date without delaying the project finish date or violating a schedule constraint.

Work Breakdown Structure: A WBS is a deliverable-oriented, hierarchical grouping of Project components that organizes and defines the total scope of the Project; Work not in the WBS is outside the scope of the Project. As with the scope statement, the WBS is often used to develop or confirm a common understanding of Project scope. Each descending level represents an increasingly detailed description of the Project deliverables.

END OF APPENDIX D

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APPENDIX E
SAFETY DATA SHEETS

CONTRACTOR AFFIDAVIT

As the responsible party for the firm of _____, I do here state that I have requested, received, read, understand, and will abide by and enforce the guidelines and conditions set forth in the Safety Data Sheets (SDS) provided by the product manufacturer for each hazardous chemical product delivered to and/or used in connection with the work specified in this Specification CB-SPEC-000001.

I further state that I am aware of, understand, and will fully implement the requirements of the OSHA Hazard Communication Standard (CFR 29, Part 1910.1200) and other workers' right-to-know laws.

I further state that I will maintain copies of the required Safety Data Sheets for each hazardous chemical in the workplace, including Company's hazardous materials, listed in this Specification; and will ensure that the Safety Data Sheets are readily accessible during each work shift to employees when they are in their work areas.

I further state that the information contained within the Safety Data Sheets sheets has been disseminated to all parties who have a right or need to know; and that all workers and other effected parties have received adequate and appropriate training in the hazards, handling, and use of hazardous chemicals.

_____ _____
Contractor's Representative/Title Date

_____
Notary Public Signature & Seal

END OF APPENDIX E

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APPENDIX F
PIPING, WELDING, NDE, AND EXCAVATION REQUIREMENTS

1.0 PIPING, WELDING, NDE AND EXCAVATION REQUIREMENTS

1.1 Piping

1.1.1 For all piping which must be abandoned or demolished as part of the Work, Contractor must comply with all requirements in Attachment F.1.1. Contractor shall follow the Guidelines for Abandoned Piping and Demolishing Abandoned Piping while performing work on piping and/or utilities which are abandoned or will be abandoned in place.

1.1.1 Pressure part materials such as pipe and fittings shall comply with Pipe and Fittings: Approved Manufacturer List (Attachment F.2.1) of this specification.

1.2 Welding and NDE

1.2.1 For all Welding and NDE that is part of the Work, Contractor must comply with the requirements in Attachment F.1.3.

1.2.2 Water Soluble Purge Dams. All use of Water-Soluble Purge Dams shall be performed in accordance with Owner's "Recommended Welding Practices for Water Soluble Purge Dams." (RWP-11)

1.3 Excavations

1.3.1 Contractor shall perform all excavation of underground utilities by non-destructive means and methods only (i.e., vacuum suction). Traditional mechanical excavation means and methods (i.e., back-hoe) shall not be utilized unless Contractor receives written approval by the SPOC.

1.3.2 When performing High Suction Vacuum excavation, Contractor's equipment must include a vacuum relief valve and a vacuum break at the point of operation. Contractor's equipment must be grounded while operating.

2.0 FOREIGN MATERIAL EXCLUSION

2.1 Site systems must remain free of foreign material contamination to operate properly. The following is an outline of required practices that Contractor and its personnel must follow to prevent foreign material contamination.

2.1.2 Foreign material contamination at the Site's components is very serious and must be addressed. Failure to do so may result in millions of dollars of equipment damage and lost revenue. The consequences could be so great that Owner will be compelled to recover damages from the Contractor.

2.1.2 In the event that foreign material is known to have entered a critical system, contact the Owner (SPOC) immediately.

2.2 Equipment Covered by Foreign Material Exclusion (FME) Procedures

2.2.1 Contractor shall follow FME practices, particularly on systems and components that are critical to the energy center such as the feedwater, condensate, steam, lubricating oil, turbine, and generator. This equipment is likely to suffer component damage if contaminated by foreign material.

2.2.2 Examples of critical components include, but are not limited to:

- Boiler tubes, headers, and drums
- Condensers
- All lube oil reservoirs
- Pumps
- Generators and seal oil systems
- Electrical cabinets
- Transformers
- In-line flow elements
- Feedwater heaters
- Flash tanks
- All piping systems
- Turbine shells and piping
- Large electric motors
- Switchgear
- Compressed air systems
- Bulk storage tanks

2.3 Sources of Foreign Material Contamination

2.3.1 Common contaminates include, but are not limited to:

- Welding & gas cutting debris
- Corrosion
- Metal chips, shavings & filings created by machining and repair operations
- Materials used for cleaning
- Improper lubricants
- Dirt, fly ash & coal dust
- Contaminants found on shoes & clothing
- Pens, rulers, coins, keys & other typical contents of a shirt pocket
- Tools
- Trash

2.3.2 Typical activities that produce foreign material include, but are not limited to:

- Drilling, cutting, grinding, machining, filing, and lapping.
- Welding thermal cutting activities.
- Lubricants or cutting oils.
- Use of tape, plugs, or seals that may leave a residue.
- Sandblasting.
- Confined space entry.
- Sweeping or using air or water to clean.
- Any activity including equipment inspection and testing that requires opening a normally sealed component.

2.4 General Foreign Material Exclusion Practices

2.4.1 Contractor shall follow Owner's minimum requirements for Contractor FME plan shown on Attachment F.2.1.

2.4.2 Owner requires that all Contractors and subcontractors have a SPOC approved FME plan prior to working on a critical energy center system.

2.4.3 Owner requires that the Contractor and subcontractors discuss FME practices with craft labor at the weekly safety meetings.

2.4.4 Contractor and subcontractor shall maintain good housekeeping practices on the entire construction site.

3.0. DEFICIENCY NOTIFICATION AND CORRECTIVE ACTION PROCESS

3.1 The following paragraphs describe the system used by Owner's quality inspection supervisors to correct deficiencies identified during a major boiler outage. Depending on the urgency and severity of the infraction, one or more of the steps may be bypassed.

- **1st Violation**: When a deficiency is identified, a verbal request for corrective action will be given to the first line supervisor and general foreman of Contractor. A full accounting of issues will be documented in the weld inspector's daily log.

- **2nd Violation**: If compliance has not been achieved through the first verbal request for corrective action, a second verbal request will be directed to the general foreman, job site superintendent and the Owner Construction Supervisor. A full accounting of issues will be documented in the weld inspector's daily log.

- **3rd Violation**: Upon the third violation a deficiency report will be generated. A deficiency report describes the violation and may include digital images documenting the violation. The deficiency report requires a written response from the Contractor within the time frame noted on the deficiency report. The deficiency report will require the Contractor to describe in writing the immediate remedial corrective action(s) taken and the long term steps taken to prevent a recurrence. Deficiency reports will be distributed electronically to the Site superintendent and the following Owner management personnel: Director-Quality Management Oversight, Director-Project Management, Supervising Engineer-Technical Support, Site manager, Site technical support superintendent, boiler engineer(s), Quality Management coordinator, PCM superintendent, project engineer (Project Engineering), Project Engineering supervising engineer, construction supervisors, and quality inspection supervisor (opposite shift). All deficiency reports issued will become part of the Contractor appraisal.

- **4th Violation**: If the deficiency report fails to bring about the desired corrective action, Work will be stopped until issues are adequately addressed. Notwithstanding the foregoing, Owner may, at its election, order Work to be stopped prior to the fourth violation, depending on the nature and effects of the violation.

Attachments for Appendix F
Attachment F.1.1: Abandoning Piping and Demolishing Abandoned Piping Guideline
Attachment F.1.2: Pipe and Fittings Approved Manufacturer List
Attachment F.1.3: Welding and NDE
Attachment F.2.1: List of Minimum Requirements for FME Plan
Attachment F2.2: Foreign Material Exclusion Barrier Log, Drop List and Final Closure Inspection

ATTACHMENT F.1.1
ABANDONING PIPING AND DEMOLISHING ABANDONDED PIPING GUIDELINE

1.0 GENERAL GUIDELINE FOR PROPERLY ABANDONNG AND/OR DEMOLISHING PIPING

The division of responsibility for the following actions to be decided at assignment of work:

1.1 A Competent Person shall pre-plan the job prior to the start of the Work.

1.2 Determine pipe to be abandoned or demolished. Review P&ID's and piping isometrics to determine isolation points and material conveyed in piping.

1.3 Review WPA requirements with the Responsible Engineer listed on the JR. Ensure proper WPA is in place to isolate lines.

1.4 Conduct a pre-job briefing to discuss Site specific safety plan and the following:

1.4.1 PPE required:

- Chemical Protection
- Eye & Face Protection
- Foot Protection
- Hand Protection
- Head Protection
- Hearing Protection
- Respiratory Protection

1.4.2 Atmospheric conditions if working in enclosed spaces.

1.4.3 WPA

1.5 Ensure proper WPA is in place to isolate lines. As part of WPA, drain lines and confirm all low spots have been drained.

1.6 Take special precautions to ensure environmental spills do not occur.

1.7 At extreme ends of pipe, remove at least a one-foot section of pipe from equipment or process piping still in use to ensure complete isolation. Cap ends of process piping that will remain in service.

1.8 For piping that will be abandoned in place, permanently tag abandoned pipe in at least three locations (Steel or Brass tag wired to pipe). Tag shall indicate pipe to be "Abandoned in Place," applicable JR number, and material pipe conveyed.

1.9 For piping to be demolished, remove piping, and dispose of properly.

1.10 Update P&IDs and piping isometrics as applicable.

ATTACHMENT F.1.2
PIPE AND FITTINGS: OWNER'S APPROVED MANUFACTURER LIST

QA Oversight Level	Minimum QA Requirements
1	• CMTR required on all shipments. Documentation sent with materials as required. • Destructive and Non-Destructive Independent Testing completed once per year for each category and manufacturer on the AML (CBN Stl Pipe, Fittings, etc.). • Quality Audit performed at manufacturer once every 2 years.
2	• CMTR required on all shipments. Documentation sent with materials as required. • Destructive and Non-Destructive Independent Testing completed once per year for each category and manufacturer on the AML (CBN Stl Pipe, Fittings, etc.). • Subject to Master Import testing as required. If performed, Owner is to receive copy of testing. • PMI Testing at Owner on each heat/lot #.
3	• CMTR required on all shipments. Documentation sent with materials as required. • Third Party testing at Factory on each shipment. • Subject to Master Import testing as required. If performed, Owner is to receive copy of testing. • Destructive and Non-Destructive Independent Testing completed twice per year for each category and manufacturer on the AML (CBN Stl Pipe, Fittings, etc.). • PMI Testing at Owner on each heat/lot #.

Product	Material	ASTM Spec.	Material Grade	Materials Class	Approved Manufacturers	Country	City/State	Approved For	Registrations/ Certifications	Mfr. QA Oversight Level	Comments
PIPE, SEAMLESS	Carbon Steel	A106	Grade B Grade C	Schedule 40 Schedule 80 Schedule 160 XXS	Arcelormittal	South Africa	Vereeniging	GEN	ISO:9001	2	
					Chung Hung Steel	Taiwan	Kaohsiung City	GEN	ISO:9001	3	
					Dnepropetrovsk	Ukraine	Dneproptrovsk	GEN	ISO:9001	2	
					Hall Longmore	South Africa	Wadeville	GEN	ISO:9001	2	
					Husteel	Korea	Seoul	GEN	ISO:9001	3	
					Hyundai Hysco	Korea	Ulsan	GEN	ISO:9001	3	
					JSC	Ukraine	Dneproptrovsk	GEN	ISO:9001	3	
					Lakeside	USA	US	GEN	ISO:9001	1	
					Maharashtra	India	Raigad	GEN	ISO:9001	3	
					Sun Steel	Vietnam	Binh Duong Province	GEN	ISO:9001	3	
					US Steel	USA	Fairfield, AL	GEN	ISO:9001	1	
					Uvjerne	Croatia	Uvjerne	GEN	ISO:9001	2	
					Wheatland/Sharon	USA	Sharon, PA	GEN	ISO:9001	1	
	Ferritic Steel	A335	P11 P22	Schedule 80 Schedule 160 XXS	JFE	Japan	Chita	GEN	ISO:9001	2	
					Michigan	USA	MI	GEN	ISO:9001	1	
					Productos	Spain	Valle de Trapaga	GEN	ISO:9001	2	
					Sumitumo	Japan	Wakayama	GEN	ISO:9001	2	
					Tenaris	Argentina	Buenos Aires	GEN	ISO:9001	2	
	Austenitic Stainless Steel	A312	**300 Series** 304 304L 316 316L etc.	Schedule 80 Schedule 160 XXS							
					Haynes	USA	IN	GEN	ISO:9001	1	
					Kawasaki	Japan	Fukuyama	GEN	ISO:9001	2	
					Kobe	Japan	Tokyo	GEN	ISO:9001	2	
					Nippon	Japan	Yamaguchi	GEN	ISO:9001	2	
					Productos	Spain	Valle de Trapaga	GEN	ISO:9001	2	
					Pusan	Korea	Janghang	GEN	ISO:9001	3	
					Sandvik	Sweden	Sandviken	GEN	ISO:9001	2	
					Sumitumo	Japan	Kashima City	GEN	ISO:9001	2	
					TaChen	Korea	Taipei	GEN	ISO:9001	3	
					Webco	USA	OK	GEN	ISO:9001	1	
		A376	**TP300 Series**	Schedule 80 Schedule 160 XXS	Bristol	USA	Bristol, TN	GEN	ISO:9001	1	
					Haynes	USA	IN	GEN	ISO:9001	1	
					Outokumpu	USA	Wildwood, FL	GEN	ISO:9001	1	
					Webco	USA	OK	GEN	ISO:9001	1	

Product	Material	ASTM Spec	Material Grade	Material Class	Approved Manufacturers	Country	City/State	Approved For	Registrations/ Certifications	Mfr. QA Oversight Level	Comments
PIPE, WELDED	Austenitic Stainless Steel	A312	300 Series 304 304L 316 316L	Schedule 80 Schedule 160 XXS	Thareus	Thailand	Rayong	GEN	ISO:9001	3	
					Pantech	Malaysia	Kuantan	GEN	ISO:9001	3	
					PreStar	Malaysia	Darul Ehsan	GEN	ISO:9001	3	
					KingMaker Steel	USA	NJ	GEN	ISO:9001	1	
					Kanzen Tetsu	Malaysia	Darul Ehsan	GEN	ISO:9001	3	
					Sonah	Vietnam	Seoul	GEN	ISO:9001	3	
					Bristol Metals	USA	Bristol, TN	GEN	ISO:9001	1	
					Outokumpu	USA	Wildwood, FL	GEN	ISO:9001	1	
FITTINGS Socket Butt Threaded Reducers Unions Ells Elbows Tees Caps Plugs Bushings	Malleable Iron	A197		150# 300#	Ward Manufacturing	USA	Blossburg, PA	GAS	ISO:9001	1	
					Anvil	USA	Columbia, PA	GAS*	ISO:9001	1	*Approved for plugs, unions, elbows, and tees only
					Jinan	China	Jinan	GEN	ISO:9001	3	
	Carbon Steel Forgings	A105		Socket Weld Threaded	Capitol	USA	Crowley, LA	GAS**,GEN	ISO:9001	2	** Only Plugs
					Bonney Forge	USA	Mt. Uniom, PN	GAS, GEN	ISO:9001	2	
	Wrought Carbon Steel/Alloy Steel	A234	W Series WPB, WPC, etc.	Butt-Weld Standard XH XXH	Arah Danang	Malaysia	Darul Ehsan	GEN	ISO:9001	3	
					Awaji	Thailand	Sumoto City	GEN	ISO:9001	3	
					Canadoil	Canada	Quebec	GEN	ISO:9001	3	
					Charming	Vietnam		GEN	ISO:9001	3	
					Erne	Austria	Hauptstasse	GEN	ISO:9001	2	
					Hackney Ladish	USA	AR, OK	GAS, GEN	ISO:9001	2	
					Pantech	Malaysia	Seiannor	GEN	ISO:9001	3	
					Teneris	Mexico	De Clorec	GEN	ISO:9001	2	
					TK	Korea	Busan	GEN	ISO:9001	3	
					Weldbend	USA	IL	GAS, GEN	ISO:9001	2	
	Wrought Austenitic Stainless Steel	A403		Butt-Weld Sch 10,40,80,160							
					Kanzen-Tetsu	Malaysia	Darul Ehsan	GEN	ISO:9001	3	
					Tru-Flo	Taiwan	Hsiang	GEN	ISO:9001	3	
					Elin	Philippines	Cavite	GEN	ISO:9001	3	
					Schulz	Brazil	Campos dos Guyacezes	GEN	ISO:9001	2	
					SPI	Malaysia	Darul	GEN	ISO:9001	3	
					SFG	USA	Travelers	GEN	ISO:9001	1	

Product	Material	ASTM Spec	Material Grade	Material Class	Approved Manufacturers	Country	City/State	Approved For	Registrations/ Certifications	Mfr. QA Oversight Level	Comments
	Forged or Rolled Alloy Stainless Steel	A182	F9 F11 F22	3000/6000# SW 3000/6000# THRD	Bonney Forge	USA	Mt. Union, PN	GEN	ISO:9001	1	
					Penn Machine	USA	PN	GEN	ISO:9001	1	
			300 Series 304/304L 316/316L	3000/6000# SW 3000/6000# THRD	Bothwell	Taiwan	Hsien	GEN	ISO:9001	3	
					ISE	Japan	Osaka	GEN	ISO:9001	2	
					Enlin Steel	Taiwan	Cavite	GEN	ISO:9001	3	
PIPE NIPPLES	Carbon Steel	A106 A733	Grade B Grade C	Standard (40) Schedule 80 Schedule 160 XXS	Westbrook	USA	Houston, TX	GAS, GEN	ISO:9001	2	
					Wisconsin	USA	Milwaukee, WI	GAS, GEN	ISO:9001	2	
	Austenitic Stainless Steel	A106 A733	**300 Series** 304/304L, 316/316L,	Standard (40) Schedule 80 Schedule 160 XXS	Westbrook	USA	Houston, TX	GEN	ISO:9001	1	
					Merit Brass	USA	Cleveland, OH	GEN	ISO:9001	1	
FLANGE, PIPE	Carbon Steel Forgings	A105	Grade B Grade C	150# 300# 600# 900#	Ameri-Forge	USA	TX	GEN	ISO:9001		
					Balkrishna	India	Gujarat	GEN	ISO:9001	3	
					Bebitz	Germany	Lebendorter	GEN	ISO:9001	2	
					Boltex	USA	Houston, TX	GAS, GEN	ISO:9001	2	
					Galperti	USA	Houston, TX	GAS, GEN	ISO:9001	2	
					Hind	India	Ghaziabad	GEN	ISO:9001	3	
					Metalfar	Italy	Brianza	GEN	ISO:9001	2	
					Munish	India	Ludhiana	GEN	ISO:9001	3	
					Norma	India	Sahibabad	GEN	ISO:9001	3	
					Rangani	India	Gujarat	GEN	ISO:9001	3	
					RNG	India	Ludhiana	GEN	ISO:9001	3	
					Tirupati	India	Ghaziabad	GEN	ISO:9001	3	
					Trilad	USA	Houston, TX	GEN	ISO:9001	1	
					Weldbend	USA	Chicago, IL	GAS, GEN	ISO:9001	2	
	Stainless Steel	A182	**300 Series** 304/304L, 316/316L,	150# 300#	Enlin	Philippines	Cavite	GEN	ISO:9001	3	
					Viraj	India	Maharashtra	GEN	ISO:9001	3	
					Hilton Metal	Mumbai	Ghonsai	GEN	ISO:9001	3	
	Forged or Rolled Alloy	A182	F9 F11 F22	150# 300# 600#	Ameri-Forge	USA	TX	GEN	ISO:9001	1	
					Maas Flange	USA	TX	GEN	ISO:9001	1	
SWAGE NIPPLES and BULL PLUGS	Carbon and Stainless Steel	A234			Capitol Manufacturing	USA	Crowley, LA	GAS	ISO:9001	2	Approved for Weld X
					Westbrook	USA	Houston, TX	GAS	ISO:9001	2	Approved for Thread X Thread

ATTACHMENT F.1.3
WELDING AND NDE

1.0 TECHNICAL REQUIREMENTS

1.1 General

All welding and welding related activities including NDE on boiler pressure parts, attachments and boiler external piping shall be performed under the Contractor's ASME or National Board "R" Stamp Quality Control program in accordance with the ASME Boiler and Pressure Vessel Code, the ASME Power Piping Code, B31.1 and the National Board Inspection Code, NB-23. All structural welding shall be done in accordance with the latest revision of the AWS Structural Welding Code, D1.1 except that welders may be qualified to the ASME Code in lieu of D1.1.

1.1.1 Recommended Weld Practices (RWP)

1.2 Welding – Ferritic Materials

Open root pressure part welds shall be made with a GTAW (gas tungsten arc welding) root pass unless otherwise specified. SMAW (shielded metal arc welding) welds on ferritic materials (carbon, carbon-moly and chrome-moly alloys) shall be made with low hydrogen electrodes. GMAW (gas metal arc welding) or FCAW (flux core arc welding) is not permitted for joining pressure parts. Subject to Owner approval, these processes may be used for non-pressure part welding such as membrane or skin casing. Welding progression for all processes shall be uphill. Membrane shall be welded from both sides unless otherwise approved.

Filler materials, preheat and post-heat temperatures shall be as shown in Table 1.2 unless otherwise approved. For joints between differing P-numbers, the PWHT temperature shall be that specified the material of the higher P-number material being joined. Finished welds in Grade 91 must be slow cooled (no forced cooling) to below 200°F before proceeding directly into PWHT. If PWHT after welding is delayed for any reason, hydrogen bake-out shall be performed PRIOR to dropping below minimum pre-heat temperature (NO EXCEPTIONS). Hydrogen bake-out shall be conducted at 600°F for 1 hour. After hydrogen bake out is complete, it is permissible to slow cool weld to room temperature, provided final post-weld heat treatment is performed within 7 days.

Table 1.2

P- No.	Nominal Composition	Preheat Temp.** (°F)	PWHT Temp. (°F ± 25)	Maximum Temp (°F)	Welding Process	
					SMAW	GTAW
P1	Carbon steel	250*	1150	1300	E7018	ER70S-2
P3	C, 1/2 Mo Grade T1	250	1150	1300	E7018-A1 E801X-B2	ER70S-A1 ER80S-B2
P3	1/2 Cr, 1/2 Mo Grade T2	250	1150	1300	E801X-B2	ER80S-B2
P4	1-1/4 Cr, 1/2 Mo Grade T11	300	1225	1350	E801X-B2	ER80S-B2
P5A	2-1/4 Cr, 1 Mo Grade T22	450	1350	1375	E901X-B3	ER90S-B3
P5B	9 Cr, 1 Mo Grade T9	450	1350	1375	E801X-B8	ER80S-B8
P15E	9 Cr, 1 Mo, 1/4 V Grade T91	450	1350-1425	1425	E901X-B9	ER90S-B9

*Refer to the applicable ASME code for 250°F preheat requirements since base material minimum thickness requirements vary by Code. 50°F preheat minimum required!

**For ambient temperatures below 32°F in the vicinity of the weld, refer to paragraphs 5.6 and 5.12 in Clause 5 in the latest addition of AWS D1.1 Code.

Note: The Maximum PWHT Temp applies when joining materials with different P- numbers.

1.3 Welding – Austenitic Materials

Open root pressure part welds shall be made with a GTAW (gas tungsten arc welding) root pass and an inert backing gas unless otherwise specified. The use of a flux or flux coated filler wire to prevent oxidation of the root pass is not permitted. The use of flux cored wire may be permitted but only with Owner's prior approval. 65°F minimum Preheat required for Stainless-to-Stainless welds. Inter-pass temperatures shall not exceed 350°F. When joining austenitic stainless steel materials of different nominal chrome content, the filler material shall have a chrome content of the higher chrome alloy.

1.4 Welding – Dissimilar Metal Welds

Welds between austenitic stainless steel materials and ferritic materials shall be made with ENiCrFe-2 or ENiCrFe-3 electrodes. Butt welds joining pressure parts shall have a weld joint geometry as shown in Figure 1.4 (a). The weld cap on the ferritic side of the weld shall extend past the edge of the weld prep as shown in Figure 1.4 (b).

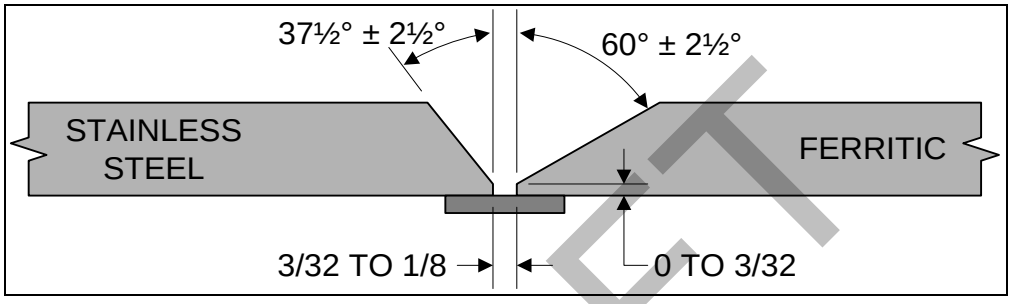

Figure 1.4 (a)

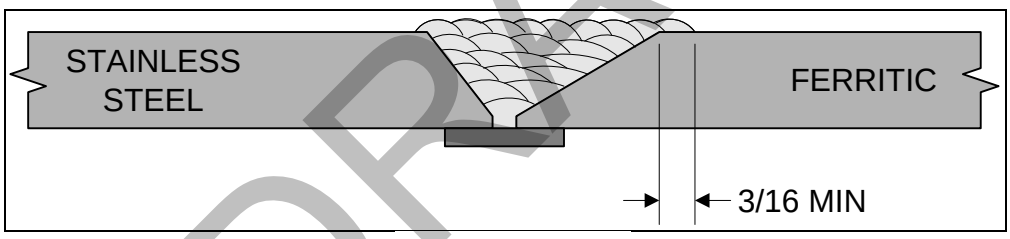

Figure 1.4 (b)

1.5 Filler Material Handling and Storage

Following is for Low Hydrogen electrodes ONLY:

Electrodes shall be stored in hermitically sealed containers until used. Opened containers and loose electrodes shall be maintained in portable heated rod caddies or rod ovens. Rod ovens shall be maintained at 250°F. Electrodes which are cold to the touch are not acceptable for use and shall be discarded. Re-baking is not permitted.

These are the allowable atmospheric exposure limits for low hydrogen electrodes:

Electrode	Hours
E70XX-X	4 max.
E80XX-X	2 max.
E90XX-X	1 max.
E100XX-X	½ max.
E110XX-X	½ max.

Electrodes stored in rod ovens shall be segregated and labeled by classification number. Only one (1) classification of electrode is permitted in each portable rod caddy.

Bare filler materials shall be stored in a clean dry area to prevent contamination and physical damage. Each straight length of bare filler material shall be marked with the classification number. Filler materials without the required markings are not acceptable for use and shall be discarded.

1.6 Weld Traceability

Each pressure boundary weld shall be traceable to the welder or welders who made the weld. Traceability shall be maintained through use of written documentation. Stamping of welds is not permitted.

1.7 Preheat and Post Weld Heat Treatment

When preheat is required by the welding procedure specification (WPS), the preheat shall be applied prior to tack welding. Oxy-fuel torches may be used for preheating tubing or pipe with a specified chrome content of 3% or less and not exceeding 4½" in diameter and ½" in wall thickness. All other preheating shall be done using resistance heating. When using oxy-fuel torches for preheat a means to verify preheat temperature, such as temperature indicating crayon, is required.

Post-weld heat treatment shall be done using resistance or induction heating unless otherwise Owner approved. Welds in Grade 91 (T91, P91) material must be slow cooled (no forced cooling) to below 200°F before proceeding directly into PWHT. If PWHT after welding is delayed for any reason, hydrogen bake-out shall be performed PRIOR to dropping below minimum pre-heat temperature (NO EXCEPTIONS). Hydrogen bake-out shall be conducted at 600°F for 1 hour. After hydrogen bake out is complete, it is permissible to slow cool weld to room temperature, provided final post-weld heat treatment is performed within 7 days.

1.8 Preheat and Post Weld Heat Treatment Procedure Submittal and Record Keeping

All PWHT information (heating/cooling rates, soak time and temperature) shall be provided to the Owner Engineer by the engineering submittal milestone date. The Contractor shall provide a copy of the approved procedure to the PWHT technician. A copy of the current calibration data for the heating equipment shall be supplied by the Contractor for approval by Owner Quality personnel. Each weld shall be clearly identified on the recording charts. The PWHT zone shall be centered on the weld and the width shall be at least 5 times the thickness of the material. A minimum of two thermocouples, located 180 degrees from each other, are required unless otherwise approved by Owner. The rates of heating and cooling shall not exceed 400°F per hour, unless approved by Owner. At 600°F the equipment may be turned off and the weldment allowed to slowly cool in still air. After completion of the PWHT, the Contractor shall submit copies of the time versus temperature strip charts for each weld within 24 hours.

1.9 Interruption of Welding

Interruption of welding may be allowed but only after prior approval by Owner for the conditions outlined below by material P-Nos. Owner reserves the right to adjust the minimum required deposited weld metal based on field applications or conditions.

1.9.1 Welding on P No's 3, 4, and 5A materials with a maximum specified chromium content not exceeding 3.0% may be interrupted provided ALL the following are satisfied:

1.9.1.1 For joint thickness less than or equal to 1.5", the joint is welded out the **lesser** of 3/8" or 25% of the groove weld thickness. For joint thickness greater than 1.5", the joint is welded out the **greater** of 3/8" or 25% of the groove weld thickness.

1.9.1.2 The weld is allowed to cool slowly to room temperature.

1.9.1.3 A visual inspection by an Owner welding inspector is performed prior to resumption of welding to ensure that no cracks have occurred.

1.9.1.4 The required preheat is reapplied and any cracks are repaired before welding resumes.

1.9.2 Welding on P No. 5B, 6 or 15E materials (with specified chromium content greater than 3%) may be interrupted and the weld allowed to cool slowly prior to heat treatment provided ALL the following are satisfied:

1.9.2.1 For joint thickness less than or equal to 1.5", the joint is welded out the **lesser** of 3/8" or 25% of the groove weld thickness. For joint thickness greater than 1.5", the joint is welded out the **greater** of 3/8" or 25% of the groove weld thickness.

1.9.2.2 An intermediate heat treatment and a controlled cooling rate are applied as specified by an Owner Engineer.

1.9.2.3 A visual examination of the weld by an Owner Welding Inspector is performed prior to resumption of welding to ensure that no cracks have occurred.

1.9.2.4 The required preheat is reapplied and any cracks are repaired before welding is resumed. Activities such as slag removal, lunch breaks, shift change and visual inspections are not considered interruptions, provided that the required preheat is maintained.

1.10 ID Counterbores and Tapers

ID counterbores and transitions shall be in accordance with the applicable sections of ASME Section I or ASME B31.1. There shall be a smooth transition to the counterbore with a 4-to-1 taper preferred, but in no case shall the taper exceed 3-to-1, unless otherwise specified. For boiler tubes, a straight counterbore shall be in no case less than ¼" in length.

1.11 Backing Rings

Backing rings are not permitted unless otherwise specified or approved.

1.12 Dimensional Verification

Prior to any demolition, the contractor shall establish datum points and reference measurements to establish physical dimensions and location of the boiler in the "as found" condition.

2.0 CONTRACTOR QUALITY MANAGEMENT

2.1 General

To ensure quality, Contractor will be required to designate a person or persons (multiple shift coverage) to monitor all welding related activities and maintain compliance with this specification and the applicable Code. The designated person shall be an AWS Certified Weld Inspector (CWI) or have welding experience credentials that per Owner approval can substitute for certification. The designated person shall not have dual job responsibilities that include supervision of qualified welders on job. The designated person will be responsible for performing visual weld inspections, marking completed and inspected welds with a hallmark in any color except white, monitoring rod control and Foreign Material Exclusion (FME), and must have the authority to correct unsatisfactory conditions when they occur.

2.2 Weld Procedures

Contractor shall furnish at the time of mobilization after award of a contract but PRIOR to the start of welding all applicable Welding Procedure Specifications (WPS). Any differences in preheat, post-weld heat treatment or filler materials between those listed in Table 1.2 and Contractor's proposed WPS's shall be noted in Contractor's proposals at the time of bid. Procedure Qualification Records (PQR) shall be available for review by Owner personnel upon request. A copy of the applicable WPS's shall be posted at job site providing the welders specific welding instructions.

2.3 Weld Map

Contractor shall furnish a weld schedule on or before the required engineering submittal milestone that provides as a minimum; a description of the weld joint; the material specification and grade, diameter and joint thickness for each of the two materials being joined; throat thickness for fillet welds; NDE required; preheat and post-weld heat treatment temperatures, welding procedure; and filler metal.

2.4 Welder Qualification and Identification

Contractor shall furnish Owner with qualification records (WQR's and welder continuity records) for each welder PRIOR to the start of welding. All welder qualification records shall be accompanied by a photograph of the welder to whom they pertain unless waived by Owner. Contractor shall assign a number and/or letter to each welder. This identification symbol shall be unique to each individual welder and shall not be assigned to any other welder during this work. To maintain traceability of weld joints to specific welders, a written record or log shall be maintained by Contractor.

2.5 Control of Material Supplied by Owner

Contractor shall establish a temporary controlled storage facility for the safekeeping of materials supplied by Owner during work. Materials that are to be used on boiler pressure parts shall be handled and stored in accordance with Contractor's approved QMP and this Specification. At end of job, Contractor is responsible for returning unused material in good condition and includes all Code markings. The Contractor shall attach Form 4983, "Return Material Tag" to all returned material along with an inventory list. Form 4983 will be provided by the Owner. Any material not returned in good condition, or that cannot be accounted for, shall be replaced by the Contractor at its expense.

2.6 Materials Furnished by Contractor

"Non-Code" materials, including attachments, that are supplied by Contractor shall as a minimum meet ASTM requirements. Material supplied for repairs performed under a Code Symbol Stamp, shall be ASME material and the proper documentation must accompany the material (i.e., certified material test report, P-4 Forms, etc.) Attachment lug material must be A36, or other material approved by Owner.

3.0 QUALITY ASSURANCE PLAN

3.1 The Owner intends to visually inspect 100% of all weldments and other non-welding areas throughout the course of this work. The Owner personnel will make these inspections in a manner as timely and expediently as possible. **Owner's QMS does not relieve Contractor from primary responsibility of quality management and control and Contractor shall not, in any way, relax Contractor's own Quality Management Plan because of Owner's inspection activities**. Contractor shall keep Owner personnel informed of all quality and welding related matters and be responsible for ensuring that all work is acceptable. Workmanship quality shall be in accordance with Contractor's approved Quality Management Plan and this specification.

3.2 When Owner personnel perform visual inspections, they will focus on dimensional as well as weldment related discontinuities. Contractor's QC person will be responsible for visual inspections and for providing a dialogue with Owner regarding these activities.

3.3 **All slag must be removed from welds before inspections will be performed.** Welds shall be free of course ripples, grooves, overlap and shall merge smoothly with surfaces being joined. The undercut on finished welds shall not exceed 1/32" or 10% of the wall thickness, whichever is less. **Filing toe of weld thus creating an undercut is not permitted under any circumstances.** Porosity, cracks, suck or blow holes, arc strikes, lack of fusion open surface defects, excessive push through and burn through on backing rings are not permitted.

3.4 Dimensional discontinuities including misalignment (doglegs), distortion, incorrect weld size and/or weld profile, incorrect final dimensions and excessive weld reinforcement are not acceptable. Maximum reinforcement shall be as listed in appropriate ASME Code Section or as specified elsewhere in Owner specification.

3.5 Radiography

3.5.1 All radiographic examination, when specified by Code or Owner, shall be performed in accordance with Article 2 of ASME Code, Section V and interpreted in accordance with acceptance criteria set forth in applicable Code Section. If a difference of opinion exists between Owner and Contractor on quality of weld, **Owner will have the final word**. Note that unless otherwise stated in this specification or field weld schedules, 10% of all butt welds shall be radiographed. All indications shall be marked on the material surface by NDE technician.

3.5.2 If the rejection rate of radiographed welds exceeds five (5) percent, the Owner shall have the option to require radiography of all welds made and this shall be done at Contractor's expense. All radiographs and interpretation reports become Owner property. Radiographs for T&M work will be billed to the Owner at applicable rates.

3.5.3 Contractor shall provide written notification to Owner's Construction Supervisor and onsite Owner welding inspector at least 24 hours prior to any radiography. All radiography shall be done in accordance with Radiography Safety Requirements (Appendix B – 7.7) of this specification. Welder qualification coupons shall **not** be radiographed inside Energy Center building.

3.5.4 When radiography is required, Owner will specify the type of shot to be taken. Each radiograph will be reviewed and approved by Owner. Once film has been processed and interpreted by testing facility, Contractor shall provide Owner with results and a copy of the film within 24 hours of processing. In applications where Computed Radiography (Digital Radiography) has been specified, Contractor shall provide both a hardcopy and an electronic copy of the shots in a format approved by the Owner Engineer.

3.5.5 In addition to the requirements outlined in ASME Code sections, excessive penetration, burn through or melt through shall be considered as a rejected weld. Owner shall determine locations of welds to be radiographed. The criteria for selection of these weld locations shall be to monitor welder performance (i.e., at least one weld for each welder performing this work shall be selected) and to ensure weld quality in known problem locations.

3.6 Ultrasonic Testing

All ultrasonic weld examinations, when specified by Code or Owner, shall be performed in accordance with Article 4 of the ASME Code, Section V and interpreted in accordance with the acceptance criteria set forth in the applicable Code section. Phased array UT (PAUT) may be used in place of RT but only with Owner's prior approval. If a difference of opinion exists between Owner and Contractor on quality of weld, **Owner will have the final word**. All indications shall be marked on the material surface by NDE technician.

3.7 Dye Penetrant Testing and Magnetic Particle Inspection

All dye penetrant examination and magnetic particle examinations, when specified by Code or by Owner, shall be performed in accordance with Articles 6 and 7 respectively of ASME Code, Section V and interpreted in accordance with acceptance criteria set forth in applicable Code section. If a difference of opinion exists between **Owner and Contractor, Owner will have the final word**. All indications shall be marked on the material surface by NDE technician.

3.8 Weld Repairs

All welds which are rejected by any of the above listed inspection techniques will be repaired at Contractor's expense. Upon completion of weld repairs, Contractor will retest each of them unless otherwise specified by Owner personnel.

4.0 WORKMANSHIP

The following general procedures shall be followed by Contractor when welding activities are being performed.

4.1 Welding

4.1.1 All pressure containing welds shall be made with a minimum of two passes. Starts and stops shall be staggered on successive layers.

4.1.2 All welding activities shall comply with Owner's Foreign Material Exclusion (FME) guidelines (see Appendix .F-2.0).

4.2 Attachment Welds

4.2.1 Contractor shall not make any attachment welds to any pressure parts piping, headers, drums, peg-fins, or tube membrane without written authorization from the Owner Engineer. All attachment material shall be A36 unless otherwise approved by Owner.

4.2.2 Prior to any attachments being welded, the appropriate preheat as specified on approved WPS shall be applied. Any lifting lugs, pad eyes, etc. welded to any equipment by Contractor shall be washed off and/or ground flush to the base material and inspected by MT or PT methods. The results of the NDE shall be reviewed by the Owner Weld Inspector. Permanent lifting lugs supplied by the material manufacturer shall be left on any new components unless the Contractor is specifically instructed by Owner Engineer to remove them.

4.2.3 Removal, installation, and replacement of all furnace wall membrane shall be performed in accordance with Owner's "Recommended Welding Practice for Membrane Removal and Replacement" (RWP-12.)

4.3 Tube Removal

When removing tubes, the Contractor shall cut the tube first using a saw or cut-off wheel to minimize debris entering inside the tube. On vertical tubing runs, the Contractor shall place a piece of steel sheet metal in the lower cut before making the upper cut. With the sheet metal securely in place, thermal cutting may be used to make the upper cut. All open tube ends shall be covered securely with metal caps or plate at all times. Any debris in the tube or header shall be removed at contractor's expense.

4.4 Pipe Removal

Saw or clam-shell cutting are the preferred methods for pipe removal. However, flame or plasma cutting maybe used provided it meets with the approval of Owner Construction Supervisor and Owner Weld Inspector. Care shall be taken to prevent any debris from falling in the piping. Any debris in the piping shall be removed at contractor's expense. All open ends of pipe shall be securely covered.

4.5 Cleaning

Prior to any welding, all surfaces shall be cleaned thoroughly. The base metal adjacent to the joint shall be free of oil, grease, dirt, moisture, paint or other contaminants that would affect integrity of weld, for a minimum of ¾" on each side of weld joint (inside and outside), unless otherwise specified. The cleaning may be done by filing, grinding, wire brushing and/or solvent cleaning. When cleaning stainless steel, only new, uncontaminated stainless steel brushes, burrs or abrasives are allowed.

4.6 Butt Welding

All weld joint preparation shall be performed in accordance with Owner's "Recommended Welding Practice for Butt Weld Replacement of Tube or Pipe Sections" (RWP-4). Refer to detail drawing for allowable tolerances. If joint design is other than that shown in recommended practice, it must have prior approval by Owner Engineer.

4.7 Socket Welds

All socket welded fittings shall be made in accordance with Owner's "Recommended Practice for Socket Welded Fittings" (RWP-5). Refer to detail drawing for allowable tolerances. Socket welds shall have a gap of approximately 1/8" between bottom of socket and end of pipe prior to welding. Scribe lines must be marked on pipe to indicate the 1/8" gap. Contractor shall not use inserts on socket welds to obtain the required 1/8" gap.

4.8 Padwelding

All padwelding of boiler pressure parts shall be performed in accordance with Owner's "Recommended Welding Practices for Padwelding" (RWP-2).

4.9 Tube Shields

Installation of all protective tube shields and clips shall be performed in accordance with Owner's "Recommended Welding Practice for Tube Shields and Clips" (RWP-6).

4.10 Window Welds

The use of "window welds" is not permissible unless authorized by the Owner's Engineer. If window welds are authorized, Contractor shall provide proof of welder's ability to perform. Proof of proficiency will be determined by Owner Quality personnel.

4.11 Component Replacement

For the removal, replacement, and installation of major boiler components, the Contractor shall note the following:

The elevations and dimensions shown on the general arrangement and reference drawings included with the specification are based on the original design, and do not reflect any deformation due to long term operation or undocumented changes performed during original construction or subsequent repair of the boiler. Therefore, prior to demolition the Contractor shall measure and document the location and elevation of the components to be replaced as well as those components used for reference for the subject replacement. This record shall be submitted to the Owner Engineer prior to commencing removals. These same dimensions shall be recorded during installation of the new components and after the work is complete to document the as-built condition. All dimensional records shall be formally submitted to the Owner engineer in accordance with the milestone schedule and shall be QC hold points depicted in the Contractor's schedule. Any deviations shall be reported immediately to Owner for deposition. If necessary, Owner will provide/designate a datum or reference point in which to use for the required measurements. Owner will also provide/identify critical dimensions to be maintained for proper installation and operation of the unit.

ATTACHMENT F.2.1
LIST OF MINIMUM REQUIREMENTS FOR FME PLAN

1) Cover all unattended openings into components.

2) Clean dirt, coal, fly ash, or any other form of debris from around covers, caps, and other devices before opening for inspection or servicing.

3) When opening critical components, ensure areas above these components are clean so no debris will drop into openings of these components. If work will be done overhead while the component is open, cover with tarps, etc. to prevent debris that is dislodged or dropped from entering the component.

4) Ensure that welding electrodes, stubs, and broken flux coating material is removed from components.

5) Clean the work area before beginning work; this may include wash down or vacuuming of the area.

6) Orient work so that debris will not drop into components.

7) Openings on the main turbine, generator, hotwell pumps, boiler circulating pumps, high-pressure boiler feed pumps, etc., shall be covered during maintenance activities.

8) All piping and tubing must be free of foreign material before and after installation.

9) Do not introduce material into components that may produce corrosion.

10) Shot and sand blasting will only be done in areas that can be adequately cleaned.

11) Use only approved solvents for cleaning.

12) Use only approved lubricants.

13) Use approved tapes, plugs, or seals. Some tapes may leave residue (adhesive) that can cause damage.

14) Use approved procedures when flushing systems.

15) Define a “FME work area” around turbines, generators, lube oil tanks, or other areas specifically designated by the specification with barricade tape and limit access of personnel, tools and materials to these areas.

16) Track all tools, parts, and materials that are allowed into the FME work area. If something cannot be accounted for, follow a systematic procedure to insure that missing item can be accounted for without causing further problems.

17) Do not allow personal items such as jewelry, change, pens, etc. into the FME area. No material shall be allowed in the FME area unless it is absolutely necessary.

18) Secure all tools, safety glasses, badges, gloves, and other loose items with lanyards, tape, or other devices.

19) Stage tools, parts, and materials outside the FME area. Remove all packaging and other unnecessary material before entering the FME area.

20) Inspect tools for parts that might come off the tool during use. Look for items such as loose handles, splintered wood parts, loose wire brush bristles. Clean all tools, materials, and parts before they are allowed into the FME area.

21) Limit the use of clear materials such as face shield visors in the FME area. They will be difficult to see if they are misplaced.

22) Use vacuum or exhaust systems to remove all fly ash and any generated airborne debris from painting, blasting, grinding, etc.

23) When cutting wires, control the ends that are snipped off.

24) Control all metal debris (screws, connectors, wire strippings, etc.) in all electrical enclosures.

25) Account for all rags, cushions, cardboard, etc., that are used in an FME area.

26) Do not use excessive lubricants. The excess lubricants may collect dirt, ash, and other debris.

27) If Contractor suspects that anything fell into the tube, use a video camera or other means of inspection prior to closing components to ensure FME.

    a. In vertical runs of boiler tubing in the radiant reheater, run a camera up and down the tube, to the nearest header.

    b. In small bore tubing at Sioux, insert a steel cable of known length from the lower tube cut line down to the nearest header.

    c. In water wall tubing, water shall be used to clear ash in the tubes. Contact the SPOC if this is not possible due to the length or geometry of the tube.

28) Follow Owner welding practices for removal of tubes and piping.

29) All open pipes, tubes, or systems, regardless of whether they are new, to be re-used or wrecked out, must have FME covers in place. This rule applies to material lying on the floor, hanging in place or staged in racks, storerooms or lay down areas. The only exception is when the tube or pipe is completely disconnected from the system and color coded with bright orange or pink paint indicating that it is scrap.

30) FME covers, when subject to high traffic, abrasion or other situations that would cause them to fall off or become damaged (such as condensate or residual water draining out of the tube, pipe, or system) shall be made of steel, or aluminum (excludes soda cans). For large diameter openings (12" or larger) plywood, canvas or nylon bags shall be used and marked as “NO STEP.” For openings subject to fire fall, grinding, arc air, or any other thermal operation, steel caps shall be used. Large diameter FME covers subject to the support of human weight shall conform to OSHA standards.

31) Water soluble paper, if properly utilized may be used as FME protection during tube or pipe joint prep operations. Sponges may also be used as FME protection during tube or pipe joint operations so long as a sponge log is maintained and implemented. Water soluble cones shall not be used as FME prevention during joint prep operations.

32) On vertical runs of tube or pipe, the first cut must be at the bottom using an abrasive cutoff wheel or other non-thermal means. Then a piece of sheet metal shall be inserted into the kerf created. The upper cut can then be made using a thermal method.

    a. For window welds in boiler tubing, follow RWP-1, including the use of FME discs. The discs are available in the Owner storeroom for multiple tubes sizes. Contact the Owner SPOC in advance to procure the proper size FME discs prior to cutting the tubes.

33) When thermal cutting is to be used to penetrate a sealed system such as headers, tanks, water boxes or large piping, it shall be included in the FME plan (6.0A) and presented to the quality Inspection or Owner (SPOC) for approval prior to the start of work.

34) FME plan requires the use of a FME Barrier Log, Foreign Material Drop List, and Final Closure Inspection signoff record per AUE-FRM-ADM4217-01 and AUE-FRM-ADM4217-02 provided below.

35) Failure to follow FME procedure will be addressed through the Deficiency Reporting system described in Appendix F.3.0**.**

ATTACHMENT F.2.2
FOREIGN MATERIAL EXCLUSTION BARRIERS LOG, DROP LIST, AND FINAL CLOSURE INSPECTION

FME BARRIER LOG				
JR # _____		Equipment		
FME Barrier	Location Installed	Date & Time Installed	Date & Time Removed	Removed By (Initial)
All FME Control Devices must be retrieved and accounted for.				

FOREIGN MATERIAL DROP LIST				
JR # _____		Equipment _____		
Item Dropped	Location	Date & Time Dropped	Date & Time Retrieved	Retrieved By (Initial)
All dropped items have been retrieved and accounted for.				

FINAL CLOSURE INSPECTION		
I certify that the system/equipment has been inspected prior to closure and all foreign material has been removed.		
	SIGNATURE	DATE
Craft Employee:		
Supervisor:		
Forward to Planning when work is complete.		

END OF APPENDIX F

APPENDIX G
MATERIAL HANDLING AND WASTE

1.0 DELIVERY, INSPECTION AND STORAGE OF MATERIALS

1.1 Contractor shall comply with the requirements of Attachment G.1 – Material Handling, Storage & Identification Instructions.

1.2 Contractor and the Project must be indicated on materials delivered to the Site.

1.3 A carrier that is compliant with the Department of Transportation's (DOT) Hazardous Materials Security Plan must be used for deliveries of hazardous materials to the Site. For a list of approved carriers visit http://vics.keyship.net/Ameren. Fill out the required fields and check the HazMat option. A list of qualified carriers will populate. Any vehicle carrying hazardous materials onto Owner facilities will be refused entry until proof of compliance is provided.

1.4 Electrical equipment, controls, and insulations shall be protected against moisture and water damage. All external gasket surfaces and flange faces, couplings, rotating equipment shafts, bearings, and like items shall be thoroughly cleaned, coated with rust-preventive compound, and protected with suitable wood, metal, or other substantial type covering to ensure their full protection. Exposed threaded parts shall be greased and protected with metallic or other substantial type protectors. Damages due to insufficient protection shall be repaired by Contractor.

1.5 Returnable containers and special shipping devices shall be returned by manufacturer's field representative at Contractor's expense.

1.6 A weatherproofed itemized list of the contents shall also be attached to the outside of each box.

1.7 All separately packaged accessory items and parts shall be shipped with the equipment. Containers for separately packaged items shall be marked so that they are identified with the main equipment. An itemized packing slip, indicating what is in that container only, shall be attached to the outside of each container used for packing. A similar list shall be inside of each container. A master packing slip, covering all accessory items for a given piece of equipment which are shipped in separate containers, shall be attached to one container.

1.8 Contractor shall provide dimensions (H" x W' x D") and weight for each shipping container with approval drawings.

1.9 If Equipment/Materials offloading requires special equipment or lifting rigs, such rigs or fixtures shall be provided by Contractor at no additional cost.

1.10 Material Receipt

1.10.1 Contractor must resolve all issues with contractor-procured material.

1.10.2 Contractor must identify, inspect, test and store material to purchase order requirements.

1.10.3 Contractor must ensure all receiving quality documentation is supplied to Owner's SPOC upon receipt.

1.11 Contractor shall provide facilities to store Materials and equipment on the jobsite. The SPOC will designate storage locations that will not interfere with Owner's personnel or operations.

1.12 If Materials are provided by Owner, they will be stored by Owner until Contractor is onsite. Contractor will be responsible for loss or damage after acceptance of Equipment or Material provided by Owner. Contractor shall inventory and haul excess Material retained by Owner to designated Owner storage location(s) after completion of Work.

1.13 Contractor shall restore construction storage areas to a reasonable condition that satisfies the SPOC.

2.0 HAZARDOUS MATERIALS

2.1 Safety Data Sheets: For materials brought onto jobsite, Contractor shall (upon request except as set forth in Section 3 Chemicals of Interest Report) provide copies of the Safety Data Sheets (SDS) to the appropriate Owner worksite personnel.

2.2 Contractor shall notify the SPOC before its use of any chemical/material that could create noxious or toxic vapors/fumes.

2.3 Certification of individual training is required prior to hazardous waste operations as defined by OSHA 29CFR1910.120 or equivalent applicable state regulations.

2.4 If any unique and/or hazardous conditions exist which were not mentioned by Owner, Contractor must inform Owner of those conditions in a timely manner.

2.5 If Project involves use or presence of chemicals or products that are regulated under Section 112 (r) of the Clean Air Act, Sections 302 & 304 of Emergency Planning & Community Right to Know Act, OSHA 29CFR1926.65 or 29CFR1910.120, then Contractor has the choice of adopting the Owner's Health and Safety Plan (HSP) or developing a similar plan that is at least as protective and compliant.

2.6 Contractor shall ensure that hazardous chemicals or materials are properly contained, labeled and stored, and that personnel are adequately trained to recognize, handle and use hazardous chemicals safely.

Small quantities (i.e., <10 gal.) of hazardous liquids, such as gasoline, diesel fuels or solvents, brought onto site shall be stored in properly labeled safety containers with flame arrestors and self-closing lids. All container labels must include contents information and display hazard symbols clearly on exterior of each container in accordance with NFPA 704M, OSHA 29CFR1910.1200 or other applicable standard.

2.7 Contractor shall complete and submit to Owner a monthly SPCC inspection report for all fuel, oils and chemicals brought on-Site by Contractor.

2.8 Contractor shall, at all times, maintain on-Site spill clean-up equipment appropriate for the Contractor's on-Site fuel, oil and/or chemicals.

2.9 All on-Site fuel dispensing stations and locations must be provided by Owner, in advance, and provided and serviced by an Owner approved fuel supplier.

2.10 Contractor shall provide Owner, in advance, with a vehicle manifest of all vehicles containing oils or chemicals that it plans to bring on-Site. Each manifest will , identify the vehicle's contents, including quantity. Vehicles will be subject to Owner's inspection.

2.11 **SPILL NOTIFICATION**. Contractor shall immediately report any on-Site spill of fuel, oil or any chemical to the Ameren Spill Line at 314-553-2683 and shall request, complete and return Owner's Spill Report Form (4293).

3.0 CHEMICAL OF INTEREST REPORTING

3.1 Contractor must complete and submit the affidavit attached as Attachment G.2.8 to Owner. "Department of Homeland Security Chemicals of Interest to be Brought on Site," which requires Contractor to list any materials being brought onsite which are identified in Appendix A of the DHS Chemical Facility Anti-Terrorism Standard Chemical (Facility Anti-Terrorism Standards (CFATS), 6 CFR Part 27.)

3.2 SDS for all chemicals of Interest (COI) must be submitted with Contractor's bid

3.3 Contractor shall provide written notification to the SPOC of any material requiring an SDS that is brought onsite by Contractor in quantities in excess of such material's Superfund Amendments and Reauthorization Act (SARA) Threshold Planning Quantity. Such notification is required for SARA Tier II reporting purposes. Chemical of Interest Reporting in the form set for below must be filled out and submitted to the SPOC.

3.4 During the Work, Contractor must inform the SPOC of any additional COI brought onsite or if the maximum amount of any COI identified in Attachment G.3.3 changes.

4.0 CONTRACTOR PROGRAM FOR CRITICAL ENERGY CENTER MATERIALS

4.1 Contractor must have a program in place to ensure receipted Material that has been identified by Owner as "critical energy center material" or Equipment is not relocated or improperly stored without proper authorization from SPOC.

5.0 SHIPPING REQUIREMENTS

5.1 Contractor shall comply with all requirements in Attachment G.5 for shipping.

6.0 WASTE

6.1 Contractor shall minimize amount of waste generated and shall review its plans for waste handling, manifest preparation, record keeping, and disposal with the SPOC in advance of these activities. Contractor shall coordinating waste handling with Owner personnel.

6.2 Contractor shall handle, package, label and store wastes in accordance with federal, state, and local and Owner's requirements.

6.3 Contractor shall remove wastes resulting from its performance of the Work from the premises in a timely manner for treatment, storage and/or disposal in full compliance with applicable laws, regulations and ordinances, including documentation requirements.

6.4 If Contractor is considered the sole generator of waste, then such waste shall be the sole responsibility of Contractor, and Owner assumes no responsibility for Contractor's compliance with applicable laws (or Contractor's failure to comply with applicable laws).

6.5 If Contractor is responsible for arranging to dispose of a hazardous or otherwise regulated waste where Owner is identified as the generator of the waste, Owner shall review, and approve or reject the waste disposal method and/or facility.

Attachments for **Error! Reference source not found.**
Attachment G.1: Material Handling, Storage & Identification Instructions
Attachment G.2.8: Affidavit/Dept. of H.S. Chemicals Of Interest To Be Brought On Site
Attachment G.3.3: List of Critical Materials and Equipment
Attachment G.5: Shipping Requirements

END OF APPENDIX G

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ATTACHMENT G.1

MATERIAL HANDLING, STORAGE AND IDENTIFICATION INSTRUCTIONS

1.0 All Owner purchased critical material received by a Contractor or subcontractor has specific requirements that must be met to comply with Owner's Quality Management System in accordance with AUE-ADM-4203. Contractor requirements contained in AUE-ADM-4203 are provided below. Contractor will be evaluated on its quality control and material management. A list of critical materials shall be provided to the Contractor during Pre-Construction Meetings.

1) Notify Responsible Engineer (RE) of Owner material received and the PO number. Ensure receiving documentation remains with the material until clear direction is provided by the Responsible Engineer.

NOTE: Steps 2-5 shall be directed by Responsible Engineer (RE)

2) Receiving documentation, number of containers, and intended storage location shall be taken to storeroom personnel.

3) Storeroom shall create a Receipt Order (RO) number for traceability and provide identification labels for attachment to each container. Information will always include the RO tracking# and may include PO #, Job #, RE, PM, Storage Level, and intended location.

4) The RO number shall be clearly marked on all boxes, containers, equipment, and packing slip(s).

5) An Owner Material Receipt Inspection Report (MRIR) shall be printed with the inspection requirements and shall be used to document inspection results. Contractor may perform additional inspections as directed by RE.

6) After successful acceptance, MRIR Inspector(s) shall sign the MRIR and each traceable barcode label; and shall attach labels to containers.

7) Hold tags shall be attached to any materials not accepted.

WARNING: Contact Responsible Engineer or Owner Designee immediately if unidentified material is discovered, labels become unreadable, material needs to be relocated, or if material location or storage level differs from label.

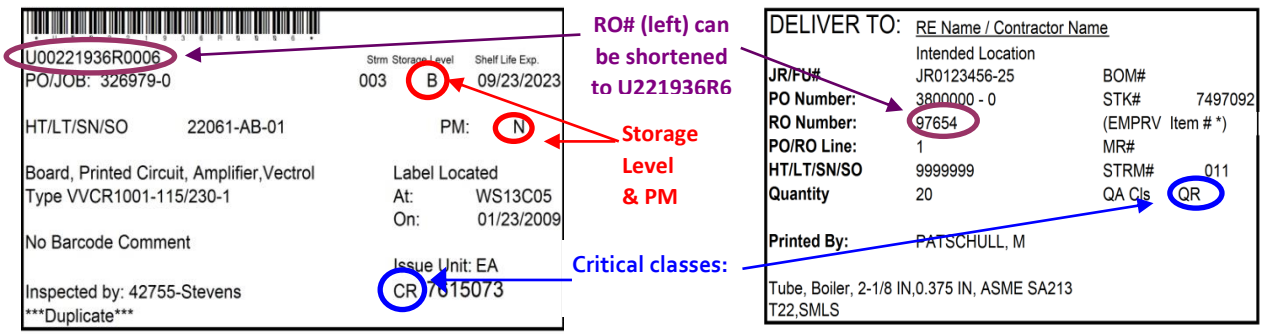
If during staging, prep work, etc., the Material is repackaged or removed from labeled containers and the potential for identification or Material loss exists, transfer the RO or barcode number, at a minimum, to the Materials.

Storage Level B – Indoor storage. Temperatures controlled between 40°F and 140°F. This level includes the storeroom, turbine floor, or any other location inside the energy center.

Storage Level C – Covered storage. Temperature control not required. These locations include secondary storerooms, covered parking areas, etc.

Storage Level D – Outside storage. Store in well drained areas in a manner allowing air circulation to minimize trapped water. Provide adequate protection from forces due to rain, wind and storms

CRITICAL MATERIAL BARCODE **DELIVERY MATERIAL TAG**



ATTACHMENT G.2.8
AFFIDAVIT

A. AUTHORIZED REPRESENTATIVE

I HEREBY AFFIRM THAT:

I am the [title]_____ and duly authorized representative of [name of business]_____ and that I possess legal authority to make this Affidavit on behalf of the business for which I am acting.

B. CERTIFICATION OF CORPORATION REGISTRATION

I FURTHER AFFIRM THAT:

1. The business named above is a corporation registered in the state or commonwealth of _____ and is in good standing with said state or commonwealth's Department of Assessments and Taxation, and that the name and address of its resident agent is:

Name _____

Address _____

_____

C. CERTAIN AFFIRMATIONS VALID

I FURTHER AFFIRM THAT:

To the best of my knowledge, information, and belief, each of the affirmations, certifications, or acknowledgments contained in this Chemicals of Interest appendix is true and correct in all respects on the date of this Affidavit and as fully set forth herein.

I DO SOLEMNLY DECLARE AND AFFIRM UNDER THE PENALTIES OF PERJURY THAT THE CONTENTS OF THIS AFFIDAVIT ARE TRUE AND CORRECT TO THE BEST OF MY KNOWLEDGE, INFORMATION, AND BELIEF.

Date_____ By_____
(Authorized Representative and Affiant)

ATTACHMENT G.2.8 (CONTINUED)
DEPARTMENT OF HOMELAND SECURITY CHEMICALS OF INTEREST TO BE BROUGHT ON SITE

Contractor: _____ Site: _____ Project: _____

Product/Chemical	COI Identified in Product/Chemical (Appendix A, 6 CFR 27)	Maximum Amount of Product On Site at Any Time (pounds)	Weight Percent COI in Product

ATTACHMENT G.3.3

LIST OF CRITICAL MATERIALS AND EQUIPMENT

Not Used.

ATTACHMENT G.5

SHIPPING REQUIREMENTS

1. Contractor shall notify Owner of all shipments not less than 14 days prior to the date of shipment to allow Owner to inspect the Equipment if so desired.

2. Contractor shall include costs of shipping all Materials and associated Equipment together in the price quote.

3. Contractor shall be responsible for delivery F.O.B. to Owner's site. This shall include special work required to support delivery of heavy and/or oversized items such as, but not limited to, road repairs, road upgrades or extensions, power line disconnections and reconnections, bridge reinforcements, grade alterations, and the like. Contractor shall provide and coordinate all special services required to complete all deliveries based on the existing conditions at the Site on the Contract Date.

4. Contractor shall discuss with Owner the routing of shipments and shall reroute the same as indicated by Owner provided the freight rates and overall costs are no greater than by other routes.

5. Truck shipments will be accepted weekdays only between the hours of 8:30 a.m. and 2:30 p.m. (Central Standard Time). After-hour deliveries not provided for by contract may be refused until the next regular workday. Cost incurred by Owner for off-loading prior to or after normal working hours shall be back-charged to Contractor unless prior authorization has been approved by Owner.

6. Packages shall be clearly marked with the Contract Number and Purchase Order Number where applicable. Packing lists shall identify Contract Number, Purchase Order Number and item numbers and quantities, bills of lading shall identify the Contract number and Purchase Order Number.

7. Equipment shall be shipped completely factory assembled. Preparation for shipment shall be in accordance with manufacturer's standards unless otherwise noted in this Specification. Manufacturer shall be solely responsible for the adequacy of the preparation for shipment to ensure Materials are received at their destination in EX-Works (EXW) conditions when handled by commercial carriers.

8. Equipment shall be boxed, crated, or otherwise suitably protected during shipment, handling, and storage. Components with moving parts which might be damaged in shipment, shall have all such moving parts securely blocked and braced. All items blocked and braced for shipment must be clearly identified and tagged accordingly. Equipment having antifriction or sleeve bearings shall be protected by weather-tight enclosures.

9. Materials required for protection during shipping and storage shall be treated for fire resistance. Wood protection shall be Class A, fire retardant, pressure treated type.

10. Coated surfaces shall be protected against impact, abrasion discoloration, and other damages. Damaged surfaces shall be repaired by Contractor.

END OF APPENDIX G ATTACHMENTS

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APPENDIX P
PRICING SHEET

1.0 **INTRODUCTION**

1.1 This Appendix contains information that shall be provided by the Supplier/Contractor as part of his bid proposal for the work described in this Specification.

1.2 This Appendix shall be completed by the Supplier/Contractor and returned as part of his bid proposal.

1.2.1 The information contained in this Appendix will be used to evaluate the proposals and to award the contract. Any additional information that the Contractor desires to be evaluated shall be attached to this document as part of his bid proposal.

1.3 All information requested shall be entered in the blanks provided in this Appendix.

1.3.1 All blanks shall be completed. Use the characters "N/A" to signify if the information requested is not applicable.

1.3.2 Several sections in this Appendix specifically request the Contractor to clarify his understanding and agreement with the various Sections of the Specification. This in no way relieves or reduces the Contractor's responsibility to completely comply with all other Sections of this Specification.

2.0 **BID FORM**

Project Name: Design, Fabrication, and Construction of Field Erected, Welded Storage Tanks

Bid From: _____
_____
_____
_____
_____

2.1 The undersigned Supplier/Contractor proposes and agrees, if this proposal is accepted, to do all work specified in Specification CB-SPEC-000005 for the Contract Price and within the contract time as specified in Specification CB-SPEC-000005.

2.2 In submitting this proposal, the Contractor represents that:

2.2.1 The Contractor has examined copies of all the contract documents, modifying letters, and addenda. The receipt of any of these is hereby acknowledged below:

Letter or Number of Addenda	Date

2.2.2 The Suppler/Contractor has familiarized himself with the all local conditions at the site and all Federal, State, and local laws and ordinances, rules, and regulations that in any manner may affect the work as specified in Specification CB-SPEC-000005.

2.2.3 The Supplier/Contractor attests that this proposal is genuine and not made in the interest or on behalf of any undisclosed person, firm, or corporation and is not submitted in conformity with any agreement or rules of any group, association, organization, or corporation. The Supplier/Contractor has not directly or indirectly induced or solicited any other contractor to submit a false proposal. The Supplier/Contractor has not solicited or induced any person, firm, or corporation to refrain from

bidding and the Supplier/Contractor has not sought by collusion to obtain for himself any advantage over any other Contractor or over the Company.

2.3 The Contractor shall complete all the work described in Specification CB-SPEC-000005 for the following lump sum firm price:

Pricing Information	
Base Scope Items	**Pricing**
1. Engineering to complete the design on all the tanks. This will be the value assigned to the contract for the LNTP.	(List price here.)
2. Fuel Oil Storage Tank A – With all appurtenances as defined in this Specification (including insulation and lining systems – No Heaters).	(List price here.)
3. Fuel Oil Storage Tank B – With all appurtenances as defined in this Specification (including insulation and lining systems – No Heaters).	(List price here.)
4. Demineralized Water Storage Tank – With all appurtenances as defined in this Specification (No Heaters).	(List price here.)
5. Service / Fire Water Storage Tank – With all appurtenances as defined in this Specification (No Heaters).	(List price here.)
6. Cost for full-time, on site safety representative.	(List price here.)
TOTAL	
Estimated Labor Man-Hours (Base Scope Work)	
On-Site Direct Labor Man-Hours (Tanks)	
On-Site Direct Labor Man-Hours (Insulation)	
On-Site Direct Labor Man-Hours (Painter)	
On-Site In-Direct Man-Hours (Tank Supplier)	
Schedule Requirements *	
1. Scheduled Time for Engineering and Drawing Completion.	(Weeks)
2. Scheduled Time for Shop Fabrication of Tank Components.	(Weeks)
3. Scheduled Time for Field Erection – Indicate if Tanks will be Erected Sequentially or Simultaneously.	(Weeks)
Optional Work	
1. Tank Heating System for Fuel Oil Storage Tanks (cost per tank).	(List price here.)
2. Tank Heating System for Demin Water Storage Tank	(List price here.)
3. Tank Heating System for Service / Fire Water Storage Tank	(List price here.)
4. Price Deduct for removing the Insulation System from the Fuel Oil Storage Tanks (cost per tank).	(List price here.)
5. Cost to apply external coating system to un-insulated Fuel Oil Storage Tanks (cost per tank).	(List price here.)
6. Cost Deduct for application of the internal lining on only the tank bottom and 4' up the side wall of the Fuel Oil Storage Tanks with the remaining internal coating (walls and internal roof) to be an organic zinc-rich epoxy prime coat only (cost per tank).	(List price here.)
7. Cost adder for the installation of heater dry-well. Per unit cost for dry-well with 8"-150# heater connection and 110" insertion length.	(List price here.)

Unit Costs for Tank Nozzles		
Provide cost adder/deduct for the addition or removal of the various tank nozzle sizes listed below (assume shell nozzle with no internals).		
Nozzle Size	**Carbon Steel Tank**	**Stainless Steel Tank**
4"-150#		
6"-150#		
8"-150#		
10"-150#		
12"-150#		

* The Schedule Requirements listed here are an overview of the Level 2 Project Schedule as required in Paragraph 3.1 in Section 1A – General Conditions.

3.0 **BID BASIS**

3.1 The Contractor agrees to meet the milestone dates as defined in Section 1A, Paragraph 1.3 of Specification CB-SPEC-000005.

3.2 All documentation provided with the proposal as defined in Section 1A, Paragraph 3.1 of Specification CB-SPEC-000005 is attached to and made a condition of this proposal.

3.3 The Contractor shall include with his bid proposal all additional information that he believes to be relevant to the scope of work and the evaluation of his proposal.

3.4 The final cost of the tanks shall be based on publicly available pricing indices from the date of the bid submittal to the Final Notice to Proceed (FNTP) date. The cost of the carbon steel tanks shall be based on WPU101703 Hot Rolled Steel Sheet and Strip. The cost of the stainless steel tank shall be based on WPU10170502 Metals and Metal Products: Stainless Wire, Stainless Steel.

4.0 **COMMUNICATIONS**

4.1 All technical questions regarding Specification CB-SPEC-000005 shall be submitted in writing to:

Mr. Mac Voss, PE
Consulting Project Engineer
Ameren Power Operations Services
11149 Lindbergh Business Court
St. Louis, MO 63123
314-957-3416
mvoss@ameren.com

All commercial matters shall be directed to the Ameren Sourcing Specialist designated on the Request for Proposal.

4.2 All questions regarding this bid proposal shall be addressed to the following address:

_____

_____

_____

_____

Phone Number: _____

E-mail Address: _____

5.0 **BID SUBMISSION**

This bid proposal is submitted on _____

Signature of Bidder:

By _____

Title _____

Address _____

_____

State of Incorporation _____

Attest _____

_____

Title _____

END OF APPENDIX P

APPENDIX S
SUBMITTALS

PART 1 – GENERAL

1.1. Drawings and Data

1.1.1. General Requirements

1.1.1.1. Only project specific drawings and data shall be submitted to the Owner as described herein.

1.1.1.2. All drawings, calculations, and data shall be in the English language.

1.1.1.3. All units on drawings and calculations shall be standard English units.

1.1.1.4. All structural drawings and documents that provide structural loading and anchorage information as an input to others shall be certified as final and complete.

1.2. Submittals

1.2.1. The project may utilize a collaborative Web site or SharePoint site for the transmittal/submitting of drawings and other project related data.

1.2.2. Hardcopies of drawings, data, and other documents are not required unless specifically requested. All information (correspondence, data, drawings, documents, etc.) shall be submitted electronically utilizing the Web site or SharePoint site indicated in Paragraph 1.2.1 or via email attachments. The size of emailed attachments is limited to 10 MB.

1.2.3. The Owner will post comments on the Supplier's transmittals via the Web site or SharePoint site or via an email transmittal.

1.2.4. The Supplier and the Owner will coordinate the specific details of the transmittal of project data during the project kickoff meeting.

1.2.5. Electronic copies of drawings, data, and other documents shall be in pdf format.

1.2.6. All Supplier transmittals shall include a unique transmittal number and clearly indicate the Owner's name, how they are being sent, and the reason for the submittal. The transmittal shall include a clear, concise description of all documents included. Documentation by drawing number, revision number, and date shall be indicated, if applicable. Separate transmittals are preferred for each discipline and/or type (General, Structural, Mechanical, calculations, weld procedures, etc.).

1.2.6.1. The Supplier shall clearly indicate on the transmittal letter the date by which comments are required to maintain the engineering, fabrication, and construction schedule.

1.2.7. Drawings shall not be “typical” but shall represent the equipment provided. Construction drawings shall be revised to reflect the “as-built” conditions.

1.2.7.1. Where alternatives are shown, the alternative being furnished shall be easily identified on that document.

1.2.8. Drawings and documents shall be clearly labeled with:

1.2.8.1. Owner's Name

1.2.8.2. Energy Center Name and Unit Number (if applicable)

1.2.8.3. Contract Number and/or Specification Number

1.2.8.4. Supplier's Order Number

1.2.8.5. Drawing Number and Title

1.2.8.6. Drawing Issue or Revision Number and Date

1.3. Master Document List

1.3.1. The Supplier shall provide the Owner with a complete list of all documents submitted or planned to be submitted as part of the work. The Master Document List shall be updated and resubmitted monthly for the duration of the work and/or until all documentation has been completed. Table S-1 – Sample Document List is an example of the format for the Master Document List:

Table S-1
Sample Document List

Document Number	Document Description	First Review Submittal (Scheduled)	First Review Submittal (Actual)	Release for Fabrication (Scheduled)	Release for Fabrication (Actual)	Percent Complete
1	General Arrangement					
2	Calculations					
3	Weld Procedures					

1.4. Review Procedure

1.4.1. Drawings that are reviewed by the Owner will be returned to Supplier via the Web site, SharePoint site, or email transmittal. All comments and questions must be resolved before a re-submittal of the drawings will be processed. If the design has not developed enough to resolve some of the comments or questions, Supplier shall place a “hold” on those items or areas of design. The Owner reserves the right to return drawings unprocessed to Supplier if there is any evidence that Supplier has not acknowledged all comments and questions.

1.4.2. Documents or portions thereof, submitted for review will be reproduced and distributed to meet the project requirements. Proprietary statements are not allowed.

1.4.3. A minimum of 20 working days shall be allowed on all comment cycles.

1.4.4. Identification of changes on all documents from previous issue/revision must be clearly shown on each document by scoping/”clouding” all revisions from the previous issue. Submittals without revisions annotated will be rejected and returned to Supplier unprocessed.

1.4.5. The Owner will stamp each drawing with one the following status codes which instruct the Suppler how to proceed with fabrication:

1.4.5.1. Status 1: Approved / No Exception Taken – The Supplier/Manufacturer may proceed with fabrication or construction in accordance with the specifications.

1.4.5.2. Status 2: Approved As Noted – The Supplier shall make the noted changes and submit the revised/final drawings. The Supplier may proceed with fabrication/construction as noted.

1.4.5.3. Status 3: Not Approved – Revise the drawings as noted and resubmit drawings for approval; hold fabrication/construction for resubmittal and approval.

1.4.5.4. Status 4: Review Not Required – Submitted for information only.

1.4.5.5. Status 5: Final Drawings – Drawings accepted as final, and the Supplier/Manufacturer may proceed with fabrication or construction in accordance with the specification.

1.4.6. The Owner's review of the drawings and documentation does not relieve the Supplier from responsibility for errors, correctness of details, or compliance with the Contract or Specification requirements.

1.4.7. The Supplier is responsible in obtaining the Owner's "Status 1" or "Status 4" on those documents covering an item at least two weeks before that item is to be shipped. Supplier shall be liable for the costs of any field changes resulting from failure to adhere to this requirement.

1.4.8. Documents shall not be submitted for Owner's record until they are acceptable to the Owner without comment (Status 1 or Status 4).

1.5. Design Document Submittals and Liquidated Damages

1.5.1. Drawings and other design documents shall be submitted by the date identified in this Specification and as set forth herein. A submittal shall include completed engineering drawings and design, shall be in final form, and shall include all parts of the set (i.e. all sheets of a drawing and all drawings of a set). The Owner will review the submittals for completeness. If the Supplier fails to submit the completed documents by the date identified in this Specification the Supplier shall pay Liquidated Damages subject to the provisions of the terms and conditions at the rated indicated below:

Table S-2 – Document Submittal Liquidated Damages for Delay

Number of Days Late	Document Delivery Liquidated Damages
1 – 10 Days	$500 per day
Over 10 Days	$1,000 per day

PART 2 – DOCUMENT SUBMITTAL SCHEDULE

2.1. Table S-2 summarizes the submittals required for this specification.

2.2. Due date description:

ANTP = After Notice to Proceed
PM = Prior to Mobilization
ASC = After Substantial Completion
AT = After Acceptance of the Test/Examination

2.3. Document submittal schedule:

Table S-3 – Document Submittal Schedule

Item	Discipline	Submittal Item	Requested Schedule *	Liquidated Damages
1.	General	Master Document List and Submittal Schedule	4 Weeks ANTP and Monthly	No
2.	General	Critical Path Method (CPM) Level 3 Schedule, Reference Appendix D	4 Weeks ANTP and Monthly	No
3.	General	Site Specific Safety Plan, Appendix B, Attachment B.1.1.	4 Weeks PM	No
4.	General	Contractor Agreement of Understanding, Appendix C, Attachment C.1.2.	4 Weeks PM	No
5.	General	List of Planned Subcontractors Working at the Site	4 Weeks PM	No
6.	General	Construction Power Requirements	4 Weeks PM	No
7.	Quality	Foreign Material Exclusion Plan per Appendix F, Paragraph 2.0 and Attachment F.2.1.	4 Weeks PM	No
8.	Quality	Project Specific Quality Plan	4 Weeks ANTP	No
9.	Quality	Inspection and Test Plan	4 Weeks PM	No

Item	Discipline	Submittal Item	Requested Schedule *	Liquidated Damages
10.	Quality	Welding Procedures and Welder Qualifications	2 Weeks PM	No
11.	Civil / Structural	Foundation Loadings	10 Weeks ANTP	No
12.	Civil / Structural	Foundation and Embedment Arrangement; including: • General requirements for foundations such as levelness, type of finish, and allowable construction tolerance. • Foundation stiffness requirements and relative (vertical) displacement/ settlement limits. • Anchor rod forces to be used to design embedment depth.	10 Weeks ANTP	Yes
13.	Civil / Structural	Structural Loading, including: • Design calculations which include the determination of environmental loads (such as snow, wind, seismic, etc.) and operating loads for foundation reactions and anchorage design.	10 Weeks ANTP	Yes
14.	Mechanical	General Arrangement Drawings, including: • Overall dimensions • Nozzle locations • Platform, ladder, and stair details	10 Weeks ANTP	Yes
15.	Mechanical	Tank Design Calculations	10 Weeks ANTP	No
16.	General	Contractor Site Laydown Requirements, including: • Crane placement plans. • Material laydown area requirements. • Trailer requirements.	4 Weeks PM	No
17.	Mechanical	Material CMTR's	2 Weeks PM	No
18.	Mechanical	API Standard 650 Storage Tank Data Sheet	10 Weeks ANTP	No
19.	Mechanical	Complete Fabrication Data Book	2 Weeks ASC	No
20.	Quality	NDE Test Results, including welding inspection and examination records and hydrotest results.	2 Weeks AT	No
21.	Mechanical	Surface preparation and coating system specifications including paint manufacturer name and catalog numbers	10 Weeks PM	No
22.	Quality	Safety Data Sheets (SDS)	4 Weeks PM (or prior to shipment)	No
23.	General	Notice of Shipping, including packing and shipping lists with weights and instructions, and BOMs.	2 Weeks PM (or prior to shipment)	No

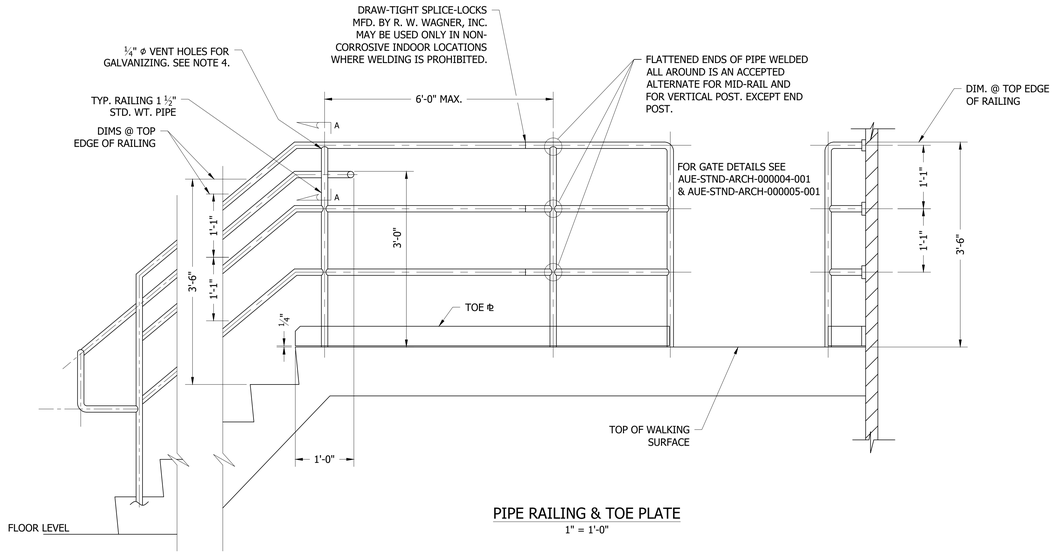
* The final (issued for purchase) schedule dates will be mutually agreed upon between the Owner and the Supplier.

PART 3 – FINAL RECORD DRAWINGS, DOCUMENTS, AND DATA

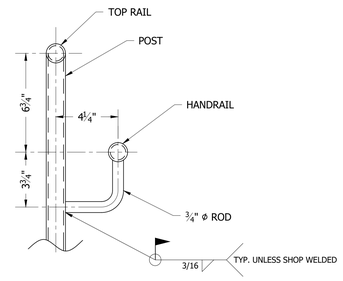
3.1. The Supplier shall submit final as-fabricated record drawings, documents, and data within 2 weeks after substantial completion, or as directed by the Owner.

3.2 At the completion of the project the Supplier shall submit a complete set of al final Suppler and Subcontractor drawings, including any changes through testing.

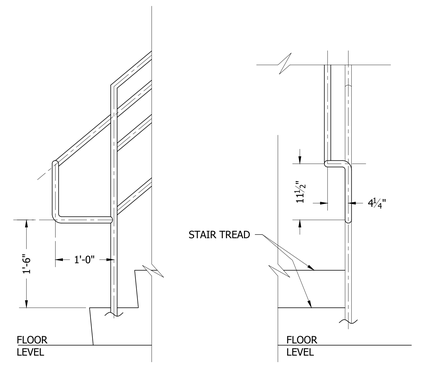
END OF APPENDIX S



PIPE RAILING & TOE PLATE
1" = 1'-0"

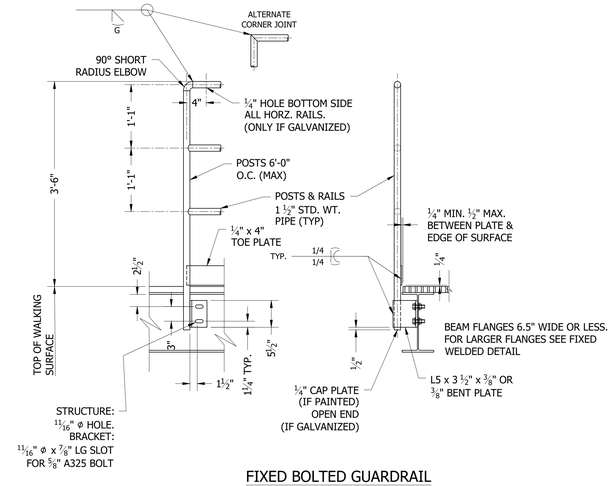


DETAIL "A"
3" = 1'-0"

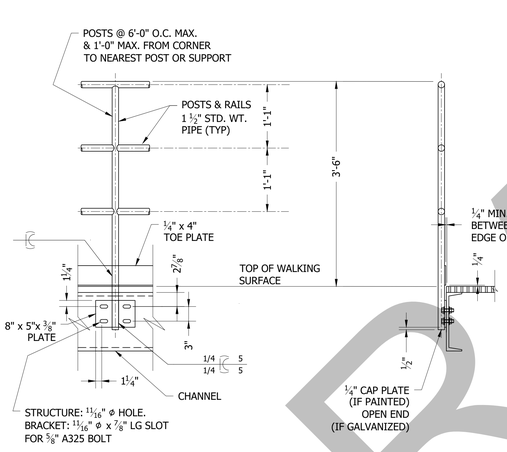


DETAIL STAIR HANDRAIL TERMINATION
1" = 1'-0"

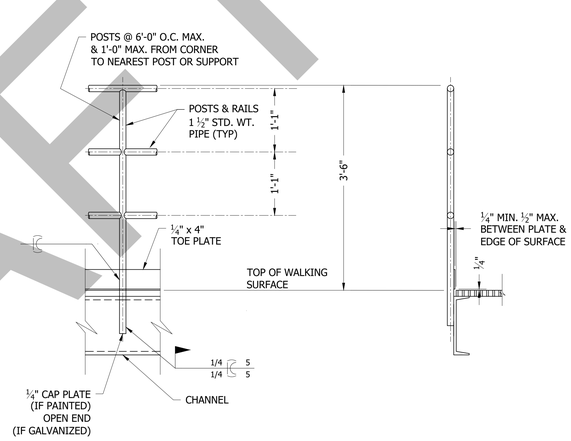
NOTE:
GATE TO OPEN INWARD ON PLATFORM.



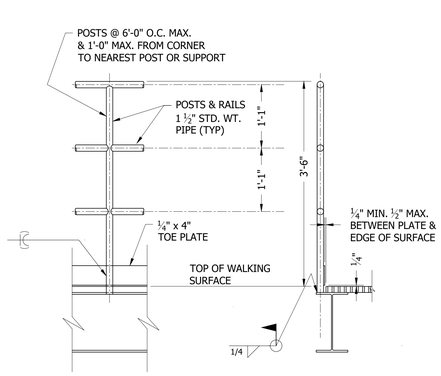
FIXED BOLTED GUARDRAIL WIDE FLANGE/OPEN CHANNEL DETAIL
1" = 1'-0"



BOLTED FLAT CONNECTION DETAIL
1" = 1'-0"

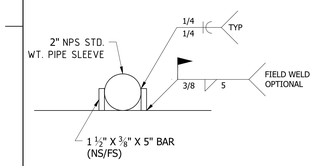


WELDED FLAT CONNECTION DETAIL
1" = 1'-0"

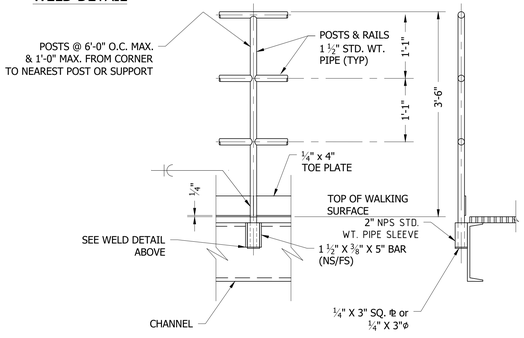


FIXED WELDED GUARDRAIL WIDE FLANGE/OPEN CHANNEL DETAIL
1" = 1'-0"

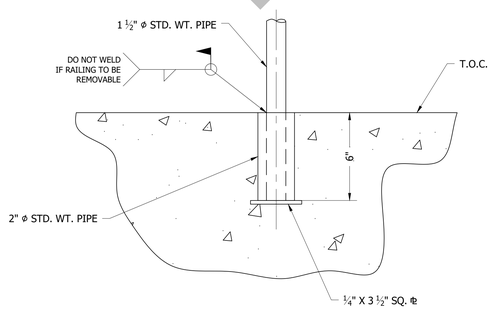
NOTE:
PIPE INSERT CAN BE ADDED FOR REMOVABLE HANDRAIL.



WELD DETAIL

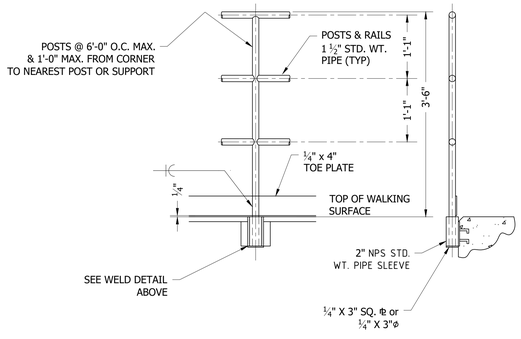


REMOVABLE CONNECTION DETAIL
1" = 1'-0"



CAST IN PLACE DETAIL AT GAURDRAIL
3" = 1'-0"

NOTE:
INSERTS TO BE GALVANIZED



REMOVABLE CONNECTION DETAIL CONCRETE
1" = 1'-0"

GENERAL NOTES:
1. ALL BOLTS SHALL BE F-3125GR. 325 UNLESS NOTED.
2. ALL PIPE SHALL BE A-53 GR. B (MIN.).
3. ALL PLATE, ANGLE, BAR & ROD SHALL BE A-36 (MIN.).
4. CONTACT ENGINEERING FOR ANY DEVIATIONS.

AS BUILT

MARK UP DRAWING NO. | REV.

SCALE	AS NOTED
UNIT NO.	NOT APPLICABLE
DWG. SIZE	34x44
SUB CLASS	03020

ARCHITECTURAL STANDARD DETAILS
TYPICAL HANDRAIL DETAILS

DRAWING RECORD

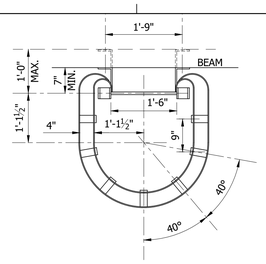
REV.	DATE	PROJECT NO.	DRAFTING DRFTR	DRAFTING CHK'D	SUPV	ENGR	DESCRIPTION
001	09/27/17	30FPR	KML	PEH	KAJ	PEH	AS BUILT - UPDATE HANDRAIL STANDARDS
002	01/24/2018	DSR 1143	IDM	BK	KAJ	BK	ASBUILT - REMOVAL OF HR09 & 10. ADDITIONS MADE TO HR05 & 01
003	11/08/2021	DSR 4649	DLF	JAG	LLK	JAG	REDRAW TO SCALE AND CORRECT TO AMEREN STANDARDS

SITE:

Ameren MISSOURI

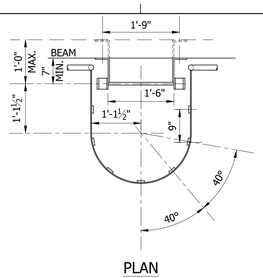
DRAWING NO. AUE-STND-ARCH-000001-001

REVISION NO. 003



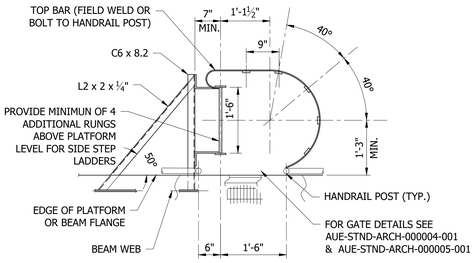
INTERMEDIATE PLAN

LADDER AND CAGE
SCALE: ¾" = 1'-0"



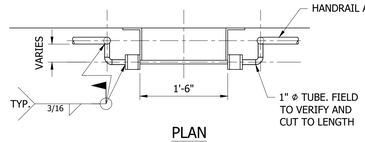
PLAN

LADDER AND CAGE
SCALE: ¾" = 1'-0"



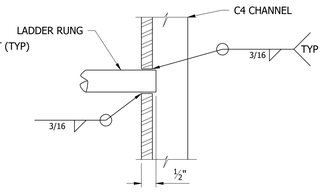
PLAN

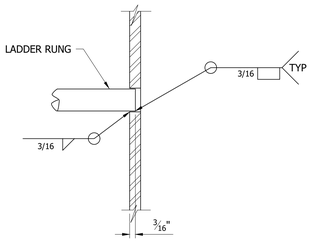
SIDE STEP LADDER
SCALE: ¾" = 1'-0"



PLAN

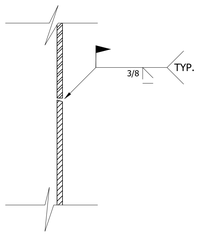
LADDER TOP ATTACHMENT
SCALE: 1" = 1'-0"





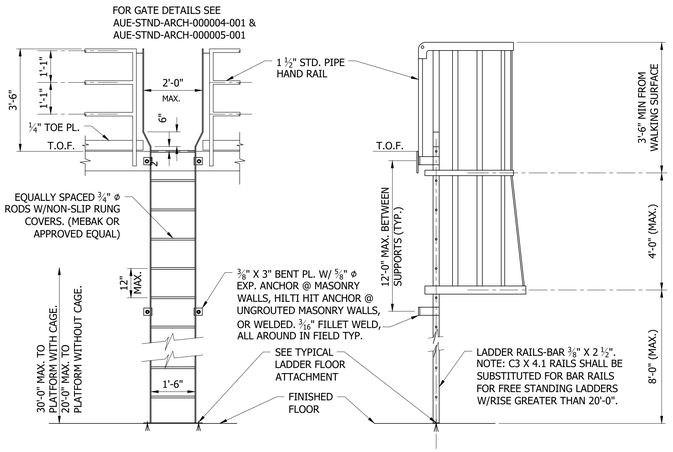
DETAIL

LADDER RUNG DETAILS
SCALE: 6" = 1'-0"



DETAIL

LADDER FIELD SPLICE
SCALE: 3" = 1'-0"

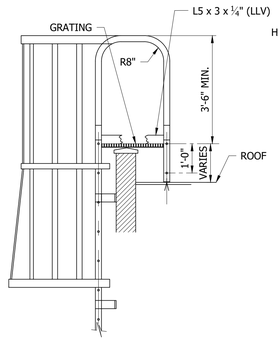


FRONT ELEVATION

SHOWN WITH NO CAGE
SCALE: ½" = 1'-0"

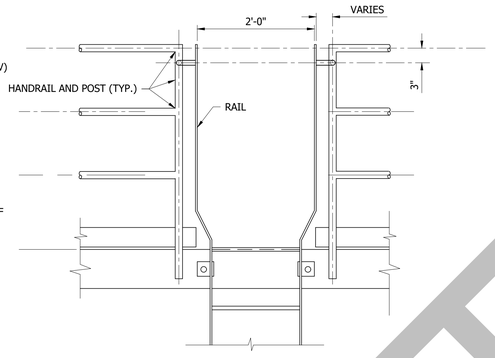
SIDE ELEVATION

SHOWN WITH CAGE
SCALE: ½" = 1'-0"



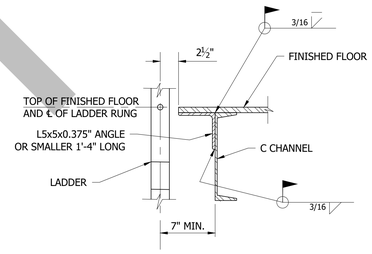
SIDE ELEVATION

LADDER OVER WALL
SCALE: ½" = 1'-0"



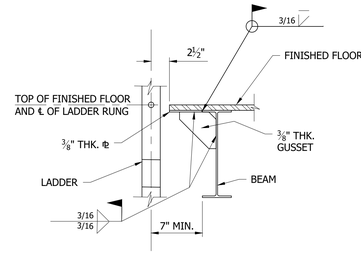
FRONT ELEVATION

LADDER TOP ATTACHMENT
SCALE: 1" = 1'-0"



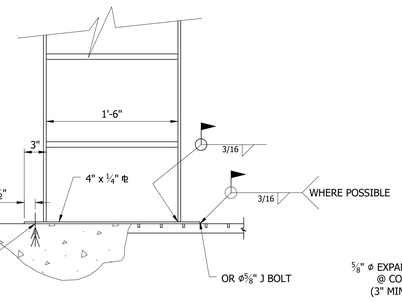
DETAIL

PLATFORM EXTENSIONS - ANGLE
SCALE: 1 ½" = 1'-0"



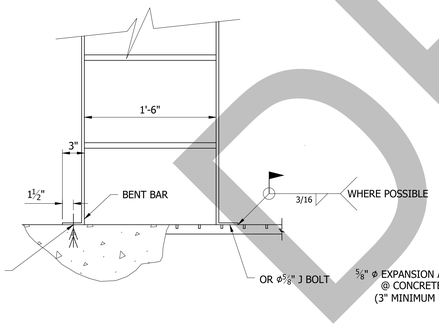
DETAIL

PLATFORM EXTENSIONS - GUSSETS
SCALE: 1 ½" = 1'-0"



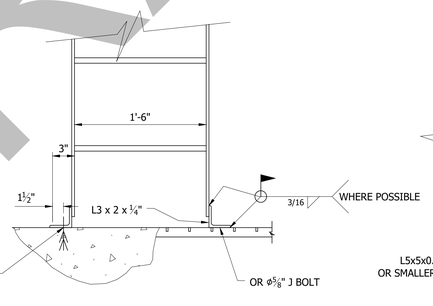
FRONT ELEVATION

LADDER FLOOR ATTACHMENT 1
SCALE: 1 ½" = 1'-0"



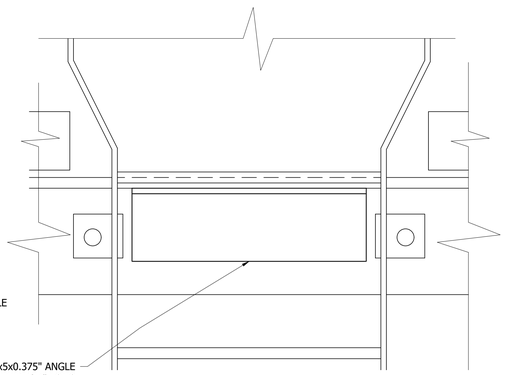
FRONT ELEVATION

LADDER FLOOR ATTACHMENT 2
SCALE: 1 ½" = 1'-0"



FRONT ELEVATION

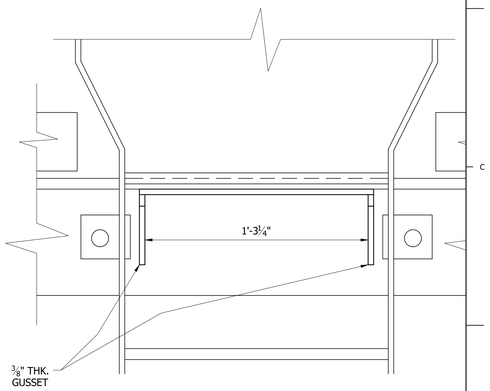
LADDER FLOOR ATTACHMENT 3
SCALE: 1 ½" = 1'-0"



FRONT ELEVATION

PLATFORM EXTENSIONS - ANGLE
SCALE: 3" = 1'-0"

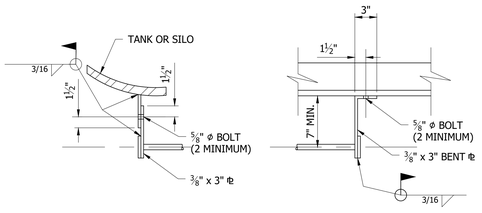
NOTE: MAX 5" LEG FOR ANGLE 1'-4" LONG. WELD ANGLE FIRST, THEN BOLT ON LADDER.
IF OVER 5" LEG ADD ⅜" ℄ AND GUSSETS INSTEAD.



FRONT ELEVATION

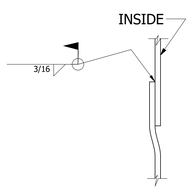
PLATFORM EXTENSIONS - GUSSETS
SCALE: 3" = 1'-0"

NOTE: KEEP BOTH GUSSETS INSIDE LADDER. WELD FIRST THEN BOLT ON LADDER. MINIMUM OF 2 GUSSETS



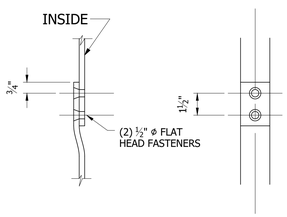
PLAN

LADDER ATTACHMENT DETAILS
SCALE: 1 ½" = 1'-0"



DETAIL

CAGE FIELD SPLICE WELDED
SCALE: 3" = 1'-0"



DETAIL

CAGE FIELD SPLICE BOLTED
SCALE: ½" = 1'-0"

AS BUILT

MARK UP DRAWING NO. | REV.

SCALE	AS NOTED
UNIT NO.	NOT APPLICABLE
DWG. SIZE	34x44
SUB CLASS	03070

ARCHITECTURAL STANDARD-DETAILS
TYPICAL LADDER DETAILS

DRAWING RECORD

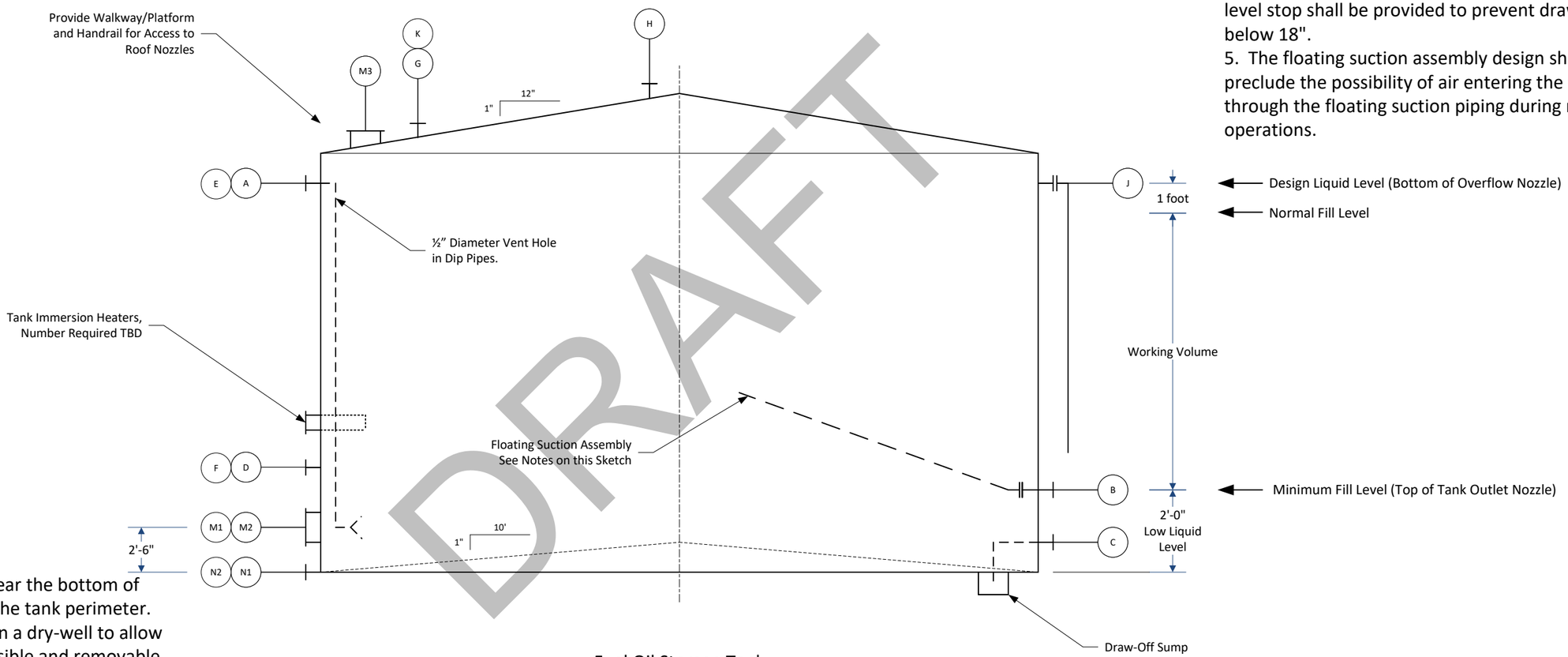
REV.	DATE	PROJECT NO.	DRAFTING DRFTR	CHK'D	SUPV	ENGR	DESCRIPTION
001	01/24/18	DSR 1143	IDM	BK	KAJ	BK	AS BUILT-MINOR UPDATES TO LAD01 SECTION A, 04 DETAIL " G", AND LAD16
002	12/29/21	DSR 4649	DLF	JAG	LLK	JAG	DRAWN TO SCALE, REDRAW DETAIL.

SITE: AMEREN POWER OPERATIONS ENERGY CENTER

Ameren MISSOURI

DRAWING NO.
AUE-STND-ARCH-000002-001

REVISION NO. 002



Fuel Oil Storage Tank

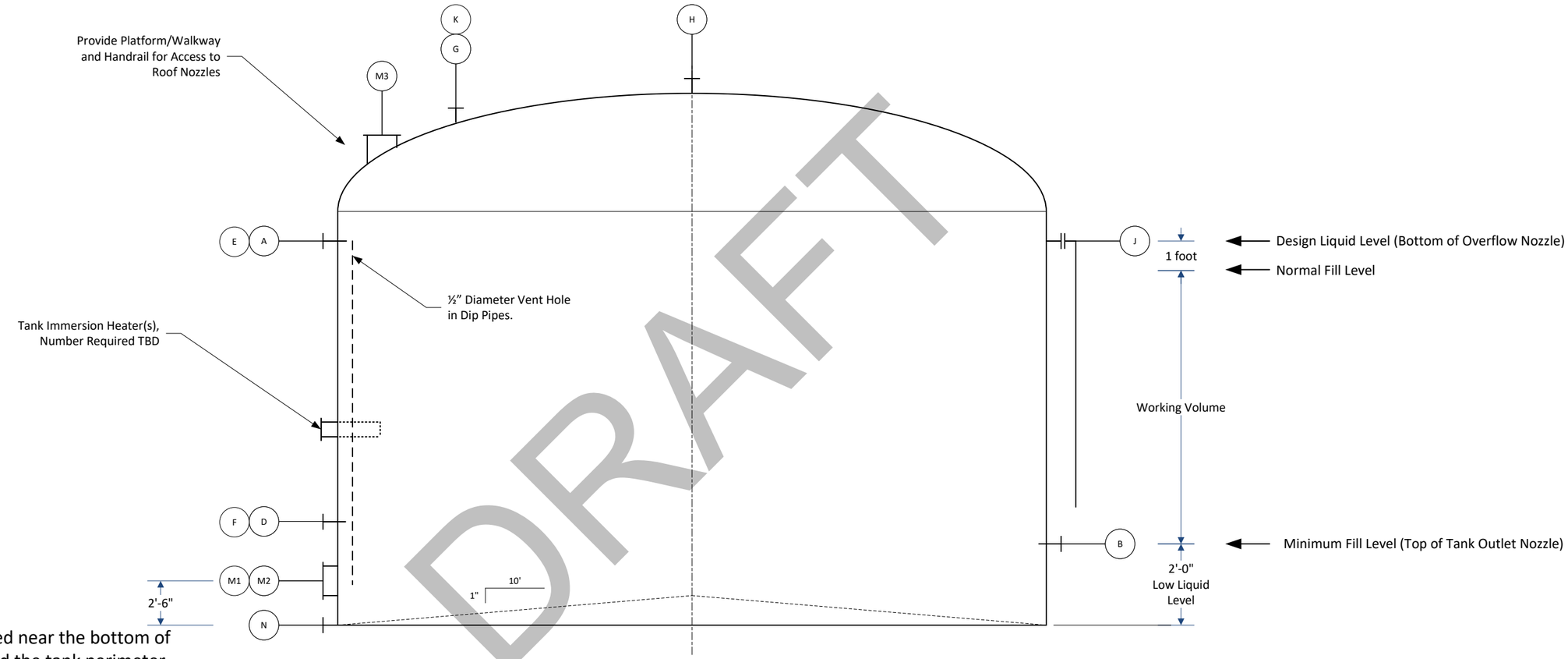
Notes:

1. The floating suction assembly shall be based on the basic principles of buoyancy and the characteristics of the fuel oil.
2. The floating suction assembly shall not impose additional loads on the tank walls or nozzles.
3. The float design shall be such that the suction pipe is submerged 2" to 12" below the fuel oil surface during all modes of operation (i.e., when the tank is full as well as at the maximum draw down level).
4. The floating suction assembly shall be capable of drawing down to 18" from the tank bottom. A low-level stop shall be provided to prevent draw-down below 18".
5. The floating suction assembly design shall preclude the possibility of air entering the system through the floating suction piping during normal operations.

Tank Immersion Heaters:

1. The heaters shall be located near the bottom of the tank, equally spaced around the tank perimeter.
2. The heaters shall be installed in a dry-well to allow the heating elements to be accessible and removable without draining the tank contents.
3. The heater mounting flange Shall be an ANSI Flange (size TBD).
4. The tank supplier shall be responsible for any internal supports that are required to support the dry-well.
5. The heaters and the controls shall be provided by the Tank Supplier.
6. The mechanical installation of the heaters shall be by the Tank Supplier.
7. Electrical connection of the heaters and controls will be by others.

Sketch Number	Description	Drawing Scale	Revision
CB-SPEC-000005-01	Sketch of Fuel Oil Storage Tank	None	D

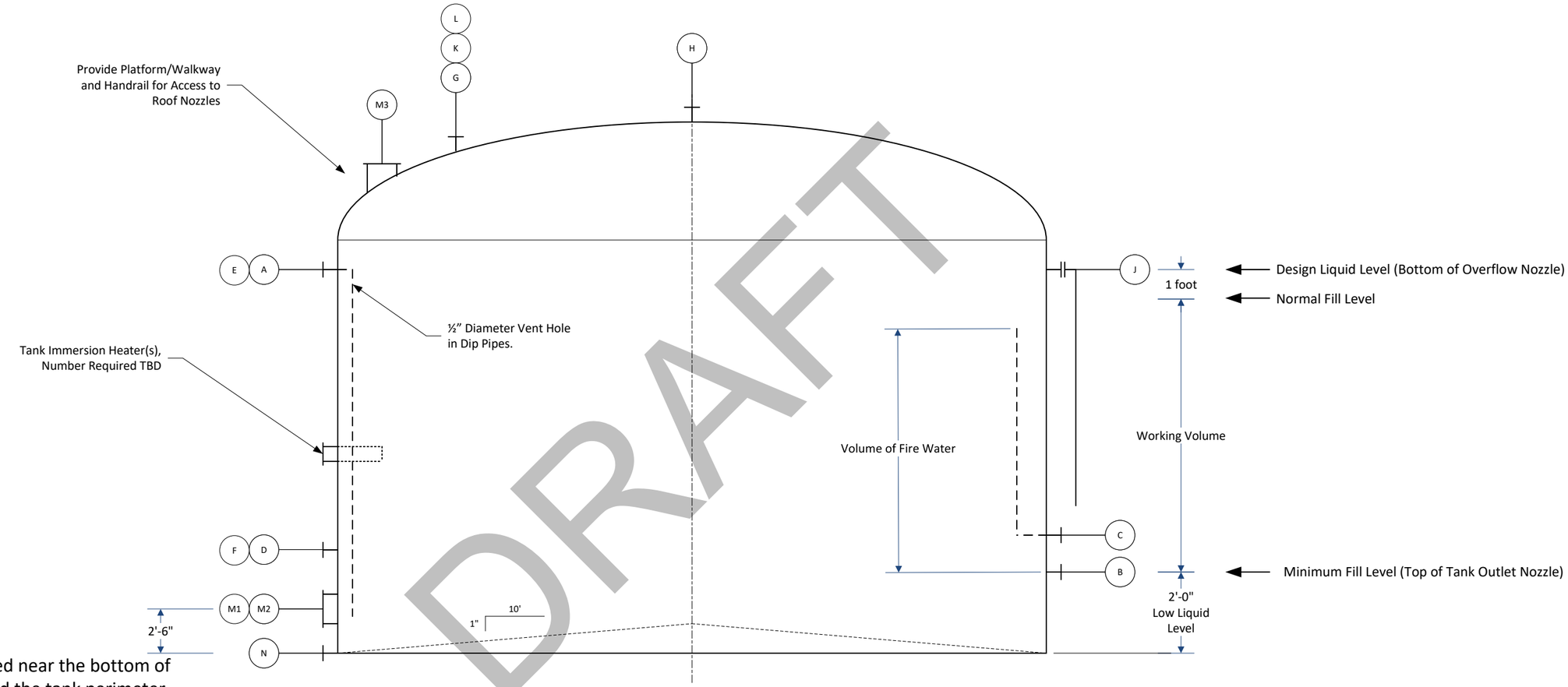


Demin Water Storage Tank

Tank Immersion Heaters:

1. The heater(s) shall be located near the bottom of the tank, equally spaced around the tank perimeter.
2. The heater(s) shall be installed in a dry-well to allow the heating elements to be accessible and removable without draining the tank contents.
3. The heater mounting flange shall be an ANSI Flange (size TBD).
4. The Tank Supplier shall be responsible for any internal supports that are required to support the dry-well.
5. The heater(s) and the controls shall be provided by the Tank Supplier.
6. The mechanical installation of the heater(s) shall be by the Tank Supplier.
7. Electrical connection of the heater(s) and controls will be by others.

Sketch Number	Description	Drawing Scale	Revision
CB-SPEC-00005-02	Sketch of Demin Water Storage Tank	None	D



Service / Fire Water Storage Tank

Tank Immersion Heaters:

1. The heater(s) shall be located near the bottom of the tank, equally spaced around the tank perimeter.
2. The heater(s) shall be installed in a dry-well to allow the heating elements to be accessible and removable without draining the tank contents.
3. The heater mounting flange shall be an ANSI Flange (size TBD).
4. The Tank Supplier shall be responsible for any internal supports that are required to support the dry-well.
5. The heater(s) and the controls shall be provided by the Tank Supplier.
6. The mechanical installation of the heater(s) shall be by the Tank Supplier.
7. Electrical connection of the heater(s) and controls will be by others.

Sketch Number	Description	Drawing Scale	Revision
CB-SPEC-000005-03	Sketch of Service / Fire Water Storage Tank	None	D

MATERIAL SPECIFICATION
CB-SPEC-000007

FOR

CONTINUOUS EMISSIONS MONITORING SYSTEM

AT

CASTLE BLUFF ENERGY CENTER

Prepared by Power Operations Combined Cycle
And Simple Cycle Project Execution Team

for

Ameren MISSOURI

Rev	Date	Revisions	Originator	Reviewer	Approver
A	04/12/2024	Draft for Review	DJ Woodress		

I N D E X

SECTION 1A - SUPPLEMENTAL GENERAL CONDITIONS FOR AMEREN MISSOURI POWER OPERATIONS

1.0 GENERAL

1.1 This section of the specification clarifies and supplements the Ameren General Conditions of Contract ("GCC") and other Contract documents. Specific duties set forth herein do not constitute an exclusive list of requirements, but complement the Ameren General Conditions of the Contract. In the event of a conflict between this specification and the Ameren General Conditions of Contract, this specification shall be controlling.

1.2 Contractor shall assure that all tiers of Subcontractors comply with all requirements of Contract documents.

2.0 DEFINITIONS

2.1 Competent Person. An individual, who is trained and certified in applicable standards, is capable of identifying workplace hazards relating to specific operations, performs inspections of industrial and construction jobsite equipment, and has authority to take corrective actions when needed.

2.2 Environmental, Safety and Health. Ameren's ES&H Department sets standards for environmental, safety and health issues and monitors compliance with Ameren policies, as well as with Federal, State and Local regulations.

2.3 Work is defined in Article 1 of the GCCs.

3.0 INTENT OF SPECIFICATIONS AND DRAWINGS

3.1 The Contract Documents shall be interpreted as being complementary. Any requirement occurring in any one of the Contract Documents is as binding as though occurring in all Contract Documents. Generally, Specifications address quality, types of materials and Contract conditions, while Plans show placement, sizes and fabrication details of materials. Reference Article 2.01 of the GCCs.

4.0 DRAWINGS, DETAILS & INSTRUCTIONS PROVIDED BY CONTRACTOR

4.1 An external Sharepoint site has been established to provide requirements for the following:

4.1.1 Drawing requests and as-built submittals

4.1.2 AutoCAD templates, borders and blocks

4.1.3 Numbering of cables, instruments, equipment, valves, etc.

4.1.4 New Ameren and foreign print drawing numbers

4.1.5 Drafting standards and guides

4.2 Contractor shall submit to Company electronic copies and one full size hardcopy of shop drawings, equipment details, installation, operating, and maintenance instructions, wiring diagrams, parts lists, etc. Reference Article 3.02 of the GCCs.

4.2.1 These submittals shall cause no delay in the fabrication of the materials. No purchasing, construction, erection, processing or shipping of the aforementioned material or equipment may begin until the drawings or details have been reviewed by the SPOC.

4.2.2 As-built drawings shall be submitted in accordance with Company's schedule.

4.2.3 Contractor shall submit drawings to Company electronically in CAD format. The CAD files shall be created in AutoCAD 2014 or a newer release of AutoCAD. Earlier versions of AutoCAD will not be acceptable.

4.2.4 Company will review submittals for general design features. Contractor is responsible for dimensions, quantities, accuracy, fit and adequacy of details. Contractor must request deviations from contract documents in writing and receive written approval from Company.

4.2.5 Contractor must request field changes in writing and receive written approval from Company to change the design. Contractor shall promptly submit as-built drawings to Company.

4.3 Professional Engineering (PE) License Seals

4.3.1 All design documentation meant for fabrication, permitting, erection or construction such as design drawings, specifications and calculations shall have a Professional Engineering (PE) seal applied, signed and dated by Contractor's registered professional engineer(s).

4.3.1.1 The license shall be current, valid, and in good standing for the appropriate state where the work is taking place.

4.3.2 Documents where seals are not required include review items (not to be constructed), sketches, samples, design control documents, operations manuals, vendor material design documents, engineered product drawings (not related to permitting) and other documents agreed upon in writing between Ameren and Contractor.

4.3.2.1 Contractor shall be responsible to contact the main Ameren contact up-front to clarify the requirements to seal any project specific documentation.

5.0 DELIVERY AND STORAGE

5.1 Contractor shall be responsible shipping and hauling materials unless otherwise stated in the Contract documents and costs shall be included in price quote.

5.2 Contractor shall label all materials delivered to the site with the project number provided by SPOC.

5.3 Contractor shall provide material storage requirements for short-term and long-term storage. If special conditions are required, please indicate.

5.4 A carrier that is compliant with the Depart of Transportation's (DOT) Hazardous Materials Security Plan must be used for deliveries to Ameren. For a list of approved carriers visit http://vics.keyship.net/Ameren. Fill out the required fields & check the HazMat option. A list of qualified carriers will populate. Any vehicle carrying hazardous materials onto Company facilities will be refused entry until proof of compliance is provided.

5.5 Contractor will be responsible for damaged material prior to acceptance of equipment or material provided at Company's destination.

5.6 Contractor shall provide an electronic packing list to the SPOC for inventory and material acceptance prior to the arrival of the equipment at Company's destination.

5.7 Company shall inspect and store material to purchase order requirements.

6.0 QUALITY REQUIREMENTS

6.1 The Quality Management System Manual, AUE-MAN-1001, provides the basis for the Ameren Missouri Power Operations Quality Management System (QMS) and provides the assurance that processes are in place to achieve our business objectives. QMS performance standards and performance criteria provide requirements to achieve a controlled and systematic approach to quality management activities and promote continuous improvement. Contractors and Sub Contractors can obtain a copy of the QMS from the Ameren Missouri Project Manager.

6.2 Contractor's quality management program and supportive procedures are subject to Ameren review and audit. Should a gap exist between the QMS and Contractor's quality management program & supportive procedures, Contractor will be required to comply with the QMS.

6.3 Contractors and Sub Contractors agree to comply with the applicable QMS requirements for the work scope included in this Ameren Missouri contract. Contractor shall provide a copy of Contractor's quality

management program and supportive procedures with the bid submittal, if Contractor is not on the Ameren Missouri 'Generation Approved Supplier List – Critical (GASLC)'.

6.4 The QMS Application Aid (QMS-AA) per Appendix Q contains the applicable QMS requirements in this Ameren Missouri contract. Contractor shall complete and return the QMS-AA with the bid submittal, if Contractor is not on the Ameren Missouri GASLC.

6.5 Contractor shall upon award develop and provide to Ameren a 'Project-specific Quality Management Plan' which is compliant with the QMS-AA.

6.6 Contractor's awarded work scope, including that of its Sub Contractors, shall be performed to the requirements of the QMS-AA.

6.7 Ameren will be allowed to make quality inspections at Contractor's and Sub Contractor's facilities at no cost to Ameren. Ameren will be allowed to view applicable Contractor's and Sub Contractor's quality procedures and procedure generated records and documents.

6.8 Design Documents and Calculations:

6.8.1 Contractors and Sub Contractors shall meet the technical requirements included in Section 1D of this specification and the QMS-AA.

6.8.2 All design documents and calculations shall be reviewed by a qualified Approver. The responsibility of the Approver is to ensure that all design documents and calculations are prepared, independently reviewed, and processed in accordance with all applicable procedures (AUE-ADM-3201, AUE-ADM-3203 and AUE-ADM-3205). The Ameren engineer shall ensure compliance with these procedures. Contractor shall request a copy of these procedures if they are applicable to his scope of work. It is not acceptable for the Approver to be the preparer of the design documents.

6.9 Material handling, traceability and storage are to be compliant to the requirements of AUE-ADM-4203.

7.0 OWNER APPROVAL OF PROCEDURE

7.1 Ameren must consent to deviations from the procedures, methods and materials agreed to in the Contract. Reference Article 2.01.

8.0 CONFIDENTIALITY

8.1 Contractor shall hold Ameren's Confidential Information confidential and shall not use or disclose to others during or subsequent to the performance of the Work (except as is necessary to perform the Work). Reference Article 9.02 of the GCCs.

8.2 Publication or advertising of information directly derived from the Project or the Work or data obtained in connection with services rendered under the Contract must first be approved in writing by Ameren (Ameren personnel need approval from Ameren Corporate Communications). Contractor shall not release any information for publication or advertising purposes relative to the material, equipment and or services furnished under the Contract Documents without the prior written consent of Ameren. Ameren reserves the right to release all advertising or publicity concerning the Project or the Work. Except as to signs required by building department regulations or any other governmental requirements, Contractor shall not display or permit any signs or advertisements to be displayed about the Project site nor publicize in any manner its performance of the Work without the express written permission of Ameren. Reference Article 9.02 of the GCCs.

8.3 Contractor shall restrict the knowledge of all confidential information regarding the Work to as few as possible of its employees who are directly connected with performance of the Work and have a definite need for such knowledge. Upon request by Ameren's Representative, Contractor shall cause such persons or groups of persons involved in the Work on Contractor's behalf as Ameren may designate to sign individual secrecy agreements in a form satisfactory to Ameren. Reference Article 9.02 of the GCCs.

9.0 WARRANTY

9.1 The Warranty shall be warranted by Contractor against defects in materials, performance, and workmanship for a period of ___ years from the date of acceptance by Ameren. Contractor shall include parts, contractor service engineer, and labor to remove and install the necessary parts and equipment.

Note: As used herein "Seller" means Vendor and "Buyer" means Customer.

Seller warrants that its services, including without limitation, its design, inspection, and installation services, and the equipment and materials to be supplied by Seller under this contract, shall be free of defects and shall conform to the requirements of the contract.

10.0 LIQUIDATED DAMAGES

Liquidated damages shall be assessed at $_____ per day if delivery of the material does not meet the delivery requirements of section of section 1B and 1C of this specification. The liquidated damages shall have a cap of __% of the contract.

In the event the cap on liquidated damages is reached, and Contractor fails to meet the Schedule within an additional 7 Days, Owner may, in addition to the liquidated damages provided for in this Section and in its sole discretion, terminate this Contract for Contractor default under Article 7.02 of the General Conditions of Contract and seek additional damages Owner may incur as a result.

END OF SECTION 1A

SECTION 1B - GENERAL SUMMARY OF WORK

1.0 INTRODUCTION

1.1 Definitions

1.1.1 The term "Company" means the entity identified in Company's Purchase Order, its agents, employees, representatives, successors, and assigns. The terms "Purchaser," "Owner," and "Buyer," if used in the Contract Documents, are considered synonymous and refer to Company.

1.1.2 The term "Engineer" means the Engineer duly appointed to represent Company as specified from time to time by Company who may be employed by Company or who may be employed by others.

1.1.3 The term "Contractor" means the entity identified in Company's Purchase Order, and its agents, employees and authorized representatives undertaking the performance of the Work as defined in this Specification. The terms "vendor," "supplier," "manufacturer," or “fabricator” if used in the Contract Documents, are considered synonymous and refer to Contractor.

1.1.4 The term "Sub-Contractor" means any individual, partnership, firm, corporation or business entity, other than an employee of Contractor, who contracts or agrees with Contractor (or another Sub-Contractor or any tier thereof) to furnish any services, labor, materials, or equipment for, or in connection with, the performance of the Work.

1.2 Location

Castle Bluff Energy Center
8200 Fine Road
Saint Louis MO, 63129

1.3 High Level Scope

1.3.1 The new Ameren Castle Bluff Energy Center will consist of 4 GE 7F.04 combustion turbine generators.

1.3.2 The combustion turbines will be capable of operating on Natural gas an fuel oil

1.3.3 This specification describes the requires for procurement of four (4) new Continuous Emissions Monitoring Systems

1.4 Contacts

1.4.1 All commercial matters should be directed to the Ameren purchasing agent designated on the Request for Proposal or listed on the purchase order.

1.4.2 All technical questions regarding this specification shall be directed to:

David Woodress
11149 Lindbergh Business Ct.
St. Louis, MO 63123
314-943-5988
DWoodress@gmail.com

2.0 SUMMARY OF WORK

2.1 Equipment requirements

2.1.1 To procure all equipment, materials and services for four (4) complete Continuous Emissions Monitoring Systems (CEMS)

2.1.2 One (1) Supervisory computer to function as the Data Acquisition and handling system.

2.1.3 Sample probes, umbilicals, and all necessary installation hardware

2.1.4 All fiber optic jumpers and hardware for interconnection of the CEMS, Supervisory computer and plant DCS

2.1.5 Each CEMS monitoring and control equipment shall be installed within a prefabricated building enclosure.

2.1.6 All equipment for a complete and successful CEMS system shall be supplied by the manufacture.
2.1.7 All equipment will be mounted and installed by the Owner's Contractor
2.1.8 Manufacture shall provide a separate line-item price and estimated qty of man-hours for technicians required to adequately supervise the installation of the equipment.
2.1.9 Manufacture shall provide a separate line-item price and estimated qty of man-hours for technicians for calibration, startup, testing and onsite training.
2.1.10 Manufacture shall provide 1 set of all special tools
2.1.11 Manufacture shall provide 1 lot of recommended spare parts
2.1.12 Manufacture shall provide adequate startup spare parts to prevent using the owner's spare parts
2.1.13 Manufacture shall provide all consumables which may be required to support startup, checkout, system flushes, cleaning, purging and initial operation of the components through successful completion of performance testing.
2.1.14 Manufacture shall provide a separate line-item price for supervision and support to the EPC contractor for stack testing, estimating 80 hours.
2.1.15 Optional price for 5 year maintenance contract

2.2 General Requirements

2.2.1 Contractor shall be responsible for furnishing all material (except those items of material specifically stated to be furnished by Company), tools, equipment, labor, supervision and any other incidental items or services required to provide all components, materials, and equipment described herein.

2.2.2 Contractor shall be responsible for any and all engineering and drafting required for design and fabrication of all the components, materials, and equipment described herein.

2.2.3 Contactor shall design components, materials and equipment to reduce any problems listed in Section 1.2.

2.2.4 Contractor shall ship (F.O.B) all components, materials and equipment so that they arrive at Castle Bluff Energy Center no later than 2nd Quarter 2027, exact time and date will need to be coordinated with all other construction activities and the Owner's EPC.

2.2.5 Contractor Design shall use the Design for Safety Guide (Appendix C).

2.2.6 Equipment to be transported by Contractor that requires a heavy hauler shall comply with Appendix M. State Transportations agencies refer to these loads as “Super Loads.” This equipment includes generator, transformer, turbine and boiler components too heavy for a standard 18-wheel truck.

3.0 SCHEDULE MILESTONES

3.1 Below is an estimated list of schedule dates and delivery for project planning purposes:

3.1.1 Bid Due Date:07/01/2024

3.1.2 Bid Review: 07/26/2024

3.1.3 Purchase Order Release:08/30/2024

3.1.4 Design Review: 10/30/24

3.1.5 Contractor Drawings Due: 05/30/2025

3.1.6 Factory Acceptance Test: 10/30/2026

3.1.7 Factory Ship Date: 2nd Quarter 2027

3.2 Payment Schedule:

(SUGGESTED MILESTONE PAYMENT SCHEDULE:)

3.2.1 Purchase Order Released --> 5% of PO Cost

3.2.2	Contractor Drawings Received	--> 15% of PO Cost
3.2.3	Material Released for Fabrication	--> 15% of PO Cost
3.2.4	Successful Completion of Factory Acceptance Testing	--> 20% of PO Cost
3.2.5	Material Delivered to Site	--> 20% of PO Cost
3.2.6	Completion of startup	--> 20% of PO Cost
3.2.7	Turnover of As-Built Drawings and Submittals with Project Engineer's Approval	--> 5% of PO Cost
3.2.8	Support for EPC Stack Testing	--> 100% upon completion

4.0 COMPANY AND MANUFACTURER'S DRAWINGS

The following drawings are included with and are considered a part of this specification. The drawings are intended for informational purposes only. These drawings in general are to scale, but figures shall always be followed and drawings are not to be scaled. Contractor shall make any requests for additional drawings in writing to the Engineer.

4.1 Ameren Drawings

4.1.1 General arrangements….
4.1.2 Need GE stack drawings? Future? By when?
4.1.3 Future EPC detailed arrangements

5.0 COMPONENTS, MATERIALS AND EQUIPMENT FURNISHED BY CONTRACTOR

5.1 All components, materials, equipment, tools and any incidental items described herein shall be furnished by Contractor. These will include, but not be limited to the following:

5.1.1 Contractor shall provide a detailed design with a complete drawing package and other information that includes, as a minimum, the following items:

5.1.1.1 General Arrangement Drawings

5.1.1.2 Erection Arrangement Drawings

5.1.1.3 Installation, Operation, and Maintenance Manuals for all Equipment

5.1.1.4 A complete Materials List or Site Receipt Book for all materials and equipment furnished under this contract. All materials and equipment shall be clearly marked or tagged with an assigned part number or other identification number.

5.1.1.5 Critical materials recognized in Ameren's QR program are purchased from Ameren approved suppliers, (i.e., welding rod).

5.1.1.6 Critical component pressures, temperatures and flows should be indicated on the Supplier's Operating Diagrams such as P&IDs.

5.1.2 Contractor shall supply any special tools required for the installation of any new or modified components and/or equipment proposed and supplied by Contractor.

5.1.3 Contractor shall provide engineering and technical support services during the installation of the components supplied in accordance with this Specification.

5.1.4 Contractor shall design, furnish, and deliver all other materials, equipment, components and services that may be reasonably inferred from the contract documents as being required to produce the objectives outlined by Company whether or not they are specifically called for in this Specification.

5.1.5 Pressure Part material such as piping, tubing, fittings and headers shall comply with Appendix N – Pipe and Fitting: Ameren Approved Manufacturer List.

END OF SECTION 1B

SECTION 1C – INFORMATION REQUIRED FROM CONTRACTORS

1.0 INFORMATION REQUIRED WITH BID PROPOSAL

1.1 Submittals

1.1.1 Proposal, as well as all related pre-contract correspondence, shall be submitted to:

David Woodress
11149 Lindbergh Business Ct.
St. Louis, MO 63123
314-943-5988
DWoodress@gmail.com

1.2 Pricing

1.2.1 Provide a lump sum firm price for _____.

1.2.2 The proposal shall be valid until _____.

1.3 Schedule

1.3.1 Contractor shall furnish Company with a complete Schedule of the work to be performed under this contract broken down by activity. The Schedule shall include the design, fabrication and delivery of the material. The Schedule shall be included as part of the proposal submitted by Contractor.

1.3.2 The level of detail in the Schedule shall be sufficient to permit Company to monitor Contractor's performance as related to the specified guidelines. Contractor shall designate one person with authority to make schedule commitments.

1.3.3 The schedule shall be of the critical path type (CMP). The float or slack time for each activity shall be shown.

1.4 General Arrangement Drawings

1.4.1 Contractor shall furnish drawings and descriptive material covering the general design concepts and special features of the specified material.

1.5 Quality

1.5.1 QMS Application Aid (Appendix Q) maps Contractor's quality management program to the Ameren Missouri Power Operations Quality Management System (QMS).

1.5.2 Copies of Contractor's quality management program and supportive procedures.

1.6 General Supplier Information

1.6.1 A list of all Sub-Contractors and suppliers of materials or services for all equipment proposed to be furnished. Descriptive information of this material shall also be provided. (See Item 1.10 below for a reference to the form to be used.)

1.6.2 Location or locations of the manufacturing facilities proposed to fabricate the specified material.

1.6.3 A complete listing of all factory tests that shall be performed. Contractor's Quality Assurance Manual shall be made available to Company for review at Contractor's Facility.

1.7 Alternatives / Options

1.7.1 Any alternatives or options proposed by Contractor shall be discussed and priced.

1.8 Exceptions

1.8.1 Any contact award resulting from this Specification will incorporate all of the provisions specified herein. It is understood that Contractor agrees to all the provisions of this Specification unless exceptions are specifically listed in his bid proposal.

1.9 Technical Services

1.9.1 Vendor shall quote, as a separate price, the services of one or more manufacturer's technical service representative on a per diem basis. Pricing for travel and per diem rates for service time shall be provided in the Bid Forms.

1.9.2 Per diem rates shall include all costs associated with the service representative's work at the site, including local travel, local travel time wages and living expenses. The round trip rate shall include all expenses for travel to and from Manufacturer's facilities and the site, including any salary costs for travel time. Owner will not reimburse Vendor for airfare costs exceeding tourist class airfare unless unusual circumstances exist. Vendor shall notify Owner in advance of such circumstances.

1.9.3 A day of service (per diem) is defined as 10 man-hours at the site. The total number of days of service shall be defined as the total regular time man-hours at the site divided by eight.

1.9.4 Contractor shall provide 2 days of training for Fossil Energy center personnel and 2 days of training.

1.10 Diverse Supplier Business Plan

1.10.1 In order to support Ameren's policy on Supplier Diversity, Diverse Supplier Business Plan (Appendix A, page 1) shall be filled out and submitted with bid. A 2nd Tier Supplier shall be defined as work as set forth in bid proposal not being self-performed. Ameren does not certify Diverse Suppliers and relies upon a 3rd party certifying organization. Ameren recognizes certification from National Minority Council (NMSDC) and its affiliate councils, Women's Business Enterprise National Council (WBENC) and its affiliate councils, and Federal, State and Local government certifying agencies.

Note: An editable version of the Diverse Supplier Business Plan with instructions and reporting guidelines will be sent out as part of bid package. Questions on filling out form can be directed towards Ameren Supplier Diversity professionals at (888) 256-1150 or at http://www.ameren.com/BusinessPartners/SupplierDiversity/Pages/SupplierDiversityHome.as

1.11 Cyber Security

1.11.1 Contractor shall include all costs associated with complying with Ameren's Cyber Security Terms and Conditions and Cyber or Network Liability Insurance requirements as described in Appendix L. The dollar value of the Cyber Insurance requirement for this project is $5,000,000. *(Engineer to update this dollar value based on the result of the cyber security screening process. Delete 3.3.5 if not required)*

2.0 INFORMATION REQUIRED AFTER CONTRACT AWARD

2.1 Schedule

2.1.1 Design, fabrication and delivery schedule as outlined in Item 1.3 above shall be submitted by Supplier on a monthly basis. Three months prior to the scheduled delivery date, the schedule shall be submitted every two weeks.

2.1.2 Contractor shall notify the Engineer immediately upon any significant change in the fabrication schedule especially if the scheduled delivery date is affected.

2.2 Fabrication Plant

2.2.1 Contractor shall state, within twenty-one (21) calendars after award of the contract, all proposed fabrication plants (including sub-contractor plants) for all of the components, materials and equipment. Company reserves the right to review and approve any proposed fabrication facilities.

2.2.2 Contractor shall notify Company of any changes to the fabrication location after award of contract.

2.3 Contractor Project Management

2.3.1 Contractor shall provide a table of organization depicting proposed individuals from the Project Manager to Engineers, including those personnel designated for updating progress reports, schedules, man-hour date and all other date reports.

2.4 Contractor's Drawings and Technical Data to be Delivered to Company

2.4.1 All documentation concerning engineering or fabrication of this material shall be delivered to: (Insert name, address, phone number and email address)

2.4.2 Supplier shall submit to Company, with such promptness as to cause no delay in the performance of the Work, copies of general arrangement drawings with adequate information for installation. No purchasing, fabrication, erection, processing or shipping of the aforementioned material or equipment may begin until the drawings or details have been reviewed by the Engineer.

2.4.3 It is preferred that documents be submitted in Microsoft Word format and drawings in AutoCAD 2014 format or newer. When neither of these formats is available, Adobe PDF format will be acceptable.

These submittals will be reviewed for general design features only. Review will not relieve Supplier of responsibility for proper dimensions, quantities, accuracy, fit, adequacy of details and coordination with other trades. Deviations from Contract Documents are not approved unless specifically requested in writing by Supplier and approved in writing by Company.

2.4.4 Contractor shall provide a detailed design with a complete drawing package and other information that includes, as a minimum, the following items:

2.4.5.1 Outline and General Arrangement drawings of all equipment to be furnished

2.4.5.2 Erection Arrangement Drawings

2.4.5.3 Installation Drawings

2.4.5.4 Critical materials recognized in Ameren's QR program are purchased from Ameren approved suppliers, (i.e., welding rod)

2.4.5.5 Critical component pressures, temperatures and flows should be indicated on Supplier's Operating Diagrams such as P&IDs

2.4.5.6 Design standard, procedures and specifications used in manufacturing and delivering the equipment, to be reviewed at Supplier's shop or office

2.4.5.7 Complete list of all materials and equipment to be furnished (Shipping Bill of Material)

2.4.5.8 Any information required for the installation of the material

2.4.5.9 Complete list of all drawings, design standards, procedures and specifications to be used in erecting and starting up the equipment

2.4.5.10 Operating and Maintenance instructions, if applicable to Contractor's scope of supply. One (1) hardcopy and one (1) electronic copy are required

2.4.5 Items 2.4.5.1 & 2.4.5.2 above require engineer approval prior to fabrication. Approval or comments by Engineer will be furnished to Contractor within 10 working days after receipt. If changes are required, Contractor shall revise and resubmit the drawings within 10 working days after receipt. Approval of drawings shall not relieve Contractor of responsibility for the completeness and accuracy of all drawings and data.

2.4.6 Contractor's drawings, including those of its suppliers, shall clearly identify all Company's connections and interface points.

2.4.7 Contractor's drawings shall be developed in accordance with Ameren's Vendor CAD Requirements as defined in Appendix J.

2.4.8 Unless specifically approved by Engineer, "typical" or "similar" documentation is not acceptable for review.

2.5 After contract award, Contractor may be responsible for utilizing the Ameren Contractor Cost Tracking Module (CCTM) for all lump sum and T&M work. Ameren Purchasing or Strategic Sourcing will decide whether to require CCTM or Ameren's API invoicing system. If CCTM is utilized, Contractor's representative(s) will be trained by Ameren on the use of the CCTM program in Ameren's EMPRV computer program. Contractor shall use the CCTM module frequently to estimate/re-estimate the job scope and record actual billing costs.

2.6 Contractor and subcontractors shall provide an FME plan in accordance with Foreign Material Exclusion Requirements (Appendix X) prior to start of work.

2.7 Contractor and subcontractors shall submit a Quality Plan which is in compliance with the Quality Requirement in Supplemental General Conditions Section 1A, Item 6.0, prior to start of work.

2.8 Diverse Supplier 2nd Tier Report

2.8.1 In accordance with Item 1.6.1 above, Diverse Supplier 2nd Tier Report (Appendix A, page 2) shall be filled out with actual spent cost and issued per timeline agreed upon between Contractor and Ameren. Typical timeline for reporting will be monthly.

Note: An editable version of Diverse Supplier 2nd Tier Report (Appendix A, page 2) with instructions and reporting guidelines will be sent out as part of Contract Award. Questions on filling out form can be directed towards Ameren Supplier Diversity professionals at (888) 256-1150 or at http://www.ameren.com/BusinessPartners/SupplierDiversity/Pages/SupplierDiversityHome.as

2.9 Contractor shall provide a list of and option to purchase recommended spare parts for all equipment provided by Contractor as part of this specification. Information required includes, but is not limited to:

2.9.1 Long description of the part

2.9.2 Noun (i.e., valve, breaker, pump, etc.)

2.9.3 Modifier (i.e., check, control, circuit, etc.)

2.9.4 Characteristic (i.e., type, size, material, etc.)

2.9.5 Standard package quantity

2.9.6 Quantity per unit

2.9.7 Manufacturer name

2.9.8 Manufacturer part number

2.9.9 Supplier name

2.9.10 Supplier part number

2.9.11 Lead time ARO

2.9.12 Authorized distributor

2.9.13 Estimated price

END OF SECTION 1C

SECTION 1D - TECHNICAL REQUIREMENTS

1.0 TECHNICAL REQUIREMENTS

1.1 This specification technical section together with attached appendices, covers the requirement for procurement of four (4) Continuous Emissions Monitoring Systems.

1.2 Codes, Standards, and Regulations

1.2.1 Contractor shall, as a minimum, perform the necessary work to meet the requirements of the codes, standards and regulations set forth in this specification. In the exercise of his experience and knowledge of the equipment, materials and work covered by this Contract, Contractor shall perform all work and provide materials and equipment in accordance with other codes, standards and regulations consistent with providing a safe and reliable product.

1.2.2 Any deviations from this specification shall be documented by the submittal of an alternate proposal. Alternate proposal shall list exception by specification section in numerical order on the first page of the alternate proposal. Alternate proposal shall list section from specification after exception sheet. Manufacturing schedule, delivery date, and price shall follow the proposal data sheets. Individual manufacturer specification technical selling points shall be listed at the end of the proposal along with the terms and conditions.

1.2.3 Contractor shall plan on having one design review meeting conference call with the customer. Contractor shall send five (5) sets of drawings and documents for approval for this meeting. See submittal requirements in Information Required By Bidders (Section 1C), Item 2.0. Contractor is responsible for setting up meeting and coordinating conference call.

1.3 Equipment and materials shall be complete in all respects within the limits herein outlined. Errors or omissions required to be corrected in the field shall be done by Manufacturer or its duly authorized representative at Vendor's expense.

1.3.1 The latest revisions or addenda to codes, standards and regulations set forth as the date of the Contract shall apply.

1.4 The following codes, standards and regulations, with the issue dates noted, shall be complied with except as modified by this Specification. Materials not specified shall be in accordance with references within the codes and standards listed, or if not listed, with the latest applicable industry standard wherever possible. Conflicts between either the codes, standards, or this Specification shall be brought to the attention of the Engineer for resolution.

1.4.1 American Society for Testing and Materials (ASTM)

1.4.2 The Basic Building Code of the Building Officials of Code Administrations International, Inc. (BOCA)

1.4.3 America Institute of Steel Construction (AISC)

1.4.4 American National Standards Institute (ANSI)

1.4.5 American Society of Mechanical Engineers (ASME)

1.4.6 Environmental Protection Agency (EPA)

1.4.7 National Fire Protection Association (NFPA)

1.4.8 Occupational Safety and Health Administration (OSHA)

1.4.9 American Welding Society (AWS)

1.4.10 American Society of Heating, Refrigeration, and Air Conditioning Engineers (ASHRAE)

1.4.11 Underwriters Laboratories, (UL)

1.4.12 Institute of Electrical and Electronic Engineers (IEEE)

2.0 DESIGN AND MATERIAL

2.1 Design change, material change/substitution or information requests require Contractor to submit request to the Responsible Engineer for approval prior to project changes. Written approval is required from the Responsible Engineer.

2.2 When supplying a skid of pre-assembled equipment containing valves, gauges, and other general instrumentation in addition to the main component (pump, blower, etc.) as part of Supplier's scope of supply, Supplier shall label all skid devices for clear identification in the field.

2.3 Equipment supplied by Contractor shall have a P&ID diagram with equipment identifications, critical settings and pressure ratings identified. The valves, instruments and other equipment shall have labels attached with the device number shown on the P&ID. The device numbers will be provided by Ameren and be compatible with energy center equipment labels and numbering schemes.

2.4 Four (4) complete systems/enclosures shall be furnished. The design specifications below shall apply to all units

2.5 Identification tags Unit 1, Unit 2, Unit 3, Unit 4

2.6 Number of measurement locations: 1 for each CEMS (Does duel fuel affect this?)

2.7 Compliance Requirements:

2.7.1 40 CFR Part 60

2.7.2 40 CFR Part 75

2.7.3 OTHERS?????

2.8 Design Information

2.8.1 Maximum flue gas design temperature : 1200 deg F

2.8.2 Flue Gas design pressure: 2 PSI

2.8.3 Stack/Duct Cross section: Refer to GE drawing XXXX

2.8.4 Distance from Sample point to CEM cabinet: Refer to GE drawing XXXX

2.8.5 Distance from CEM shelter to control room: Refer to GA drawing

2.8.6 Distance from sample point to upstream disturbance: Refer to GE drawing XXX

2.8.7 Distance from sample point to downstream disturbance: Refer to GE drawing XXX

2.8.8 Type of CEM system required: Full extractive (dry)

2.9 Flue gas analyzers and monitors

2.9.1 Nitrogen oxides (NO and NO_2)

2.9.1.1 Analyzer quantity: 1

2.9.1.2 Measurement technique: Analytical

2.9.1.3 Units: PPMVD

2.9.1.4 Primary measurement span: 100

2.9.1.5 Expected Emissions: 15-50

2.9.2 Diluent O2

2.9.2.1 Analyzer quantity:1

2.9.2.2 Units: %

2.9.2.3 Primary measurement span: 25

2.9.3 Calibration frequency will be per manufacture's standard

2.9.4 CEMS system walk-in enclosure

2.9.4.1 Indoor design temperature: 75 deg F

2.9.4.2 Enclosure outdoor design temperature: 125 deg F

2.9.4.3 HVAC control shall consist of a thermostat that shall be capable of automatically switching between heating and cooling modes of operation

2.9.4.4 Wind Loading: Per ASCE 7-98

2.9.4.5 Seismic loading: Per ASCE 7-98

2.9.4.6 Wall loading, vertical: Per ASCE 7-98

2.9.4.7 Roof live loading: 20 PSF

2.9.4.8 Illumination level: 60 ft-candles

2.9.4.9 Stand-alone equipment rack required: yes

2.9.4.10 Air compressor required: No

2.9.4.11 Main power feed: 120/208, or 480 vac 3 phase

2.9.4.12 UPS required: Yes

2.10 Data Acquisition and Handling system terminals

2.10.1 Computer hardware spec??

2.10.2 Software shall be ESC E-DAS CEM

2.10.3 Main DAHS located in new control room connected via Local Area Network (LAN)

2.11 System controller I/O – needs to be verified with what we are requiring for the new install.

Quantity	System I/O	Signal	Range	Units	Interface (4 to 20 mA or 0 to 5 volts ac or Dry contact)
6	Analog outputs				
		NOx	0-100	ppmvd	4 to 20 mA
		O2	0-25	%	4 to 20 mA
		NOx @ 15% O2	0-100	ppmvd - 1min	4 to 20 mA

Quantity	System I/O	Signal	Range	Units	Interface (4 to 20 mA or 0 to 5 volts ac or Dry contact)
		NOx mass emission	0-100	Lb/hr - 1min	4 to 20 mA
		heat input	0-2500	MMbtu/ hr	4 to 20 mA
		wtr/fuel ratio	0-1		4 to 20 mA
4	Digital Outputs				
		CEMS general alarm	(Open to alarm)		Dry contact
		CEMS in calibration	(Close in cal)		Dry contact
		CEMS in maintenance	(Close in maint)		Dry contact
		NOx high	(Open to alarm)		Dry contact
3	Analog Inputs				
		megawatts			4 to 20 mA
		gas flow			4 to 20 mA
		water injection flow			4 to 20 mA
1	Digital Input				
		flame detected	(Closed on Flame)		Dry contact

2.12 Spares
- 2.12.1 Spare processor capacity: 100%
- 2.12.2 Spare I/O for each type: 50%
- 2.12.3 Spare I/O card capacity: 20%

2.13 CEMS system shall be connected to the LAN via Fiber Optic cable
- 2.13.1 Vendor shall supply a wall mounted fiber termination cabinet, with termination adapters for up to 12 fibers (6 pair)
- 2.13.2 All fiber optic connections (jumpers, media converters, etc) from the termination cabinet to the CEMS systems shall be supplied by the vendor.
- 2.13.3 Interconnection fiber optic cable from CEMS enclosure to DAHS system shall be by the EPC contractor.

2.14 Umbilical & Support hardware
- 2.14.1 Manufacturer shall provide all the necessary hangers, clamps, messenger cable and related hardware for the supply and installation of the umbilical including heat tracing of the umbilical if required.

2.15 Components
- 2.15.1 Sample proves shall be 316 stainless steel or UNS N10276
- 2.15.2 Sample line tubes PFA Teflon
- 2.15.3 Sample umbilical Low temperature PVC or polyethylene

2.16 Work by others
- 2.16.1 CEMS building foundations.

2.16.2 Installation of all sampling/sensors and umbilical equipment to connect to the CEMS equipment
2.16.3 CEMS building power supply.
2.16.4 Offloading and setting of the CEMS building
2.16.5 Installation of interconnection fiber external to the CEMS enclosure

2.17

3.0

4.0 TECHNICAL SERVICES

4.1 Manufacturer's technical service representatives shall be technically competent; factory trained; experienced in the installation and operation of the equipment; and authorized by Manufacturer to perform any work stipulated.

4.2 Manufacturer's technical service representatives shall furnish written certification to Owner that the equipment has been field inspected and adjusted by them or under their direction and that it is ready for service, all of which shall be done before initial operation of equipment.

4.2.1 Providing technical advice to assist the installation contractor in installing the equipment.

4.2.2 Inspecting and testing the equipment after installation and directing any changes or adjustments required to assure proper operation.

4.2.3 Providing technical direction during start-up and initial operation of the equipment.

4.2.4 Directing the correction of any design or manufacturing errors.

4.2.5 Instructing/training the energy center personnel in the operation and maintenance of the equipment.

4.2.6 Providing services required as a condition to providing the warranties and guarantees specified.

4.3 When, in the judgment of Owner, a field service representative's time is required under Section 1D, Item 3.1 above, solely and expressly for the purpose of correcting design or manufacturing errors covered under warranty, no payment will be made, nor will the time spent at the site while correcting such errors apply toward the days of service or round trips specified for Section 1D, Item 3.2 (a), (b), (c), (e) and (f) above.

5.0 TESTING

5.1 List any testing requirements and test.

5.2 Owner reserves the right to observe the above tests being performed.

5.3 Factory acceptance Testing is at the discretion of the Project Engineer and is included in the scope of the material specification.

5.4 Vendor shall notify Owner of all tests not less than 14 days prior to the date of test to allow Owner to observe testing of the equipment if so desired.

5.5 Certified copies of inspection and test reports shall be provided by Vendor for all test and inspections conducted on the specified equipment. One (1) copy of each report shall be submitted to Owner within one (1) week after completion of each test or inspection as specified in Item 3.2 above.

5.6 A site acceptance test will be performed to verify voltage, current, and wattage requirements. A performance test will be performed to verify the rating after temperature compensation.

6.0 PRE-SHIPMENT INSPECTION

6.1 Owner reserves the right to inspect the equipment prior to shipment.

6.2 Vendor shall notify Owner of all Shipments not less than 14 days prior to the date of shipment to allow Owner to inspect the equipment if so desired.

7.0 SHIPPING

7.1 Shipments to the energy center site shall be consigned to the Shipping Address as defined in the Location Section 1B, 1.2.1.

7.2 Vendor shall include costs of shipping all materials and associated equipment together in the price quote.

7.3 Vendor shall be responsible for delivery to Owner's site F.O.B. This shall include special work required to support delivery of heavy and/or oversized items such as, but not limited to, road repairs, road upgrades or extensions, power line disconnections and reconnections, bridge reinforcements, grade alterations, and the like. Vendor shall provide and coordinate all special services required to complete all deliveries based on the existing conditions surrounding the site on the Contract Date

7.4 Vendor shall discuss with Owner the routing of shipments and shall reroute the same as indicated by Owner provided the freight rates and overall costs are no greater than by other routes.

7.5 Truck shipments will be accepted weekdays only between the hours of 8:30 A.M. and 2:30 P.M. (Central time). After-hour deliveries not provided for by contract may be refused until the next regular workday. Cost incurred by Owner for offloading prior to or after normal working hours shall be back-charged to Vendor unless prior authorization has been approved by Owner.

7.6 Packages shall be clearly marked with the Contract Number and Purchase Order Number where applicable. Packing lists shall identify Contract Number, Purchase Order Number and item numbers and quantities, bills of lading shall identify the Contract number and Purchase Order Number. Packing lists shall be submitted electronically to SPOC prior to shipment.

7.7 Equipment shall be shipped completely factory assembled. Preparation for Shipment shall be in accordance with Manufacturer's standards unless otherwise noted in this specification. Manufacturer shall be solely responsible for the adequacy of the preparation for shipment to ensure materials are received at their destination in EX-Works (EXW) conditions when handled by commercial carriers.

7.8 Equipment shall be boxed, crated, or otherwise suitably protected during shipment, handling, and storage. Components with moving parts which might be damaged in shipment, shall have all such moving parts securely blocked and braced. All items blocked and braced for shipment must be clearly identified and tagged accordingly. Equipment having antifriction or sleeve bearings shall be protected by weather-tight enclosures.

7.9 Materials required for protection during shipping and storage shall be treated for fire resistance. Wood protection shall be Class A, fire retardant, pressure treated type.

7.10 Coated surfaces shall be protected against impact, abrasion discoloration, and other damages. Surfaces which are damaged shall be repaired.

7.11 Electrical equipment, controls, and insulations shall be protected against moisture and water damage. All external gasket surfaces and flange faces, couplings, rotating equipment shafts, bearings, and like items shall be thoroughly cleaned, coated with rust-preventive compound, and protected with suitable wood, metal, or other substantial type covering to ensure their full protection. Exposed threaded parts shall be greased and protected with metallic or other substantial type protectors. Damages due to insufficient protection shall be repaired by Vendor.

7.12 Returnable containers and special shipping devices shall be returned by Manufacturer's field representative at Vendor's expense.

7.13 A weatherproofed itemized list of the contents shall also be attached to the outside of each box.

7.14 Spare parts shall be shipped separate in heavily constructed wooden boxes. The boxes shall be designed as permanent storage enclosures. Separate boxes shall be used for the spare parts for each major piece of equipment. Where applicable, boxes shall be designed and constructed for return shipment of damaged or worn components for repair.

7.15 Spare parts shall be protected from damage due to moisture and dirt accumulation during an extended storage period by use of special coatings, airtight membranes, bags of desiccant, or other means acceptable to Owner.

7.16 All separately packaged accessory items and parts shall be shipped with the equipment. Containers for separately packaged items shall be marked so that they are identified with the main equipment. An itemized packing slip, indicating what is in that container only, shall be attached to the outside of each container used for packing. A similar list shall be inside of each container. A master packing slip, covering all accessory items for a given piece of equipment which are shipped in separate containers, shall be attached to one container.

7.17 Vendor shall provide dimensions (H" x W' x D") and weight for each shipping container with approval drawings.

7.18 If materials require special fixtures or lifting rigs for offloading, such rigs or fixtures shall be provided at no additional cost with shipment.

8.0 RECEIPT INSPECTION

8.1 Materials or equipment purchased under this contract may be inspected at the specified receiving points and there accepted or rejected. Inspection will include the necessary testing for determining compliance with the specifications. All expense of initial acceptance tests will be borne by Owner. The expense of subsequent test due to failure of materials or equipment first offered will be charged against Vendor. Owner may reject damaged materials or equipment at any point along the line of shipment with the return and shipment costs to Vendor's account.

END OF SECTION 1D

APPENDIX A

Reference Copy; Ameren Buyer will provide template for Bidder use

Supplier/Subcontractor Business Plan for Ameren

Ameren has a corporate Supplier Diversity Strategy to create, access, development and long-term sustainable partnerships with companies certified as diverse-owned (minority, women, veteran/services disabled & lesbian, gay, bi-sexual, transgender (LGBT)) by 3rd party certifying entities. Providing diverse-owned companies greater opportunities to do business with Ameren is a critical component of our business and economic development strategy. Ameren's goal is to achieve 20% total annual spending with the utilization of certified diverse-owned business by 2020.

As a participant in this RFP, Ameren expects that the bidders share in the commitment to the Supplier Diversity Strategy. To support this Strategy in the contract for the services in this RFP, there are target participation levels for diverse spend of 20%. Bidders unable to reach the target should submit bids with the highest levels of Diverse spend that they are able to achieve. The target should not limit bidders from exceeding the target. Ameren expects bidders to demonstrate in the Diverse Supplier Form/Plan how their submitted diverse participation levels will be met without causing impractical cost or risk to the contract.

The proposal must clearly outline in the Supplier/Subcontractor Business Plan how diverse supplier participation will be achieved by identifying proposed diverse suppliers/subcontractors. In your bid response, please indicate the maximum level of participation expressed as a percentage of all subcontracted work for the amount of work that you will be able to commit to a diverse subcontractor on the Supplier/Subcontractor Business Plan. Only firms that have been certified as diverse business at the time of award will be credited for diverse supplier participation as part of each bidder's proposal.

If you contacted and sought bids from diverse suppliers for the subcontracting work but were unable to award, please include in your bid response on the Supplier/Subcontractor Business Plan the name of the diverse suppliers you contacted and sought bids for the suppliers/subcontracting work and the reason(s) why the award did not occur.

Note: Please list all diverse and non-diverse subcontractors on supplier/subcontractor business plan. Ameren will require bidders to track spend amounts when subcontracts are awarded to Diverse Suppliers. If bidder is unable to award to Diverse Supplier indicate name of diverse supplier contacted and reason(s) why bidder was unable to award.

Please specify in the cell below the % diverse supplier participation as part of the bid

% of Diverse Supplier Participation:	-				
Name of Supplier/Subcontractor	Email	Business Classification of Diverse Subcontractor (Select from the Pull Down)	Type of Work/Services to be Provided by Subcontractor	Anticipated Value of Work ($) to be Performed	Reason(s) why unable to award to Diverse Subcontractor (Select from the Pull Down)

Please describe "Other" in this space:

Image from Supplier Diversity Business Plan Template - 2020.xlsx

END OF APPENDIX A

APPENDIX C
DESIGN FOR SAFETY GUIDE

OBJECTIVE

Develop and maintain design guidelines to ensure engineering designs reduce safety risks for construction, operations, and maintenance of equipment and facilities.

These Guidelines reflect Ameren's commitment to incorporate safety into all designs. The designer of record is ultimately responsible for adherence to all governing Federal, State, and Local code requirements.

While attempts will be made to follow the recommendations in this guideline during the engineering phase there will be occasions where conditions and physical constraints may render some recommendations impractical or unattainable.

Several of the Design for Safety recommendations are subjective and can vary from energy center to energy center (i.e. serviceable access for equipment, pipe labeling, & color coding). Ameren Engineering and contracted consultants must engage energy center stakeholders during the design phase to accommodate energy center specific safety and operating requirements.

GENERAL FACILITY SAFETY DESIGN

YES	NO	N/A	
☐	☐	☐	General Arrangement layouts shall provide for adequate serviceable access for operation, maintenance, and replacement (i.e., personnel access, tool access, cart access, vertical lift access, fork truck access).
☐	☐	☐	Stairs shall not be used as access platforms. No valves, controls, equipment, etc., shall be positioned / designed to be accessed by personnel standing on stairs.
☐	☐	☐	Permanent, well identified and load rated fall protection tie-offs, should be incorporated into the building structure at removable handrails and access hatchways.
☐	☐	☐	Self-closing swing gates are to be used instead of chains and clips at all personnel access openings for fall protection guarding where the elevated surface is used as a work platform or walkway.
☐	☐	☐	Non-slip "Mebac" ladder rung covers should be used on all fixed access ladders.

YES	NO	N/A	
☐	☐	☐	All new handrails shall be fabricated utilizing 1½“ diameter standard pipe rails and posts. Posts shall be spaced a maximum 6’-0" on centers. Rails shall include one (1) top rail (top of top rail shall be 42" above walking surface); **two (2) mid rails** *equally spaced to provide increased fall protection*; and a standard 4” high toeboard.
☐	☐	☐	OSHA required clearance to handrails on stairs (3”) must be maintained. Structural bracing, electric conduit, or mechanical piping is not located within the required clearance space.
☐	☐	☐	No more than a 3” open gap is maintained between a walking surface and the side of a piece of equipment penetrating the walking surface.
☐	☐	☐	When practical, valves should be located to allow for ergonomically correct operation.
☐	☐	☐	When practical, provide stairs rather than ladders to equipment, valves, etc. that requires routine access for operations and/or maintenance.
☐	☐	☐	Provide chain wheel operators for valves that cannot be accessed from a permanently installed ladder or platform.
☐	☐	☐	When possible, design stairs with lower angle of stairway rise (6½” R, 11” T). Stair landings are provided every 10 to 12 treads.
☐	☐	☐	When possible, no low mounted equipment, piping, ducting, conduit, etc. in travels paths. No “duck-unders.” Use a minimum design head clearance of 7’-0”.

YES	NO	N/A	
☐	☐	☐	All 90-degree corners of structural steel members and plate trimmed / clipped where close to personnel access areas.
☐	☐	☐	Maintenance and replacement access considered when locating lighting fixtures (especially on stairways, over tops of equipment and high overhead locations).
☐	☐	☐	Underground utilities should be designed and installed with warning and location indicators for future excavations in the areas of buried utilities.
☐	☐	☐	Underground utilities should be designed and installed at shallowest depth possible (while maintaining freeze protection and surface surcharge loads) to minimize deep trenching hazards.
☐	☐	☐	Thermal protection guarding incorporated into design where required.
☐	☐	☐	Utilize aboveground liquid containments or rigid structural underground containment. Avoid below grade lined pits.
☐	☐	☐	Incorporate seismic shut-off valves for gas service lines entering buildings and at meter locations. (Application mostly at non-energy center, off-site buildings / facilities).
☐	☐	☐	Walkways shall be clear of protruding obstructions and bump hazards. No valves, valve stems, valve handles, controls, equipment, etc. should be positioned / designed within the normal walking path within personnel walkways. If not possible, paint or otherwise safeguard.

YES	NO	N/A	
☐	☐	☐	Utilize yellow warning striping along edges of personnel walkways to guide / warn walking personnel of potential obstructions, ramps, bump hazards, grade / slope changes.
☐	☐	☐	Provide personnel access to all roofs for inspection and maintenance purposes.
☐	☐	☐	Provide permanent fall protection tie-offs that are well identified, load rated, and incorporated into the building structure on roofs where there are no parapets or guard railing. (Review the need for fall protection tie-offs on specific roof areas on a case-by-case basis).
☐	☐	☐	To eliminate the need for fall protection tie-offs, when practical building roof parapets should be designed high enough to meet OSHA fall protection guarding requirements.
☐	☐	☐	Where possible, roof-mounted equipment shall not be designed and installed closer than 15’ to open, unguarded edge of roof.
☐	☐	☐	Provide fall protection guarding at edge of roof (without parapet) where roof-mounted equipment is installed closer than 15’ to open edge of roof.
☐	☐	☐	Provide fall protection guarding on both sides of a fixed roof access ladder onto roofs with no parapet or guard railing.
☐	☐	☐	Provide fall protection guarding or tie-off point at all personnel access roof hatches.

YES	NO	N/A	
☐	☐	☐	Provide fall protection guarding at roof-mounted skylights (many commercial skylights are available with security grills that will act as fall protection guarding).
☐	☐	☐	Design roof-mounted equipment, ducting, and piping with adequate clearance for roof maintenance and replacement. Design clearances shall meet the NRCA recommendations for equipment to roof clearances.
☐	☐	☐	Provide service power for roof-mounted equipment.
☐	☐	☐	Eliminate tripping hazards on roofs / floors. No low-to-roof / floor-mounted electric conduits and drain pipes.
☐	☐	☐	Utilize safety balls on lightning protection air terminals. Eliminate impalement hazard of pointed air terminals on roofs.
☐	☐	☐	“Roof slippery when wet” signs shall be installed at all personnel access points onto roofs.
☐	☐	☐	Provide lighting on roofs in areas of personnel access for maintenance of equipment.
☐	☐	☐	Design mechanical / electrical equipment and components to be watertight for washdown cleaning.

YES	NO	N/A	
☐	☐	☐	Provide the proper quantity and type of fire extinguishers and hose stations.
☐	☐	☐	Provide proper washdown facilities (hose reels, supply pipes, drains) to allow facility cleaning.
☐	☐	☐	Assure proper safety signage is in place (chemicals, hearing protection, etc.).
☐	☐	☐	Assure roof drains are not placed where water will freeze and become a slipping hazard.
☐	☐	☐	Provide ice dams on sloped roofs above doorways and walkways to prevent and/or break up sliding ice.

COMMENTS TO GENERAL FACILITY SAFETY DESIGN:

ELECTRICAL SAFETY DESIGN

YES	NO	N/A	
☐	☐	☐	Walk down conduit and cable tray routes before installation to identify hazards such as tripping, head, thermal, chemical, etc.
☐	☐	☐	The location, cable tray material, and conduit shall be designed for the identified hazards for that specific location.
☐	☐	☐	Place electrical equipment in accessible locations.
☐	☐	☐	Electrical Room Egress: Provide at least two exit paths even if Code allows one exit for "un-occupied space". These spaces frequently become temporary Control Centers during construction, commissioning, and start-up.
☐	☐	☐	Cabinet/enclosures shall be designed to allow sufficient space for maintenance if maintenance to be performed inside the cabinet/enclosure.
☐	☐	☐	Provide sufficient space to allow for cabinet / enclosure access doors to fully open.
☐	☐	☐	Provide sufficient space for electrical equipment as defined by NEC in walkways, area between cabinets, etc. for forklifts, routine maintenance, etc.
☐	☐	☐	All control switches should be accessible from outside of the cabinet.

YES	NO	N/A	
☐	☐	☐	Provide the manufacturer's recommended spacing for equipment cooling.
☐	☐	☐	Obtain arc flash incident energy level and labels for any equipment rated 480V and higher or greater than 125KVA at 120VAC & above per NFPA 70E.
☐	☐	☐	Consider extra guarding of high voltages (Plexiglas) in electrical cabinets to reduce PPE requirements.
☐	☐	☐	Switchgear shall be specified to provide "Lock Out" capability.
☐	☐	☐	Equipment shall be designed for the ratings for which it will be subject to (i.e., maximum voltage, short circuit current, continuous current, ambient temperature, etc.).
☐	☐	☐	Equipment, cable, conduit, tray, etc. shall be labeled with the voltage level.
☐	☐	☐	Equipment shall be labeled with normal power feed and backup power feed (if applicable).
☐	☐	☐	Consider backup power feed for systems where failure of normal power feed would result in a hazardous event.

YES	NO	N/A	
☐	☐	☐	Label all equipment with appropriate equipment description (if applicable).
☐	☐	☐	When possible, critical conduits shall be installed in a duct bank rather than direct buried.
☐	☐	☐	Control cabinets and wiring termination cabinets should be accessible from platforms or at grade level. Ladders should be avoided.
☐	☐	☐	Provide fall protection tie-off points at tops of transformers.

COMMENTS TO ELECTRICAL SAFETY DESIGN:

MECHANICAL SAFETY DESIGN

YES	NO	N/A	
☐	☐	☐	Walking or climbing surfaces are sheltered or maintained in a manner to avoid slippery surfaces from rain or ice. (Review on a case-by-case basis).
☐	☐	☐	Emergency drainage systems are provided to direct flammable liquid leakage to a safe location.
☐	☐	☐	Provide eye wash stations at locations where liquids are sampled or “open fluids” are otherwise handled.
☐	☐	☐	Stairs, ladders, or ramps are provided at all locations where equipment design or maintenance actions require personnel to abruptly change elevation by more than 12 inches.
☐	☐	☐	Fixed ladders designed with a slope of 75 degrees or more where practical.
☐	☐	☐	Whenever practical, provide adequate access for maintenance personnel to all mechanical components, small-bore piping, ducts, valves, thermowells, flow meters and other appropriate instrumentation on piping runs and equipment units which require inspecting, testing, servicing, adjusting, greasing, removal, replacement, or repair.
☐	☐	☐	When practical, locate instruments, sample points, valves, etc. that require frequent readings, calibration, operation, etc. to allow for walk-up access.

YES	NO	N/A	
☐	☐	☐	Specify equipment to include handling features that will aid in grasping, removing, and carrying equipment.
☐	☐	☐	Labeling and coding is provided for service and adjustment points to clearly identify the key aspects of the maintenance activity.
☐	☐	☐	Equipment and components shall be labeled with weights for lifting and removing for later maintenance or replacement. When modifying existing equipment, determine the weight of the existing equipment plus modifications and label or revise the existing labels accordingly. When possible, the label should include references to the calculation, project, and/or drawing number.
☐	☐	☐	Provide lifting devices (lifting lugs, beams, monorail, etc.) for maintenance and replacement of equipment. Lifting devices shall be labeled with the rated lifting capacity.
☐	☐	☐	Provide Indicators for convenient and reliable determination of fluid levels.
☐	☐	☐	Drain fittings are provided to support fluid removal readily and safely.
☐	☐	☐	Ensure design basis application for failure modes on all positioned equipment. Example, loss of air, loss of DC, etc.
☐	☐	☐	Standardize parts, maintenance and adjustment points as much as possible. For example, use the same size and type of bolts to eliminate special wrenches/tools. Utilize common rigging points to minimize types of rigging connections, etc. If standardization is not possible, clearly differentiate specialized items with signs, markings, etc.

YES	NO	N/A	
☐	☐	☐	Minimize steam hazards, heat hazards, sharp corners, edges, and projections on equipment.
☐	☐	☐	Equipment should be placed on concrete housekeeping pads, especially where standing water might accumulate.
☐	☐	☐	Add equipment protection features to guard against hazards that cannot be removed or designed out of the system.
☐	☐	☐	Specify that equipment vendor technical manuals deal with one specific equipment model rather than with many different equipment models.
☐	☐	☐	Valves shall be provided with “Lock Out” devices.
☐	☐	☐	Provide adequate isolation valving and venting for WPA, maintenance, etc. on piping systems and equipment. Follow applicable code/standard section requirements.

COMMENTS TO MECHANICAL SAFETY DESIGN:

CHEMICAL SAFETY DESIGN

YES	NO	N/A	
☐	☐	☐	Insure that bulk chemical tanks have separate containment areas. Containment areas shall be washable and have the ability to be drained.
☐	☐	☐	All materials used to construct storage tanks, containment, piping, etc. must be verified to be compatible for use with the chemicals used in each specific application.
☐	☐	☐	Lengths of chemical piping runs should be minimized. Chemical supply tanks and pumps should be designed to be as close to injection points as possible. Overhead chemical piping runs should be minimized. When used, labels shall be affixed to the floor beneath the piping with proper hazard communication. Chemical lines must be labeled a minimum of every 10 feet. All PVC/CPVC chemical piping must be protected from foot traffic.
☐	☐	☐	Chemical day tanks shall be properly sized to minimize the number of drums in the work area.
☐	☐	☐	Designate storage areas for each type of chemical, taking into account compatibility of each.
☐	☐	☐	Provide sufficient room for servicing instruments around bulk chemical storage tanks.
☐	☐	☐	Drains to sump shall be located around all chemical feed equipment. Local washdown water must be provided in chemical feed area. Include hose and hose reels for local washdown water.

YES	NO	N/A	
☐	☐	☐	All laboratory areas must contain proper first-aid kit(s).
☐	☐	☐	Material for chemical spill control (pigs, pads, soda ash, etc.) shall be located in a designated area close to chemicals.
☐	☐	☐	Personal protective equipment shall be located in a designated area close to chemicals.
☐	☐	☐	Chemicals shall be transferred to equipment (mixing tanks or day tanks) in a way to minimize chances of contacting personnel and avoid manual dumping of bottles and drums.
☐	☐	☐	Chemical containers must be labeled with chemical names and HAZCOM placards.
☐	☐	☐	All safety showers shall be supplied with tepid water. Safety showers located outside shall also be covered and protected from the wind. Safety shower activation shall signal an alarm in the control room.
☐	☐	☐	All concrete and equipment exposed to chemicals shall be coated with an appropriate chemical-resistant coating.
☐	☐	☐	PA shall be located convenient to all chemical use areas, but beyond the area that could be engulfed by a chemical spill.

YES	NO	N/A	
☐	☐	☐	Operating and Maintenance personnel shall be isolated from all chemical pumps and feed systems by plastic screens or curtains.

COMMENTS TO CHEMICAL SAFETY DESIGN:

END OF APPENDIX C

APPENDIX E
MATERIAL SAFETY DATA SHEETS
CONTRACTOR AFFIDAVIT PURCHASE ORDER NO.

As the responsible party for the firm of _____, I do here state that I have requested, received, read, understand, and will abide by and enforce the guidelines and conditions set forth in the Material Safety Data (MSD) Sheets provided by the product manufacturer for each hazardous chemical product delivered to and/or used in connection with the work specified in _____.

I further state that I am aware of, understand, and will fully implement the requirements of the OSHA Hazard Communication Standard (CFR 29, Part 1910.1200) and other workers' right-to-know laws.

I further state that I will maintain copies of the required MSD Sheets for each hazardous chemical in the workplace, including Company's hazardous materials, listed in this Specification; and will insure that the MSD Sheets are readily accessible during each work shift to employees when they are in their work areas.

I further state that the information contained within the MSD sheets has been disseminated to all parties who have a right or need to know; and that all workers and other effected parties have received adequate and appropriate training in the hazards, handling, and use of hazardous chemicals.

_____ _____
Contractor's Representative/Title Date

_____
Notary Public Signature & Seal

END OF APPENDIX E

APPENDIX H
FERC STANDARDS OF CONDUCT
PROCEDURE AUE-ADM-5476, REV. 4

Contractor and subcontractors agree to comply with Ameren's FERC Affiliated Restrictions and Standards of Conduct per **procedure AUE-ADM-5476**.

Contractor/Consultants with access to Transmission Information shall complete the appropriate Ameren training requirements related to the Standards of Conduct as determined by the Ameren manager/supervisor responsible for the consultant. Training on the Standards of Conduct is included in the "FERC Compliance Training" module. Applicable training will be identified by Engineer.

No Conduit Rule – The No Conduit rule prohibits all employees, including contractor/consultants, from acting as a conduit to provide Transmission Information to employees that are not otherwise permitted access to that information.

END OF APPENDIX H

APPENDIX I
CHEMICAL OF INTEREST REPORTING

Contractor must complete the table below, "Department of Homeland Security Chemicals of Interest to be Brought on Site," which requires Contractor to list any materials being sent onsite which are identified in Appendix A of the DHS Chemical Facility Anti-Terrorism Standard Chemical (Facility Anti-Terrorism Standards (CFATS), 6 CFR Part 27.)

MSDS for all COI must be submitted with Contractor's bid.

Before shipment, Contractor must inform the SPOC of any additional COI brought onsite or if the maximum amount of any material identified in Sheet I-2 below.

AFFIDAVIT

A. AUTHORIZED REPRESENTATIVE

I HEREBY AFFIRM THAT:

I am the [title]_____ and duly authorized representative of [name of business]_____ and that I possess legal authority to make this Affidavit on behalf of the business for which I am acting.

B. CERTIFICATION OF CORPORATION REGISTRATION

I FURTHER AFFIRM THAT:

1. The business named above is a corporation registered in the state or commonwealth of _____ and is in good standing with said state or commonwealth's Department of Assessments and Taxation, and that the name and address of its resident agent is:

Name _____

Address _____

_____

C. CERTAIN AFFIRMATIONS VALID

I FURTHER AFFIRM THAT:

To the best of my knowledge, information, and belief, each of the affirmations, certifications, or acknowledgments contained in this Chemicals of Interest appendix is true and correct in all respects on the date of this Affidavit and as fully set forth herein.

I DO SOLEMNLY DECLARE AND AFFIRM UNDER THE PENALTIES OF PERJURY THAT THE CONTENTS OF THIS AFFIDAVIT ARE TRUE AND CORRECT TO THE BEST OF MY KNOWLEDGE, INFORMATION, AND BELIEF.

Date_____ By_____
(Authorized Representative and Affiant)

DEPARTMENT OF HOMELAND SECURITY CHEMICALS OF INTEREST TO BE BROUGHT ON SITE

Contractor: _____ Site: _____ Energy Center Project: _____

Product/Chemical	COI Identified in Product/Chemical (Appendix A, 6 CFR 27)	Maximum Amount of Product On Site at Any Time (pounds)	Weight Percent COI in Product

END OF APPENDIX I

APPENDIX J

VENDOR DRAWING TRANSMITTAL / CAD REQUIREMENTS

The purpose of this document is to specify the procedures and method of transmittal of Computer Aided Drafting (CAD) electronic files and other design file requirements for drawings generated by vendors/architectural engineering firms working for Ameren Missouri.

PROCEDURES FOR TRANSMITTING FILES

A/E-Vendor Originated Drawings:

Drafting and Document Control Supervisor of Power Operations Services, @Elec Design - EC Design, will coordinate the transmittal and submittal of electronic CAD drawing files and other records for the project.

CAD SOFTWARE DESIGN REQUIREMENTS

Ameren Missouri will provide a workspace to utilize when creating or modifying drawings. This can be obtained by contacting @Elec Design - EC Design. Ameren Missouri utilizes Autodesk AutoCAD. As built drawings are required to be submitted in the latest version of AutoCAD, not to exceed two previous releases. (Example AutoCAD 2014 is acceptable).

DELIVERABLES

Vendor shall provide electronic CAD files via the external SharePoint site maintained by the Ameren Missouri Drafting Department. Hardcopies of as-built drawings shall be produced on an as-needed basis determined by the Engineer.

Questions regarding drafting deliverables or standards shall be addressed to:

Drafting and Document Control Supervisor
Ameren Missouri
11149 Lindbergh Business Ct.
St. Louis, MO 63123
@Elec Design - EC Design

Vendor shall enclose all necessary documentation associated with as-built CAD files as applicable (i.e., file names, reference files and any other necessary information). All original drawings sent to vendors, all voided drawings and all manual drawings that have been redrawn are to be returned to Ameren Missouri.

Electronic files for all CAD drawings shall be delivered to Drafting and Document Control Supervisor by one of the following transmittal methods:

- CD-ROM
- Ameren approved file transfer site – Microsoft SharePoint 365

https://aueameren-portal2.sharepoint.com/default.aspx

Virus protection is paramount with any of the above methods. All corporate procedures will be followed to ensure transmittals will be free of viruses. All files supplied to Ameren Missouri shall be compatible in format and file structure as outlined in these requirements. Incompatible or incomplete files will be returned for further refinement before acceptance will be granted.

Samples of CAD files in an intermediate state can be submitted for approval of conformance to Ameren Missouri's drafting standards and is encouraged in the early stages of project development. Ameren Template files are available and are recommended to ensure compliance to Ameren Missouri drafting standards.

RESERVING NUMBERS FOR NEW AMEREN MISSOURI DRAWINGS

Power Operations Services Drafting and Document Control Department is responsible for reserving numbers for vendors to use for new drawings for construction projects. The drawing class will be necessary to assign new numbers. See Attachment C. An Ameren Service Request shall be completed and submitted to the Ameren Missouri approved File Transfer Site mentioned above. One drawing number will be assigned for each class of drawing needed. Sheet numbers shall be utilized in lieu of additional drawing numbers in the same class up to 999 sheets.

RESERVING FOREIGN PRINT DRAWING AND FOREIGN PRINT MANUAL NUMBERS
Power Operations Services is responsible for reserving numbers for vendors to use for new foreign print drawings and manuals for construction projects. It will be necessary to request the number of foreign prints by class, drawing or manual. An Ameren Service Request, shall be completed and submitted to the Ameren Missouri approved File Transfer Site mentioned above. The manufacturer's name is required to reserve the foreign print numbers.

FILE NAMING CONVENTIONS
To properly identify files it is necessary to adhere to several rules. The drawing file extensions shall be **.dwg** as the CAD system default file extensions.

The following special characters shall not be used in file names or titles:
! * / ({ < > }) & ? $ # @ ” ’ + [ ] ~ \

Ameren Drawings Numbers

- The CAD file naming convention shall adhere to the following format:
    - <site>-DWG-<drawing class>-<seq ######><sheet ###>.dwg
        - <site> – Refers to a two-letter abbreviation for each generation site.
        - DWG – Refers to a three-letter abbreviation used to indicate the file is a drawing class type.
        - <drawing class> – Refers to a four-letter abbreviation for each drawing class.
        - <seq ######> – refers to a six-digit drawing number provided by Ameren Missouri.
        - <sheet ###> – refers to a three-digit sheet number associated with the drawing number.
    - See Attachment C for name convention abbreviations.
    - Example of file name **LB-DWG-ELEC-000001001.dwg**

Foreign Prints Manuals

- The CAD file naming convention shall adhere to the following format:
    - <site>-FPM-<seq ######><sheet ###>.dwg
        - <site> – Refers to a two-letter abbreviation for each generation site.
        - FPM – Refers to a three-letter abbreviation used to indicate the file is a drawing class type. All foreign print manuals are listed as FPM.
        - <seq ######> – refers to a six-digit drawing number provided by Ameren Missouri.
        - <sheet ###> – refers to a three-digit sheet number associated with the drawing number.
    - See Attachment C for name convention abbreviations.
    - Example of file name **LB-FPM-000001001.dwg**

Foreign Prints Drawings

- The CAD file naming convention shall adhere to the following format:
    - <site>-FPD-<seq ######><sheet ###>.dwg
        - <site> – Refers to a two-letter abbreviation for each generation site.
        - FPD – Refers to a three-letter abbreviation used to indicate the file is a drawing class type. All foreign print drawings are listed as FPD.
        - <seq ######> – refers to a six-digit drawing number provided by Ameren Missouri.
        - <sheet ###> – refers to a three-digit sheet number associated with the drawing number.
    - See Attachment C for name convention abbreviations
    - Example of file name **LB-DWG-FPD-000001001.dwg**

FOREIGN PRINT TITLING REQUIREMENTS

The title shall be titled such that a keyword search of the title field will produce successful results. Titles should include a concise and specific description of the equipment/system it pertains to, including equipment ID numbers whenever possible. Words should be spelled out completely and abbreviations avoided (common abbreviations such as AC, DC, PLC and VFD are acceptable). **Do not use special characters in the title**. See File Naming Conventions for list of special characters. If a drawing or Foreign Print applies to more than one piece of equipment (for example, two identical valves but in different trains), the complete ID numbers for all should be included in the title. Instruction manual titles should include the model number, series, type, etc.

- AIR DRYER INSTRUCTION and MAINTENANCE MANUAL – A INSTRUMENT AIR DRYER PNEUMATECH PE SERIES
- INSTALLATION, OPERATION and MAINTENANCE MANUAL FOR UNITS 1 - 2 CONDENSER SUMP PUMPS GORMAN-RUPP SUPER T SERIES MODEL T4A60S

DRAWING REQUIREMENTS

Titling – The title shall begin on the second line. The first line of the drawing title shall be drawing type: **Building - Architectural Plans**, **Conduit - Hangers**, **Electrical – One Line Diagram**. The second line shall be system description. **See desktop instruction in the external SharePoint site, Ameren AutoCAD Vendor Drawing template (new drawings), Ameren Add Title block Information (existing drawings) for further instruction and details** under the **Guides-AutoCAD Starter Files-AutoCAD-template** folder Title blocks to be in Layout (Paper) Space, all other drawing elements shall be in Model Space. Abbreviations when necessary shall follow the ANSI standard of abbreviations and Acronyms for Use on Drawings and Related Documents. **Do not use special characters in the title**. **See File Naming Conventions for list of special characters. (Page 5)**

Fraction display – Diagonal (i.e., 1½"). Note: For drawing title blocks use 1.5IN or 10.5FT or 10FT-6IN.

Dimension readout – feet and inches (not metric or in decimal form)

Angular Measurement – decimal degrees

Line weight – default (.20mm) or to match existing drawing for bold lines and good drafting practice

Patterning – as specified on each drawing

Revision number and date are required in title block area of each drawing. Revisions to existing drawings are numeric and increase by one each revision (i.e., Revision 002 would increase to 003). **All new drawings are issued at zero "000", revision. New drawings when revised increase to "001" for the first revision**. For vendors wanting to do multiple revisions to drawings prior to returning to Ameren Missouri, it is preferred that an alphanumeric numbering series is used. (i.e., if a Drawing is sent to vendor at revision "001". Vendor creates "1A0", "1A2", "1A3" revisions and then submits final revision to Ameren labeled as "As Built". Ameren will determine the latest revision number according to the system).

Scoping:
All revisions to existing drawings will have a revision cloud (scoping) placed around the areas revised.

Layer Names:

AL_REVISION CLOUD, Line Weight .53mm, Color Cyan & Transparency 75%.

This shall be left on the drawing upon final submittal, except in the case the drawing is a new drawing.

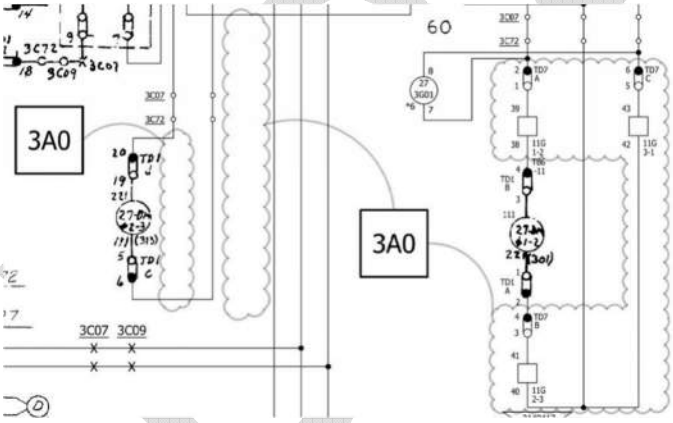
AL_ABANDON, Line Weight .53mm, Color Cyan & Transparency 50%

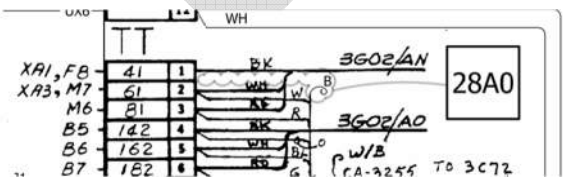
AL_ABANDON HATCH, Line Weight .25mm, Color Cyan & Transparency 50%.

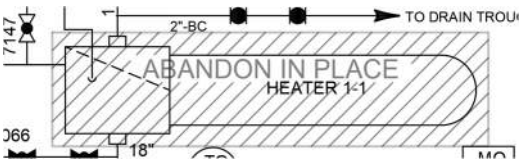
This shall be left on the drawing upon final submittal.

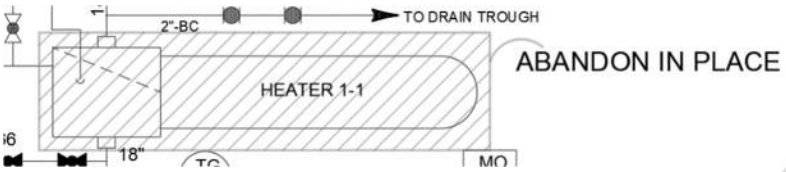
This Stamp is to be added to Construction Drawings that have Removal Drawings

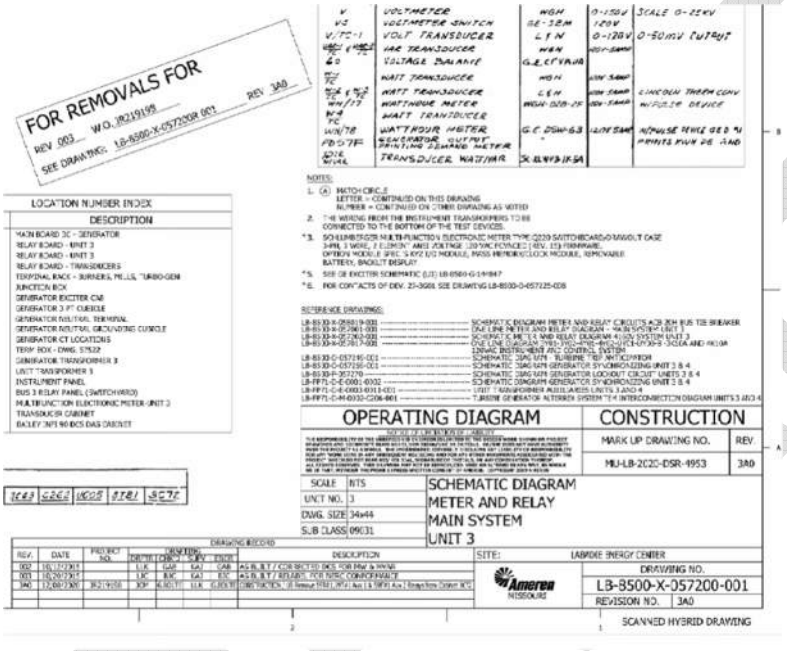
Examples of Scoping/Revision Clouds and Abandon In Place on Construction Drawings











Reference files – Vendors are requested to supply any reference file that is attached to the set of AutoCAD drawings to be delivered to Ameren Missouri.

Drawing layers – Layers are part of the Ameren AutoCAD template, see Attachment D. Any new Layers added by a vendor are required to be named with the vendor initials in the beginning of the layer name.

Operating Diagram – See Attachment E Instructions for Operating Diagram Issuance.

Drawing Standards – Contractor shall comply with the drawings standard layouts listed in Attachment F. Electronic copies of these drawing standards are available on the Ameren Missouri, Drafting and Document Control external SharePoint site.

BLOCK LIBRARIES and TEMPLATE FILES
These files are located on the Ameren Missouri Drafting and Document Control external SharePoint site. Access to this external SharePoint site may be requested from the Drafting and Document Control Supervisor as described above.

CABLE/CONDUIT/EQUIPMENT AND VALVE INFORMATION
Cable schedule, conduit, equipment and valve numbers are maintained in databases. Requests for new numbers shall be made through the external SharePoint site. Submittal of these numbers shall be in the format of Microsoft Excel or in Microsoft Access data files and submitted on the external SharePoint site.

Equipment Manuals (a.k.a. Foreign Print Manuals)
Concrete layout and placement
Architectural
Civil
Structural Steel arrangement and details
Building mechanical drawings (HVAC, plumbing, lighting, receptacles)
Equipment cut sheets and datasheets
Bill of Material

Schematics – internal schematic connections pre-wired or pre-programmed do not require assignment of Ameren numbers. However, all interconnections performed in the field to other Ameren equipment must have an Ameren designation.

P&ID – All equipment designated on the drawings must be labeled with an Ameren equipment number such as valves, pumps, heat exchangers, instrumentation, etc.

One-line electrical – all equipment designated on drawings must be labeled with an Ameren equipment number such as breakers, transformers, disconnect switches, power panels, etc.

Control/Loop drawings - internal loop connections pre-wired or pre-programmed do not require assignment of Ameren numbers. However, all interconnections performed in the field to other Ameren equipment must have an Ameren designation.

Class 2 - Drawings and information designated as Class 2 shall be categorized as either a foreign print or an Ameren Missouri drawing by the engineering team performing the modifications. Designation as an Ameren drawing requires that the original drawing be received in Ameren format with Ameren equipment and electrical designations, or that it is redrawn in accordance with Ameren format and with Ameren equipment and electrical designations.

Foreign Prints should be received in “as-built” configuration. If the drawing is not “as-built”, vendor should revise drawing to reflect the as-built configuration of SSC’s. If vendor refuses to “as-built” drawing, engage Ameren drafting and/or document control to “as-built” the drawing.

Enter foreign print into document control using AUE-DI-000018.

Existing foreign prints which are revised during a modification are to be as-built and incorporated into Ameren format and Ameren equipment designations. After engineering approval, the new Ameren drawing shall supersede the corresponding foreign print.

Note: This does not apply to Rush Island foreign prints with original Bechtel designations. See flowchart.

MANUALS

The engineer shall review the manual submitted or created.

Drawings included in manuals that indicate configuration such as P&ID’s or schematics should be removed from the manuals and entered into document control separately.

Calculations included in manuals should be removed from the manual and entered into document control separately.

Bill of Materials, cut sheet, and datasheets turned over as a separate document should either be included as part of a manual, or become a manual themselves.

OTHER DOCUMENTS

Several other types of documents may be required to be entered into the document control system as a controlled document; however the documents may not be a drawing or a manual. These documents may include:

Factory/Field Test Reports, Equipment Lists, Permits or Licenses, Procedures, calculations, Design Basis Documents, Instrument Calibration Sheets, Relay settings, Pressure vessel lists, Etc.

TITLING OF DRAWINGS, MANUALS, AND OTHER DOCUMENTS

All drawings and Foreign Prints should be titled such that a keyword search of the title field will produce successful results. Titles should include a concise and specific description of the equipment/system it pertains to, including equipment ID numbers whenever possible. Words should be spelled out completely and abbreviations avoided (common abbreviations such as AC, DC, PLC, VFD, and & are acceptable). If a drawing or Foreign Print applies to more than one piece of equipment (for example, two identical valves but in different trains), the complete ID numbers for all should be included in the title. Instruction manual titles should include the model number, series, type, etc.

Below are examples of good titles:

- WIRING DIAGRAM UNIT AUXILIARY TRANSFORMER 1X02, 2X02
- SCHEMATIC DIAGRAM ASH HANDLING SYSTEM AC POWER PLC CABINET 1C40A
- SCHEMATIC DIAGRAM HIGH PRESSURE BOILER FEED PUMP SUCTION VALVES 1HV908A, 1HV908B, 2HV908A, 2HV908B
- CONTINUOUS BARGE UNLOADER CONVEYOR 103 SECTIONS & DETAILS
- PNEUMATECH PE SERIES AIR DRYER INSTRUCTION & MAINTENANCE MANUAL – A INSTRUMENT AIR DRYER
- GORMAN-RUPP SUPER T SERIES MODEL T4A60S INSTALLATION, OPERATION, & MAINTENANCE MANUAL FOR UNITS 1 & 2 CONDENSER SUMP PUMPS

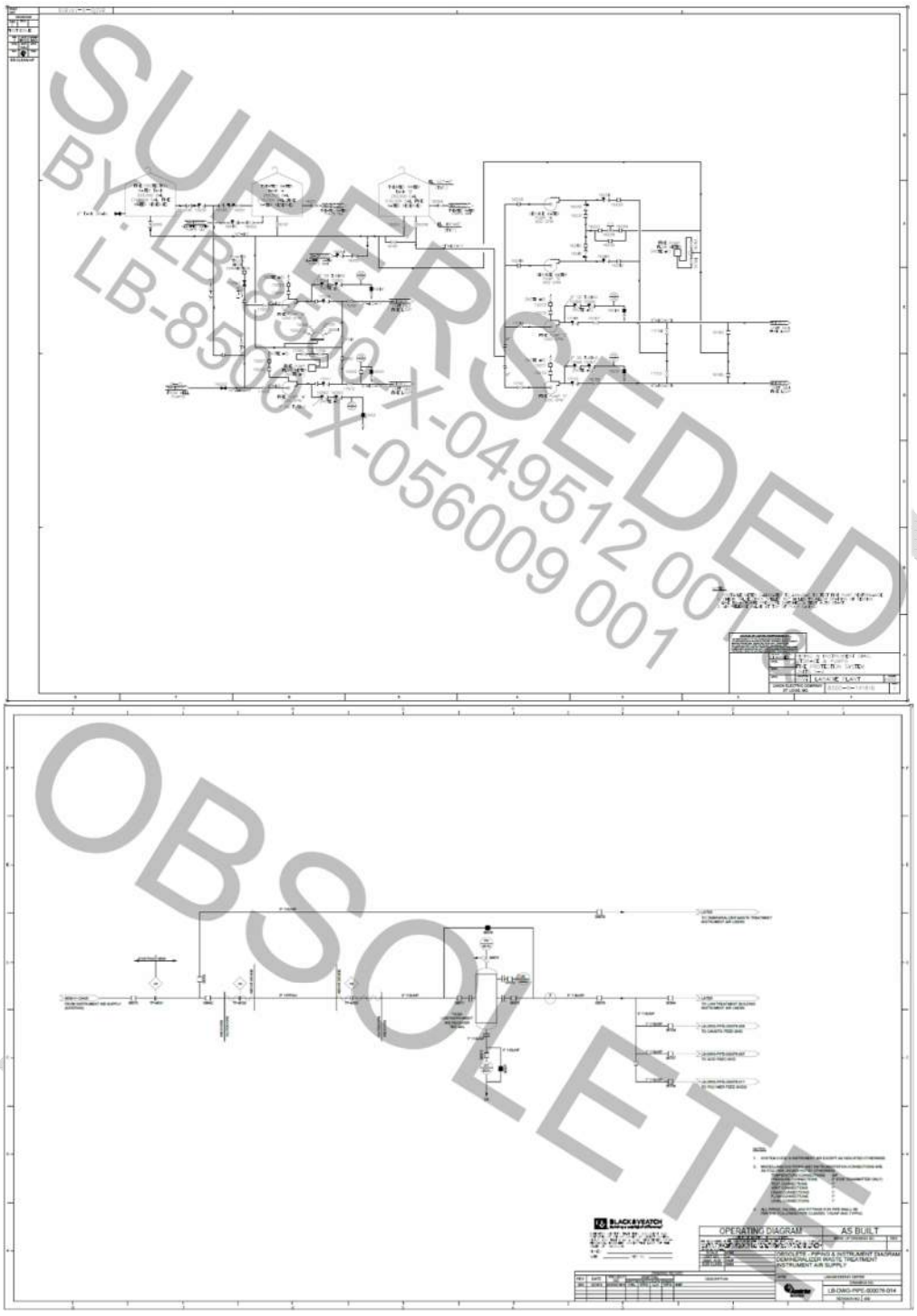
Below are examples of titles which don't lend themselves to being readily found when searching on keywords:

1. SVS2000 INSTALLATION & OPERATION MANUAL
2. OPERATION & MAINTENANCE MANUAL CRANE VALVES

SUPERSEDING/OBSOLETING DRAWINGS AND FOREIGN PRINTS

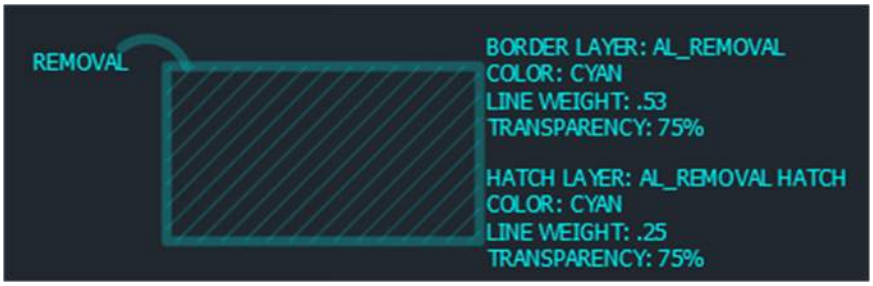
Drawings and Foreign Prints superseded or obsoleted will be returned with stamps found in the external SharePoint site **Guides and Templates/AutoCAD Starter Files/AutoCAD/Blocks/PID or Electrical/Stamp Obsolete or Stamp Superseded.** Obsolete drawings are drawings **not** being replaced with another drawing. Superseded drawings are being replaced by another drawing. Edit Stamp Superseded by adding the superseding drawing number (i.e. Superseded by LB-DWG-ELEC-123456 001). For questions or specific circumstances, contact Drafting and Document Control Supervisor.

Examples of Superseded and Obsolete drawings (Transparency 75%)

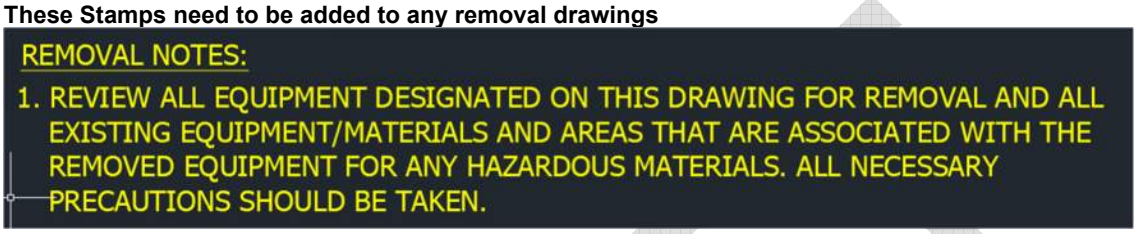


REMOVAL/DEMOLITION DRAWINGS

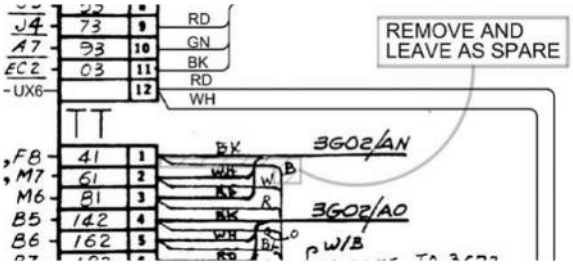
Removal/Demo drawings will be provided when equipment is removed or removed and replaced. This applies to all affected physical and electrical drawings, including schematics. The outline around the removal hatch line weight is .53mm. The 45° hatching line weight for removals is .25mm this will encompass the removed items. The removal color is cyan with a Transparency of 75%.
The drawing will be numbered with a following "R" (i.e. LB-DWG-ELEC-123456R 001 and the drawing file with be saved as LB-DWG-ELEC-123456001R.DWG).

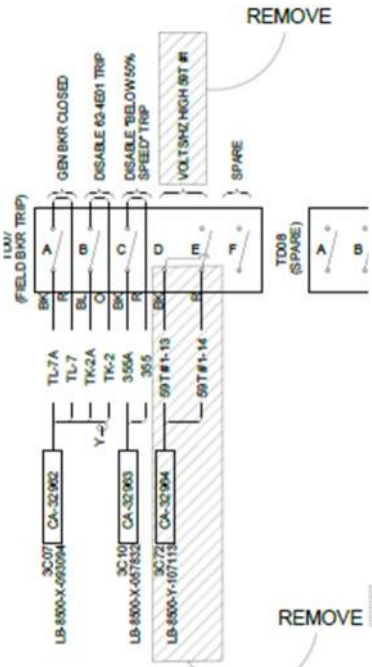


These Stamps need to be added to any removal drawings



Example Removal/Demolition drawings





FOR REMOVALS ONLY
REMOVE
FOR ADDITIONS SEE
LB-8500-X-093094-001 REV 28A0
W.O. JR219199

REMOVAL NOTES:
1. REVIEW ALL EQUIPMENT DESIGNATED ON THIS DRAWING FOR REMOVAL AND ALL EXISTING EQUIPMENT/MATERIALS AND AREAS THAT ARE ASSOCIATED WITH THE REMOVED EQUIPMENT FOR ANY HAZARDOUS MATERIALS. ALL NECESSARY PRECAUTIONS SHOULD BE TAKEN.

E-2442E SHEET 1
REVISION NO. 2

W.O. NO. 155254 CUST P.O. 7100-E9 E.C.
THE WOLFE & MANN MFG. CO.
AVC69 BALTIMORE, MARYLAND

AS BUILT
MARK UP DRAWING NO. MU-LB-2020-DSR-4953 REV. 28A0

NOTICE OF LIMITED RESPONSIBILITY
THE RESPONSIBILITY OF THE UNDERSIGNED ENGINEER, LIMITED TO THE DESIGN WORK SHOWN ON PROJECT AND DOCUMENTS BEARING HIS/HER DUAL SIGNATURES OR INITIALS, IS HEREBY DEEMED NOT TO HAVE AUTHORITY OVER THE PROJECT AS A WHOLE. THE UNDERSIGNED DISCLAIMS ANY RESPONSIBILITY FOR WORK DONE UNDER SUBSEQUENT REVISIONS AND NOT OTHER DOCUMENTS ASSOCIATED WITH THE PROJECT WHICH DO NOT BEAR HIS/HER SEAL, SIGNATURE OR INITIALS.

SCALE	NTS
UNIT NO.	3
DWG. SIZE	24x44
SUB CLASS	00045

PANEL WIRING DIAGRAM
PROTECTIVE RELAY BOARD
3C07
UNIT 3

SUPERSEDES LB-FP71-34E-00094002I 001 REV. 24 DATE 11/18/13

DRAWING RECORD

REV.	DATE	PROJECT NO.	DRAFTING DRFTR	CHK'D	SUPV	ENGR	DESCRIPTION
025	03/19/09	20162	JEO	MDP			REMOVE EH3
026	3/22/06	OP379	LKS				DRAW AS AS-BUILT AT AS-IS
027	11/10/11		BSD		KAJ		ELSEWHERE
028	02/01/19	JR168662	LTM	JK	LLK	GAB	AS-BUILT CHANGES TO TERMINATIONS

SITE: LABADIE ENERGY CENTER
Ameren MISSOURI
DRAWING NO. LB-8500-X-093094R-001
REVISION NO. 028

2 1 SCANNED HYBRID DRAWING

Questions concerning the transmittal of files shall be directed to:
Drafting and Document Control Supervisor

Ameren Missouri
11149 Lindbergh Business CT.
St. Louis, MO 63123
@Elec Design - EC Design

Attachments

A - Border Size Chart
B - Lettering Convention for Wire/Cable
C - Ameren Missouri Documents and Drawing Abbreviations
D - Drawing Level Scheme (mechanical/structural)
E - Instructions of Operating Diagram Issuance
F - Design Drawing Standard Examples
G - 480V Motor Operated Valve
H - 480V MOV-DCS (000001-001)
I - 480V MOV-DCS (000002-001)
J - 480V Motor-MCC
K - Medium Voltage Motor (000004-001)
L - Medium Voltage Motor (000004-002)
M - Medium Voltage Switchgear
N - LB-8500-O-103676-066
O - Typical 480V MOV Logic
P - Typical 480 SWGR Motor Logic
Q - Typical Medium Voltage Motor Logic

ATTACHMENT A: Border Size Chart

Border	(ANSI)	Drawing Size
A*	(A)	8½ x 11
G	(B)	11 x 17
J		23¼ x 11½
Z	(C)	17 x 22
O		11½ x 36
P		11½ x 44
X	(E)	44 x 34
Y	(D)	36 x 24
W*	(Custom)	Up to 36 x 144

***No longer used and is for historic purposes only**

ATTACHMENT B: Lettering Convention for Wire/Cable

WH = White

BK = Black

BR = Brown

RD = Red

GN = Green

BL = Blue

VI = Violet

OR = Orange

GR = Gray

YL = Yellow

RD/BK = Red – Black

GN/BK = Green – Black

BL/BK = Blue – Black

BL/RD = Blue – Red

BL/GN = Blue – Green

OR/GN = Orange – Green

RD/YL = Red – Yellow

RD/BR = Red – Brown

YL/BK = Yellow – Black

YL/BL = Yellow – Blue

BR/YL = Brown – Yellow

BR/GN = Brown – Green

GN/YL = Green – Yellow

VI/YL = Violet – Yellow

BL/BR = Blue – Brown

ATTACHMENT C: Ameren MISSOURI DOCUMENTS AND DRAWING ABBREVIATIONS

Technical Documents and Drawings Site Abbreviations			
<site>	**Site**	**<site>**	**Site**
AD	Audrain	MO	Moreau
AT	Atchison	MR	Meramec
ATS	Atchison Substation	MS	Montgomery
BJ	Barnes Jewish	MX	Mexico
FG	Fairgrounds	MY	Maryland Heights
GC	Goose Creek	OF	O'Fallon
GR	Green City	OLS	Outlaw Substation
HP	High Prairie	OS	Osage
HPN	High Prairie North	PC	Peno Creek
HPS	High Prairie South	PV	Pinckneyville
KK	Keokuk	RC	Raccoon Creek
KM	Kinmundy	RI	Rush Island
KV	Kirksville	RW	Richwoods
LB	Labadie	SX	Sioux
LC	Lambert	TS	Taum Sauk
MB	Moberly	UT	Utica
MC	Meramec CTG	VN	Venice

Technical Documents	
Types	**Description**
AMAN – Ameren Manual (Change Controlled)	• CDM – Component Design Manual • DBM – Design Basis Manual • DFT – Drafting Manual • OMM – Operations and Maintenance Manual
CALC – Calculation Calculation Type (Change Controlled)	• Civil/Structural • Electrical • Mechanical
FPD – Foreign Print Drawing (Change Controlled)	• N/A
FPM - Foreign Print Manual (Change Controlled)	• N/A
SFTW – Software **Software Type** (Change Controlled)	• DCS • PLC • Wonderware
SPEC – Specification **Specification Type** (Change Controlled)	• Construction • Equipment • Functional Requirement • Material • Software • System / Subsystem
STND – Standard **Specification Type** (Change Controlled)	• Architechral (ARCH) • Drafting (DRFT) • Electrical (ELEC) • Instrument (INST) • Mechanical (MECH)

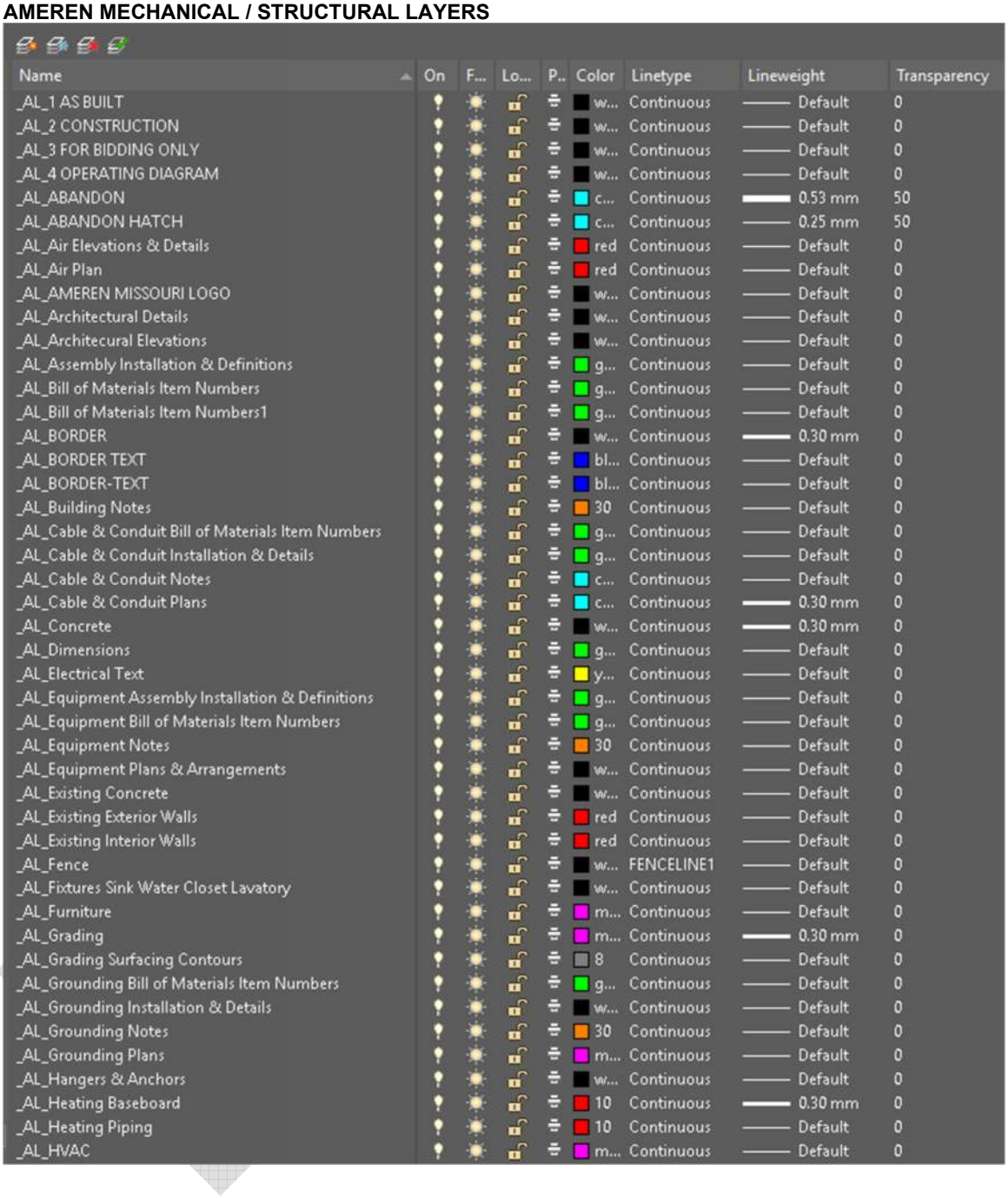
Drawings	
Class: <drawing class>	**Types**
BLDG – Building Drawing Building Type (Change Controlled)	• Architectural Plans • Building Services • Concrete, Brick, Stone & Reinforcing • General • Piling, Foundations, Excavation • Roofing, Flashing • Stairs, Walkways, Floors, Partitions, Elevators, Grating • Steel Framing & Details, Column Schedules • Stress, Clearance Loading Diagrams
CNDT – Conduit; Tray; Cable Drawing Conduit; Tray; Cable Type (Change Controlled)	• Boxes • General • Hangers • Installation, Details & B/M • Plans • Schedules
DUCT – Ducts Drawing Ducts Type (Change Controlled)	• General • Installation, Details • Plans

Drawings	
Class: <drawing class>	**Types**
ELEC – Schematic Wiring Drawing Schematic Wiring Type (Change Controlled)	• General • One Line & Meter-Relay Diagrams • Panel Wiring Diagrams • S.D. – 11 KV and above • S.D. – 2.3 KV. To 11 KV • S.D. – Below 2.3 KV • Schematic & Logic Diagrams • W.D. – 11 KV. And above • W.D. – 2.3 KV. To 11 KV • W.D. – Below 2.3 KV • Wiring & Interconnection Diagrams
EQPT – Equipment Drawing Equipment Type (Change Controlled)	• Brush Specifications • General • Installation, Details, Assembly & B/M • Plans and Arrangements
GRND – Grounding Drawing Grounding Type (Change Controlled)	• General • Installation, Details & B/M • Plans
LINE – Line Construction Drawing Line Construction Type (Change Controlled)	• Configuration Diagrams • Data Sheets • Foundations Concrete • Foundations Steel Frame • Foundations Steel Tripods • General • Grounding • Guying and Staking • Insulator & Hardware Details • Maps • Phasing Diagrams • Plan & Profiles • Steel Poles • Stress Diagrams • Tower Lighting & Painting • Towers Steel Framing & Details
PANL – Panel Drawing Panel Type (Change Controlled)	• General • Installation, Details & B/M • Layout – Front or Rear View • Nameplate Bill of Material
PIPE – Piping Drawing Piping Type (Change Controlled)	• Control • Flow Diagrams, Isometrics, Composites, P&ID • General • Hangers, Anchors • Installation – Details – Air • Installation – Details – Misc. • Installation – Details – Oil • Installation – Details – Steam • Installation – Details – Water • Plans

Drawings	
Class: <drawing class>	**Types**
PROP – Property - Site Drawing Property – Site Type (Change Controlled)	• Engineering Records, Engineering Data, Organization Charts, Forms and General Drawings • Plats, Sewers, Yard Plans, Grading Levees, Roadways, Surveys, Fences
STRU – Structure Drawing Structure Type (Change Controlled)	• Assembly & Details • Concrete, Reinforcing, Inserts • General • Lighting, Yard Lighting & Piping • Piling, Excavation • Plans • Steel Framing & Details

ATTACHMENT D: Drawing LAYER SCHEME

AMEREN MECHANICAL / STRUCTURAL LAYERS



Name	On	F...	Lo...	P..	Color	Linetype	Lineweight	Transparency
_AL_1 AS BUILT					w...	Continuous	Default	0
_AL_2 CONSTRUCTION					w...	Continuous	Default	0
_AL_3 FOR BIDDING ONLY					w...	Continuous	Default	0
_AL_4 OPERATING DIAGRAM					w...	Continuous	Default	0
_AL_ABANDON					c...	Continuous	0.53 mm	50
_AL_ABANDON HATCH					c...	Continuous	0.25 mm	50
_AL_Air Elevations & Details					red	Continuous	Default	0
_AL_Air Plan					red	Continuous	Default	0
_AL_AMEREN MISSOURI LOGO					w...	Continuous	Default	0
_AL_Architectural Details					w...	Continuous	Default	0
_AL_Architecural Elevations					w...	Continuous	Default	0
_AL_Assembly Installation & Definitions					g...	Continuous	Default	0
_AL_Bill of Materials Item Numbers					g...	Continuous	Default	0
_AL_Bill of Materials Item Numbers1					g...	Continuous	Default	0
_AL_BORDER					w...	Continuous	0.30 mm	0
_AL_BORDER TEXT					bl...	Continuous	Default	0
_AL_BORDER-TEXT					bl...	Continuous	Default	0
_AL_Building Notes					30	Continuous	Default	0
_AL_Cable & Conduit Bill of Materials Item Numbers					g...	Continuous	Default	0
_AL_Cable & Conduit Installation & Details					g...	Continuous	Default	0
_AL_Cable & Conduit Notes					c...	Continuous	Default	0
_AL_Cable & Conduit Plans					c...	Continuous	0.30 mm	0
_AL_Concrete					w...	Continuous	0.30 mm	0
_AL_Dimensions					g...	Continuous	Default	0
_AL_Electrical Text					y...	Continuous	Default	0
_AL_Equipment Assembly Installation & Definitions					g...	Continuous	Default	0
_AL_Equipment Bill of Materials Item Numbers					g...	Continuous	Default	0
_AL_Equipment Notes					30	Continuous	Default	0
_AL_Equipment Plans & Arrangements					w...	Continuous	Default	0
_AL_Existing Concrete					w...	Continuous	Default	0
_AL_Existing Exterior Walls					red	Continuous	Default	0
_AL_Existing Interior Walls					red	Continuous	Default	0
_AL_Fence					w...	FENCELINE1	Default	0
_AL_Fixtures Sink Water Closet Lavatory					w...	Continuous	Default	0
_AL_Furniture					m...	Continuous	Default	0
_AL_Grading					m...	Continuous	0.30 mm	0
_AL_Grading Surfacing Contours					8	Continuous	Default	0
_AL_Grounding Bill of Materials Item Numbers					g...	Continuous	Default	0
_AL_Grounding Installation & Details					w...	Continuous	Default	0
_AL_Grounding Notes					30	Continuous	Default	0
_AL_Grounding Plans					m...	Continuous	Default	0
_AL_Hangers & Anchors					w...	Continuous	Default	0
_AL_Heating Baseboard					10	Continuous	0.30 mm	0
_AL_Heating Piping					10	Continuous	Default	0
_AL_HVAC					m...	Continuous	Default	0

AMEREN MECHANICAL / STRUCTURAL LAYERS (CONTINUED)

_AL_Installation & Details				w...	Continuous	Default	0
_AL_Lighting				w...	Continuous	Default	0
_AL_Miscellaneous Elevations & Details				g...	Continuous	Default	0
_AL_Miscellaneous Plans				g...	Continuous	Default	0
_AL_Motors				g...	Continuous	Default	0
_AL_New Concrete				w...	Continuous	0.30 mm	0
_AL_New Exterior Walls				w...	Continuous	0.30 mm	0
_AL_New Interior Walls				w...	Continuous	0.30 mm	0
_AL_NOLOL				w...	Continuous	Default	0
_AL_Oil Elevations & Details				m...	Continuous	Default	0
_AL_Oil Plan				m...	Continuous	Default	0
_AL_Panel Installation-Details-BOM				m...	Continuous	Default	0
_AL_Panel Layout Front or Rear View				g...	Continuous	Default	0
_AL_Panel Nameplate Bill of Material				c...	Continuous	Default	0
_AL_Panel Notes				30	Continuous	Default	0
_AL_Parking and or Easement				red	Continuous	Default	0
_AL_PARTIALLY SUPERSEDED STAMP				w...	Continuous	Default	0
_AL_Patterning				c...	Continuous	Default	0
_AL_Piling & Excavation				w...	Continuous	0.30 mm	0
_AL_Pipe Dimensions				g...	Continuous	Default	0
_AL_Pipe Notes				30	Continuous	Default	0
_AL_Piping & Instrument Diagram				g...	Continuous	Default	0
_AL_Plans & Arrangements				w...	Continuous	Default	0
_AL_Plats				c...	Continuous	0.30 mm	0
_AL_Plumbing Hot & Cold				10	Continuous	0.30 mm	0
_AL_Plumbing Waste & Vent				10	Continuous	0.30 mm	0
_AL_Power & Receptacles				c...	Continuous	Default	0
_AL_Property Dimensions				g...	Continuous	Default	0
_AL_Property Lines-Street Survey				red	BORDER	Default	0
_AL_Property Notes				30	Continuous	Default	0
_AL_RASTER				w...	Continuous	Default	0
_AL_Reinforcing				m...	DASHED2	0.30 mm	0
_AL_REMOVAL				c...	Continuous	0.53 mm	75
_AL_REMOVAL HATCH				c...	Continuous	0.25 mm	75
_AL_REVISION CLOUD				c...	Continuous	0.53 mm	75
_AL_Roadways				w...	DASHED	Default	0
_AL_Sewers				30	Continuous	Default	0
_AL_Steam Elevations & Details				g...	Continuous	Default	0
_AL_Steam Plan				g...	Continuous	Default	0
_AL_Steel Column Lines				m...	DASHDOT	Default	0
_AL_Steel Framing				w...	Continuous	0.30 mm	0
_AL_Structural Dimensions				g...	Continuous	Default	0
_AL_Structural Location Plan				c...	Continuous	Default	0
_AL_Structural Notes				30	Continuous	Default	0
_AL_Structural Patterning				m...	Continuous	Default	0
_AL_SUPERSEDES STAMP				w...	Continuous	Default	0
_AL_TITLE BLOCK TEXT				g...	Continuous	Default	0
_AL_VIEWPORT				9	Continuous	Default	0
_AL_Water Elevations & Details				c...	Continuous	Default	0
_AL_Water Plan				c...	Continuous	Default	0
_AL_Yard Lighting				w...	Continuous	0.30 mm	0
0				w...	Continuous	Default	0
Defpoints				w...	Continuous	Default	0

AMEREN P&ID LAYERS

Name	O..	Fr...	L.	Plot	Color	Linetype	Lineweight	Transparency
_AL_1 AS BUILT					white	Continuous	Default	0
_AL_2 CONSTRUCTION					white	Continuous	Default	0
_AL_3 FOR BIDDING ONLY					white	Continuous	Default	0
_AL_4 OPERATING DIAGRAM					white	Continuous	Default	0
_AL_ABANDON					cyan	Continuous	0.53 mm	50
_AL_ABANDON HATCH					cyan	Continuous	0.25 mm	50
_AL_Air Elevations & Details					red	Continuous	Default	0
_AL_Air Plan					red	Continuous	Default	0
_AL_AMEREN MISSOURI LOGO					white	Continuous	Default	0
_AL_BORDER					white	Continuous	0.30 mm	0
_AL_BORDER TEXT					blue	Continuous	Default	0
_AL_Electrical Text					yellow	Continuous	Default	0
_AL_Hangers & Anchors					white	Continuous	Default	0
_AL_Miscellaneous Elevations & Details					green	Continuous	Default	0
_AL_Miscellaneous Plans					green	Continuous	Default	0
_AL_NOLOL					white	Continuous	Default	0
_AL_Oil Elevations & Details					magenta	Continuous	Default	0
_AL_Oil Plan					magenta	Continuous	Default	0
_AL_PARTIALLY SUPERSEDED STAMP					white	Continuous	Default	0
_AL_Pipe Dimensions					green	Continuous	Default	0
_AL_Pipe Notes					30	Continuous	Default	0
_AL_Piping & Instrument Diagram					green	Continuous	Default	0
_AL_RASTER					white	Continuous	Default	0
_AL_REMOVAL					cyan	Continuous	0.53 mm	75
_AL_REMOVAL HATCH					cyan	Continuous	0.25 mm	75
_AL_REVISION CLOUD					cyan	Continuous	0.53 mm	75
_AL_Steam Elevations & Details					green	Continuous	Default	0
_AL_Steam Plan					green	Continuous	Default	0
_AL_SUPERSEDES STAMP					white	Continuous	Default	0
_AL_TITLE BLOCK TEXT					green	Continuous	Default	0
_AL_VIEWPORT					9	Continuous	Default	0
_AL_Water Elevations & Details					cyan	Continuous	Default	0
_AL_Water Plan					cyan	Continuous	Default	0
0					white	Continuous	Default	0
Defpoints					white	Continuous	Default	0

AMEREN ELECTRICAL LAYERS

Name	On	F...	Lo...	P..	Color	Linetype	Lineweight	Transparency
_AL_1 AS BUILT					w...	Continuous	Default	0
_AL_2 CONSTRUCTION					w...	Continuous	Default	0
_AL_3 FOR BIDDING ONLY					w...	Continuous	Default	0
_AL_4 OPERATING DIAGRAM					w...	Continuous	Default	0
_AL_ABANDON					c...	Continuous	0.53 mm	50
_AL_ABANDON HATCH					c...	Continuous	0.25 mm	50
_AL_AMEREN MISSOURI LOGO					w...	Continuous	Default	0
_AL_BORDER					w...	Continuous	0.30 mm	0
_AL_BORDER TEXT					bl...	Continuous	Default	0
_AL_Cable & Conduit Bill of Materials Item Numbers					g...	Continuous	Default	0
_AL_Cable & Conduit Installation & Details					g...	Continuous	Default	0
_AL_Cable & Conduit Notes					c...	Continuous	Default	0
_AL_Cable & Conduit Plans					c...	Continuous	0.30 mm	0
_AL_Electrical Bus					g...	Continuous	0.53 mm	0
_AL_Electrical Device					g...	Continuous	Default	0
_AL_Electrical Schematic & Wiring					g...	Continuous	Default	0
_AL_Electrical Text					y...	Continuous	Default	0
_AL_Equipment Assembly Installation & Definitions					g...	Continuous	Default	0
_AL_Equipment Bill of Materials Item Numbers					g...	Continuous	Default	0
_AL_Equipment Notes					30	Continuous	Default	0
_AL_Equipment Plans & Arrangements					w...	Continuous	Default	0
_AL_Grounding Bill of Materials Item Numbers					g...	Continuous	Default	0
_AL_Grounding Installation & Details					w...	Continuous	Default	0
_AL_Grounding Notes					30	Continuous	Default	0
_AL_Grounding Plans					m...	Continuous	Default	0
_AL_NOLOL					w...	Continuous	Default	0
_AL_Panel Installation-Details-BOM					m...	Continuous	Default	0
_AL_Panel Layout Front or Rear View					g...	Continuous	Default	0
_AL_Panel Nameplate Bill of Material					c...	Continuous	Default	0
_AL_Panel Notes					30	Continuous	Default	0
_AL_PARTIALLY SUPERSEDED STAMP					w...	Continuous	Default	0
_AL_RASTER					w...	Continuous	Default	0
_AL_REMOVAL					c...	Continuous	0.53 mm	75
_AL_REMOVAL HATCH					c...	Continuous	0.25 mm	75
_AL_REVISION CLOUD					c...	Continuous	0.53 mm	75
_AL_SUPERSEDES STAMP					w...	Continuous	Default	0
_AL_TITLE BLOCK TEXT					g...	Continuous	Default	0
_AL_VIEWPORT					9	Continuous	Default	0
0					w...	Continuous	Default	0
Defpoints					w...	Continuous	Default	0

ATTACHMENT E: Instructions for Operating Diagram Issuance

OPERATING DIAGRAMS (Ameren Drawings and Vendor/Foreign Prints):

After field installation and drawings are corrected to an “As-Built” condition, the following classifications of drawings are designated as “Operating Diagrams”:

One Line & Meter-Relay Diagrams
S.D.-11Kv and above
S.D.-2.3Kv to 11Kv
S.D.-Below 2.3Kv
Schematic and Logic Diagrams
Piping and Instrument Diagrams

Activate layer **_AL_4 Operating Diagram** to turn on.

The drawings are identified with this “Operating Diagrams Sticker”

ATTACHMENT F: Drawing standard layouts

Number	Sheet	Title
AUE-STND-ARCH-000001	001	Standard Ameren Energy Centers Steel Handrails 001
AUE-STND-ARCH-000002	001	STANDARD AMEREN ENERGY CENTERS STEEL LADDER ARRANGEMENTS
AUE-STND-ARCH-000003	001	ENGINEERING RECORDS-CLOSURE PLATE DETAIL ENERGY CENTERS
AUE-STND-ELEC-000003	001	Control System- DCS
AUE-STND-ELEC-000006	001	Flow Elements
AUE-STND-ELEC-000008	001	Level Elements
AUE-STND-ELEC-000010	001	Pressure Elements
AUE-STND-ELEC-000013	001	Temperature Elements
AUE-STND-ELEC-000017	001	Alarm Management Philosophy
AUE-STND-ELEC-000018	001	Control System Network Segmentation Standards
AUE-STND-ELEC-000019	001	ELECTRICAL DRAWING STANDARD - 480V MOTOR OPERATED VALVE SH. 1
AUE-STND-ELEC-000020	001	ELECTRICAL DRAWING STANDARD - 480V MOTOR OPERATED VALVE SH. 2
AUE-STND-ELEC-000021	001	ELECTRICAL DRAWING STANDARD - 480V MOTOR OPERATED VALVE - DCS SH. 1
AUE-STND-ELEC-000022	001	ELECTRICAL DRAWING STANDARD - 480V MOTOR OPERATED VALVE - DCS SH. 2
AUE-STND-ELEC-000023	001	ELECTRICAL DRAWING STANDARD - 480V MOTOR MCC
AUE-STND-ELEC-000024	001	ELECTRICAL DRAWING STANDARD - MEDIUM VOLTAGE MOTOR SH. 1
AUE-STND-ELEC-000025	001	ELECTRICAL DRAWING STANDARD - MEDIUM VOLTAGE MOTOR SH. 2
AUE-STND-ELEC-000026	001	ELECTRICAL DRAWING STANDARD - MEDIUM VOLTAGE SWITCHGEAR
AUE-STND-ELEC-000027	001	ELECTRICAL DRAWING STANDARD - HISTORIC SYMBOL STANDARDS
AUE-STND-MECH-000001	001	INSTRUMENT INSTALLATION DETAIL NEW AIR USER
AUE-STND-MECH-000001	002	INSTRUMENT INSTALLATION DETAIL TYPICAL AIR SUPPLY INSTALLATION
AUE-STND-MECH-000001	003	INSTRUMENT INSTALLATION DETAIL TYPICAL PIPE STAND CONSTRUCTION
AUE-STND-MECH-000001	004	INSTRUMENT INSTALLATION DETAIL LIQUID FLOW ORIFICE TRANSMITTER BELOW CONNECTIONS
AUE-STND-MECH-000001	005	INSTRUMENT INSTALLATION DETAIL LIQUID FLOW ORIFICE WITH DIAPHRAGM SEALS
AUE-STND-MECH-000001	006	INSTRUMENT INSTALLATION DETAIL LIQUID FLOW NOZZLE TRANSMITTER BELOW CONNECTIONS
AUE-STND-MECH-000001	007	INSTRUMENT INSTALLATION DETAIL FULL-BODY MAG FLOW WITH REMOTE ELECCTRONICS
AUE-STND-MECH-000001	008	INSTRUMENT INSTALLATION DETAIL VORTEX FLOW METER
AUE-STND-MECH-000001	009	INSTRUMENT INSTALLATION DETAIL AIR-GAS FLOW PITOT TRANSMITTER ABOVE CONNECTIONS

AUE-STND-MECH-000001	010	INSTRUMENT INSTALLATION DETAIL LIQUID LEVEL-GAUGE PRESSURE TRANSMITTER BELOW CONNECTION
AUE-STND-MECH-000001	011	INSTRUMENT INSTALLATION DETAIL LIQUID LEVEL DIFFERENTIAL PRESSURE WITH DIAPHRAGM SEALS
AUE-STND-MECH-000001	012	INSTRUMENT INSTALLATION DETAIL ULTRASONIC LEVEL TRANSMITTER
AUE-STND-MECH-000001	013	INSTRUMENT INSTALLATION DETAIL AIR-GAS STATIC PRESSURE TRANSMITTER ABOVE CONNECTION
AUE-STND-MECH-000001	014	INSTRUMENT INSTALLATION DETAIL STATIC PRESSURE WITH DIAPHRAGM SEAL
AUE-STND-MECH-000001	015	INSTRUMENT INSTALLATION DETAIL EXHAUST GAS STATIC PRESSURE TRANSMITTER BELOW CONNECTION
AUE-STND-MECH-000001	016	INSTRUMENT INSTALLATION DETAIL STEAM-LIQUID STATIC PRESSURE TRANSMITTER BELOW CONNECTION
AUE-STND-MECH-000001	017	INSTRUMENT INSTALLATION DETAIL PRESSURE GAUGE LOCAL
AUE-STND-MECH-000001	018	INSTRUMENT INSTALLATION DETAIL PRESSURE GAUGE LOCAL WITH DAMPENER
AUE-STND-MECH-000001	019	INSTRUMENT INSTALLATION DETAIL PRESSURE GAUGE LOCAL WITH DIAPHRAGM SEAL
AUE-STND-MECH-000001	020	INSTRUMENT INSTALLATION DETAIL STEAM-LIQUID DIFFERENTIAL PRESSURE TRANSMITTER BELOW CONNECTIONS
AUE-STND-MECH-000001	021	INSTRUMENT INSTALLATION DETAIL LIQUID DIFFERENTIAL PRESSURE TRANSMITTER ABOVE CONNECTIONS
AUE-STND-MECH-000001	022	INSTRUMENT INSTALLATION DETAIL AIR-GAS DIFFERENTIAL PRESSURE TRANSMITTER ABOVE CONNECTIONS
AUE-STND-MECH-000001	023	INSTRUMENT INSTALLATION DETAIL DIFFERENTIAL PRESSURE WITH DIAPHRAGM SEALS
AUE-STND-MECH-000001	024	INSTRUMENT INSTALLATION DETAIL THERMOCOUPLE AND TEST WELL ASSEMBLY-NPT
AUE-STND-MECH-000001	025	INSTRUMENT INSTALLATION DETAIL THERMOCOUPLE AND TEST WELL ASSEMBLY-FLANGED
AUE-STND-MECH-000001	026	INSTRUMENT INSTALLATION DETAIL TEMPERATURE INDICATOR NPT
AUE-STND-MECH-000001	027	INSTRUMENT INSTALLATION DETAIL TEMPERATURE INDICATOR FLANGED
AUE-STND-MECH-000001	028	INSTRUMENT INSTALLATION DETAIL THERMOCOUPLE DUCT PROTECTION TUBE
AUE-STND-MECH-000001	029	INSTRUMENT INSTALLATION DETAIL AIR PURGE
AUE-STND-MECH-000001	030	INSTRUMENT INSTALLATION DETAIL WATER PURGE
AUE-STND-MECH-000001	031	INSTRUMENT INSTALLATION DETAIL WATER FLUSH
AUE-STND-MECH-000001	032	INSTRUMENT INSTALLATION DETAIL BOILER DRAFT PRESSURE WITH AIR PURGE AND BLOWBACK
AUE-STND-MECH-000001	033	INSTRUMENT INSTALLATION DETAIL BOILER DRAFT PRESSURE WITH AIR PURGE AND BLOWBACK

ATTACHMENT G: ELECTRICAL, INSTRUMENTATION, & CONTROLS NOMENCLATURE GUIDE

Introduction/General

1. This document contains the general electrical/I&C equipment nomenclature requirements for Labadie and Rush Island Energy Centers.
2. Both Rush Island and Labadie plants were constructed using the Bechtel Company nomenclature style. Nomenclature for most equipment was consistent between the two sites with the exception of some equipment. The intent is to continue with most aspects of the Bechtel style laid out in the legacy documents but with this guidebook superseding the legacy documents.
3. Ameren Missouri requests that the Contractor follow the requirements set forth in this guidebook for naming and numbering all equipment. Any alternative conventions or changes to this convention (additions, deletions, or revisions) shall be reviewed and approved by Ameren Missouri prior to implementation. For items not called out in this guide the Contractor shall propose naming conventions for Ameren approval.
4. All equipment shall be clearly marked in the field per the requirements of the specification. Nomenclature shall be consistent between equipment and design documents, drawings, manuals, forms, records, test reports, and all other documentation.
5. All equipment names and tags shall be shown on the respective equipment lists and schedules.
6. Per the island design concept, nomenclature shall be done consistently between units and islands so that a common design is achieved between units.
1. Exceptions apply only for areas which fall outside of the common islanding approach
7. Starting sequence numbers shall be verified by the Contractor with Ameren Drafting. The Contractor shall work with Ameren to formally request the sequence numbers from Ameren Drafting.

Definitions & References

1. “Unit” refers to the corresponding generating unit number, and shall correspond to the respective system and other equipment which services that particular unit. Unit may be abbreviated as “U,” for instance Unit 1 may be referred to as “U1.” Equipment designated to serve a particular unit shall have the associated unit in the tag name as follows:
1. Rush Island U1: Equipment tags begin with number “1”
2. Rush Island U2: Equipment tags begin with number “2”
3. Rush U1&U2 Common: Equipment tags begin with the number “0”
4. Labadie U1: Equipment tags begin with number “1”
5. Labadie U2: Equipment tags begin with number “2”
6. Labadie U3: Equipment tags begin with number “3”
7. Labadie U4: Equipment tags begin with number “4”
8. Labadie U1&U2 Common: Equipment tags begin with letter “O”
9. Labadie U3&U4 Common: Equipment tags begin with letter “U”
2. “Sequence” refers to a numerical or alphanumeric sequence number. Sequence numbers shall be staged per the instructions in the nomenclature description sections. Many equipment sequence number ranges are catalogued by equipment type and shall be assigned to the Contractor by Ameren where specified.
3. “Name” refers to the terminology applied to a specific type of equipment. Names may be followed by alphanumeric designations to provide for unique asset naming and may imply singularity or redundancy.
4. “Tag” refers to the unique asset alphanumeric identifier assigned to a specific piece of equipment. All equipment shall have separate tag identifiers in every case.
5. Voltage ranges are defined as follows (AC unless otherwise noted):
1. High voltage power (transmission voltage): 138,000VAC, 345,000VAC
2. Medium voltage power: 13,800VAC, 6900VAC, 4160VAC, 2300VAC
3. Low voltage power: 480VAC, 277VAC, 240VAC, 208VAC, 120VAC
4. Control voltage: 125VDC, 120VAC, 48VDC, 48VAC, 24VDC, 24VAC
5. DC voltage power: 250VDC, 125VDC, 48VDC, 24VDC
6. Voltages shall always be shown in volts (not KV) on all equipment and design documents throughout the project (including DCS tags).
6. “Bus” refers to a collection of circuit breakers, switches, contactors, or other power distribution and control equipment. Bus may be synonymous with switchgear, load center, motor control centers, or panels/panelboards.

7. "Circuit" or "Scheme" refers to the alphanumeric combination tag which makes up the origination of a supply. A circuit may be named after a bus cubicle or compartment where the power supply and power supply control originates and extends to field devices or monitoring/control systems. For circuits without breakers associated the scheme will have the unit number followed by the appropriate letter to designate the proper system followed by up to four numerals and/or letters to designate the specific circuit.
1. All schemes shall be proposed by the vendor and approved by Ameren prior to implementation. The vendor will confirm the schemes match existing and are acceptable to Ameren.
2. Where no Bechtel scheme designation exists, the vendor shall propose new scheme designations for other equipment provided under the vendor's scope of work. This shall be done as a logical separation by major equipment, location, and/or function. Scheme designations shall be approved by Ameren.
8. References:
1. ANSI C37.2 – Standard for Electrical Power System Device Function Numbers, Acronyms, and Contact Designations
2. Bechtel legacy documents, mainly Rush Island drawing #8550-A-67908.
3. Conceptual one-lines (exact nomenclature ordering may change depending upon the electrical system proposed by the contractor).

Power Transformers

Service Auxiliary Transformers (SAT)

1. A power transformer with high voltage nominal primary windings shall be named "Service Auxiliary Transformer." This may be abbreviated as "SAT."
2. Following the name "Service Auxiliary Transformer" a number referencing the unit shall be included.
    1. For example: "Service Auxiliary Transformer 1" for a plant's Unit 1 SAT.
3. The SAT tag shall contain the generating unit number followed by the equipment letter "X" followed by a sequence number:
    1. (Unit#)**X**(Sequence#)
    2. Sequence numbers shall be three digits and begin with 201.
    3. Ameren shall assign the sequence number to be used (see below)
    4. For example: "1X101"
4. Only one SAT shall be provided per generating unit, therefore SAT transformers shall be named as follows:
    1. Rush Island U1 SAT: 1X201, Station Auxiliary Transformer (SAT) 1
    2. Rush Island U2 SAT: 2X201, Station Auxiliary Transformer (SAT) 2
    3. Labadie U1 SAT: 1X201, Station Auxiliary Transformer (SAT) 1
    4. Labadie U2 SAT: 2X201, Station Auxiliary Transformer (SAT) 2
    5. Labadie U3 SAT: 3X201, Station Auxiliary Transformer (SAT) 3
    6. Labadie U4 SAT: 4X201, Station Auxiliary Transformer (SAT) 4

Station Service Transformers (SST)

5. A power transformer with medium voltage primary windings nominal shall be named "Station Service Transformer." This may be abbreviated as "SST."
6. Following the name "Station Service Transformer" a numeric value referencing the unit and letter designation of the switchgear it feeds shall be included.
    1. For example: "Station Service Transformer 1" for a plant's Unit 1 SST.
7. In the event an SST supplies one side of two switchgear line-ups (possibly linked with a tie breaker), following the name "Station Service Transformer" an alphanumeric value referencing the unit and letter designation of the switchgear it feeds shall be included.
    1. For example: "Station Service Transformer 1A" for a plant's Unit 1 SST feeding the "A" designated bus line-up and "Station Service Transformer 1B" for the "B" side line-up.
8. The SST tag shall contain the generating unit number followed by the equipment letter "X" followed by a sequence number:
    1. (Unit#)**X**(Sequence#)
    2. For an SST with a 6900V or 480V secondary, the sequence numbers shall be three digits and begin with 211.
    3. Sequence numbers shall be a numeric and shall increment in order for those units supplying an "A" and a "B" bus.

4. For example: “1X211” for the A bus and “1X212” for the B bus are transformers feeding “A” and “B” buses, respectively.

Lighting Transformers

9. A power transformer which supplies low voltage lighting panels shall be named a “Lighting Transformer.”
10. Preceding the name “Lighting Transformer” a description of the associated area and/or system shall be used. For these projects this term shall be assigned by the contractor based on the logical system or location for which (most) of the feeders service. Following the name “Lighting Transformer” a numeric value referencing the unit shall be included.
    1. For example: “Absorber Lighting Transformer 1” for a plant’s Unit 1 lighting transformer providing lighting primarily to the Absorber area panel(s) or bus(es).
11. In the event a lighting transformer supplies one of two or more panels linked to the same area and/or system, following the name a letter designation corresponding to the panel which it feeds shall be included.
    1. For example: “Absorber Lighting Transformer 1A” for a plant’s Unit 1 Lighting Transformer feeding the “A” designated panel and “Absorber Lighting Transformer 1B” for the “B” panel.
12. The lighting transformer tag shall contain the generating unit number followed by the equipment letter “XL” followed by a sequence number:
    1. (Unit#)**XL**(Sequence#)
    2. Sequence numbers shall be three digits and begin with 201.
    3. Sequence numbers shall be a numeric value based on the criteria stated above. The tag shall associate the transformer with the corresponding panel which it feeds and shall be sequenced to line-up with the naming convention as well.
    4. For example: “1XL201” and “1XL202” correspond to the “1A” and “1B” named lighting transformers, respectively, and also feed the 1L201 (“1A”) and 1L202 (“1B”) corresponding lighting panels.
13. Note that in the event the transformer supplies panels mixed with lighting and other non-lighting loads, the transformer shall default to a “Power Panel Transformer” (see below for naming convention).

Emergency Lighting Transformers

1. A power transformer which supplies low voltage emergency lighting panels shall be named an “Emergency Lighting Transformer.”
2. The same tag criteria as Lighting Transformer shall apply but the equipment letter shall be “XLE.”
    1. (Unit#)**XLE**(Sequence#)

Power Panel Transformers

3. A power transformer which supplies low voltage process or general purpose power panels shall be named a “Power Panel Transformer.”
4. The same tag criteria as Lighting Transformer shall apply but the equipment letter shall be “XP” and sequence numbers shall begin at 251 instead of 201.
    1. (Unit#)**XP**(Sequence#)
    2. Sequence numbers shall be three digits and begin at 251.

Instrument Panel Transformers

5. A power transformer which supplies low voltage process instrument panels shall be named an "Instrument Panel Transformer." Typically this is fed from a UPS or transfer switch.
6. The same tag criteria as Lighting Transformer shall apply but the equipment letter shall be "XY."
    1. (Unit#)**XY**(Sequence#)

External Control Power Transformers

7. An external control power transformer is typically located separate from an MCC bucket or other integral piece of equipment and is typically rated at 5,000VA or less. This device shall be named a "Control Power Transformer."
8. The same tag criteria as Lighting Transformer shall apply but the equipment letter shall be "XC" and instead of a sequence number the supplying circuit number shall be used (numeric portion only).
    1. (Unit#)**XC**(Circuit#)
    2. Note that this does not apply to MCC bucket control power transformers.

AC Buses and Panels

13,800V Medium Voltage Unit Buses

1. A medium voltage bus is a collection of breakers, contactors, switches, and other associated power distribution and control equipment and shall be named "Unit Bus."
2. Preceding the name "Unit Bus" a voltage (in volts, not KV) and brief description of the associated system shall be used. Following the name "Unit Bus" a numeric value referencing the unit and letter designation of the switchgear it feeds shall be included.
        1. For example: "13,800V <system name> Unit Bus 1" for a system bus associated with U1.
3. In the event a unit bus comprises of two or more line-ups (possibly linked with a tie breaker), following the name "Unit Bus" an alphanumeric value referencing the unit and letter designation shall be included.
        1. For example: "13,800V Unit Bus 1A" for a plant's Unit 1"A" designated bus line-up and "13,800KV Unit Bus 1B" for the "B" side line-up.
4. Bus tags shall contain the generating unit number followed by the equipment letter "H" followed by a sequence letter:
        1. For 13,800V buses: (Unit#)**H**(Sequence Letter)
        2. Sequence letters shall be based on the criteria stated above. The letter shall associate with the corresponding transformer from which it receives power, if that transformer also has a letter.
        3. For example: "1HA" and "1HB" are the "A" and "B" buses, respectively.
5. Switchgear compartments/cubicles shall be tagged with the unit bus tag as explained above, followed by a sequence number representing the breaker position number.
        1. (Unit#)**H**(Sequence Letter)(Cubicle#)
        2. Cubicle numbers shall be two digits and begin with 01.
        3. Breaker position numbering shall start with the first compartment (facing the front from left to right) and increase in order down the line.
        4. For example: For the "A" Bus "1HA01" is the first cubicle (from left to right) and "1HA02" is the next cubicle. For the "B" Bus the respective cubicles would be "1HB01" and "1HB02."
        5. This also serves as the circuit or scheme number for that bus position.

6900V Medium Voltage Unit Buses

6. Bus naming shall follow the same criteria as 13,800V Unit Buses but the voltage in the name shall be "6900V."
7. Bus tags shall follow the same criteria as 13,800V Unit Buses but the equipment letter shall be "A" and sequence lettering shall be as described below.
        1. (Unit#)**A**(Sequence Letter)
        2. Sequence letters shall begin with "E."

3. For example: “1AE” and “1AF” are the “E’ and the “F” buses, respectively.

8. Switchgear compartments/cubicles shall follow the same criteria as 13,800V Unit Buses but the equipment letter shall be “A” and sequencing shall be as described below:
   1. (Unit#)**A**(Sequence Letter)(Cubicle#)
   2. Cubicle numbers shall be two digits and begin with 01.
   3. For example 1AE01.

Low Voltage Load Centers/Buses

9. A low voltage load center is a collection of draw-out breakers, contactors, switches, and other associated power distribution and control equipment and shall be named “Bus.”
10. Preceding the name “Bus” the voltage level and a description of the associated area and/or system shall be used. For these projects this term shall be assigned by the contractor based on the logical system or location for which (most) of the feeders service. Following the name “Bus” a numeric value referencing the unit shall be included.
    1. For example: “480V Absorber Bus 1” for an Absorber system load center associated with U1 and operating at 480V.
11. In the event a load center comprises of two or more line-ups (possibly linked with a tie breaker), following the name “Load Center” an alphanumeric value referencing the unit and letter designation shall be included.
    1. For example: “480V Absorber Load Center 1A” for a plant’s Load Center 1“A” designated bus line-up and “480V Absorber Load Center 1B” for the “B” side line-up.
12. Bus tags shall contain the generating unit number followed by the equipment letter “B” followed by a sequence number:
    1. (Unit#)**B**(Sequence#)
    2. Sequence numbers shall be three digits and begin with 211. In the event a group of load centers comprises of two or more line-ups, the sequence numbering will be sequential (starting with the “A” bus).
    3. “A” bus tags shall be odd numbers and “B” buses shall be even numbers. For example: “1B211” and “1B212” are the “A” and “B” buses, respectively.
    4. Load center sequence numbers shall also match the sequence number of the transformer feeding the load center.
    5. The next sequence of load centers shall increment by 10 each time (1B111 and 1B112, then 1B121 and 1B122 and so on).
13. Load center compartments/cubicles shall be named with the load center tag as explained above, followed by a sequence number representing the cubicle position number.
    1. (Unit#)**B**(Load Center Sequence#)(Cubicle#)
    2. Cubicle sequence numbers shall be two digits shall start at 01 for the front facing top left cubicle (typically an instrument/control cubicle) and increase in order from the breaker cubicle closest to the incoming cubicle (typically the main breaker) and increase from there towards the middle to the tie cubicle which shall always be 10. This shall be top to bottom and left to right for “A” side load centers or right to left for “B” side load centers.
    3. For example on a main-tie-main close coupled configuration: For an “A” side bus, “1B21101” is the front facing top left incoming/instrument cubicle and “1B21102” is the next main breaker cubicle below it. For a “B” side bus, “1B21201” is the front facing top right cubicle and “1B21201” is the cubicle below it. “1B21110” is always the tie breaker cubicle.
    4. This also serves as the circuit or scheme number for that Load Center breaker position.

Low Voltage Motor Control Centers (MCC)

14. A low voltage motor control center is a collection of draw-out motor control buckets, contactors, switches, breakers and other associated power distribution and control equipment and shall be named “Motor Control Center.” This may be abbreviated as “MCC.”
15. Preceding the name “MCC” a description of the associated system shall be used along with operating voltage. For these projects this term shall be assigned by the contractor based on the logical system or location for which (most) of the feeders service. Following the name “MCC” an alpha-numeric value referencing the unit and letter designation (staring with “A”) shall be included.

1. For example: “480V Absorber MCC 1A” for an Absorber system load center associated with U1 and operating at 480V. Note that for MCC’s, the “A” letter is always included in the name, even if there is no “B” MCC.

16. In the event an MCC comprises of two or more line-ups servicing the same types of equipment, following the name “MCC” an alphanumeric value referencing the unit and letter designation shall be included.
    1. For example: “480V Absorber MCC 1A” for a plant’s MCC 1“A” designated line-up and “480V Absorber MCC 1B” for the “B” side line-up.
17. MCC tags shall contain the generating unit number followed by the equipment letter “B” followed by a sequence number:
    1. (Unit#)**B**(Sequence#)
    2. Sequence numbers shall be three digits and be in line with the load center feeding the MCC (for instance 480V Bus 1B111 feeds an MCC so the MCC will be 1B213, 1B215, 1B217. 480V Bus 1B212 feeds MCC’s 1B214, 1B216, etc.
    3. “A” side MCC’s shall be odd numbers and “B” side MCC’s shall be even numbers. For example: “1B213” and “1B214” are the “A” and “B” MCC’s, respectively.
    4. MCC sequence numbers shall also match the sequence number of the transformer feeding the MCC (only if there is a transformer directly feeding the MCC).

    MCC compartments/cubicles shall be named with the MCC tag as explained above, followed by a sequence number representing the cubicle position number.
    5. (Unit#)**B**(MCC Sequence#)(Cubicle Sequence#)
    6. Cubicle sequence numbers shall be two digits shall start at 01 for the front facing top left cubicle (typically an instrument/control cubicle) and increase in order from the bucket cubicle closest to the incoming cubicle (typically the main breaker, or first motor feed bucket if the MCC has no main breaker) and increase from there towards the end of the line-up. This shall be from top to bottom in each vertical section, and left to right from vertical section to vertical section.
    7. For example: For MCC 1B213, “1B21301” is the incoming/instrument cubicle and “1B21302” is the next main breaker cubicle below it.
    8. This also serves as the circuit or scheme number for that MCC position.

Lighting Panels

18. A power panel which supplies low voltage lighting circuits shall be named a “Lighting Panel.”
19. Preceding the name “Lighting Panel” a description of the associated area and/or system shall be used along with the operating voltage level. For these projects this term shall be assigned by the contractor based on the logical system or location for which (most) of the feeds service. Following the name “Lighting Panel” a numeric value referencing the unit shall be included.
    1. For example: “120/208V Absorber Lighting Panel 1” for a plant’s Unit 1 lighting panel providing lighting circuits primarily to the Absorber area and operating at 120/208V.
20. In the event a lighting panel comprises one of two or more panels servicing the same area and/or system, following the name a letter designation corresponding to the panel which it feeds shall be included.
    1. For example: “120/208V Absorber Lighting Panel 1A” for a plant’s Unit 1 Lighting Panel “A” and “120/208V Absorber Lighting Panel 1B” for the “B” panel.
21. The lighting panel tag shall contain the generating unit number followed by the equipment letter “L” followed by a sequence number:
    1. (Unit#)**L**(Sequence#)
    2. Sequence numbers shall be three digits and begin with 201.
    3. Sequence numbers shall be a numeric value based on the criteria stated above. The tag shall associate the panel with the corresponding transformer and shall be sequenced to line-up with the naming convention as well.
    4. For example: “1L201” and “1L202” correspond to the “1A” and “1B” named lighting panels, respectively, and also fed from the 1XL201 (“1A”) and1XL 202 (“1B”) corresponding lighting transformers.
22. Note that in the event the panel contains lighting circuits and other non-lighting circuits together, the panel shall default to a “Power Panel” (see below for naming convention).
23. Lighting Panel circuit breakers shall be named with the panel tag as explained above, followed by a sequence number representing the breaker position number.
    1. (Unit#)**L**(Panel Sequence#)(Breaker Sequence#)
    2. Breaker sequence numbers shall be two digits and begin with 01. This shall increment up to the number of circuit breaker positions in the panel (typically 30 or 42).

3. Breaker position sequence numbering shall begin with the first load breaker closest the incoming lugs/main and shall increase in order in typical fashion for power panel schedules. Circuit numbers shall increment from side to side starting left to right and top to bottom (or bottom to top where the incoming lugs/main are at the bottom of the panel).
4. For example: "1L20101" is the first left-side feed from the lugs/main and "1L10102" is the next breaker on the right. "1L20103" is below "1L20101" and "1L20104" is below "1L20102" and so on.
5. If a main breaker is included, the main breaker sequence number shall be "00" (if not already part of the body of circuit breakers 01 thru 30 or 42).
6. In the event a two pole breaker is utilized, the sequence number shall correspond to the top left (or top right) circuit position which is the position of the first pole. The second pole sequence number shall be skipped in the process. Same methodology applies to three pole breakers.
    1. For example, a two pole breaker is installed in circuit positions 1L20101 and "1L20103." The two pole breaker will be named "1L20101" and the "1L20103" position will be skipped in the naming (the next breaker below the two pole breaker will be "1L20105").
7. This also serves as the circuit or scheme number for that panel breaker position.

Emergency Lighting Panels

24. A power panel which supplies low voltage emergency lighting circuits only shall be named an "Emergency Lighting Panel."
25. The same tag criteria as Lighting Panel shall apply but the equipment letter shall be "LE."
    1. (Unit#)**LE**(Sequence#)

Power Panels (General Purpose)

26. A power panel which supplies low voltage process or general purpose circuits shall be named a "Power Panel."
27. The same tag criteria as Lighting Panel shall apply but the equipment letter shall be "P." Starting sequence numbers shall also begin at 251 instead of 201.
    1. (Unit#)**P**(Sequence#)
    2. Sequence numbers shall be three digits and begin at 251.

Instrument Panels

28. A power panel which supplies low voltage process instruments and loads shall be named an "Instrument Panel Transformer." Typically this is fed from a uninterruptible power supply (UPS).
29. The same tag criteria as Lighting Panel shall apply but the equipment letter shall be "Y."
    1. (Unit#)**Y**(Sequence#)

Motors and Local Motor Control

Motors

1. Low and medium voltage motors shall be generally referred to as "Motor." Preceding the name "Motor" a description of the associated service shall be used. For these projects this term shall be assigned by the contractor based on the logical purpose for which the motor is used. Following the name "Motor" a numeric value referencing the unit and letter designation corresponding to the tag of the equipment it services shall be included.
    1. For example: "Recycle Pump Motor 1A" for a motor which drives the Recycle Pump 1A.
2. Motor tags shall contain the generating unit number followed by the equipment letter "M" followed by the bus and breaker position designation from the power supply circuit (essentially mimicking the circuit number):
    1. (Unit#)**M**(Bus#)(Cubicle#)
    2. For example: "1ME02" is the motor fed from bus 1AE, circuit 1AE02.
    3. For example: "1M21102" is the motor fed from MCC 1B211, circuit 1B21102.
3. When a motor is fed from a transfer switch which provides two or more potential power sources the motor tag shall be named for the "normal" or "primary" source. The "emergency" or "secondary" source shall be included in the tag name in parenthesis on drawings and labeled on the motor in the field.

1. For example: “1B21102” is the normal feed for motor “1M21102” and “1B22102” is the emergency feed. The motor tag shall read as “1M21102” but the motor shall be tagged and labeled with both the primary and secondary source “1B22102” called out.

Local Motor Starters

4. A local medium or low voltage motor starter is located in the field and not contained within a bus line-up. This includes stand-alone soft starters, adjustable frequency drives, and combination starters. These local starters shall be named “Motor Starter.”
5. Following the name “Motor Starter” a numeric value referencing the unit and letter designation of the switchgear it feeds shall be included.
    1. For example: “Water Pump Motor Starter 1” for a plant’s Unit 1 water pump.
6. In the event a local starter supplies one of two or more identical purpose/area motors, following the name “Motor Starter” an alphanumeric value referencing the unit and letter designation of the switchgear it feeds shall be included.
    1. For example: “Water Pump Motor Starter 1A” for a plant’s Unit 1 water pump motor starter feeding the “A” designated motor and “Water Pump Motor Starter 1B” for the “B” motor.
7. The starter tag shall contain the generating unit number followed by the equipment letter “MS” followed by a sequence number:
    1. (Unit#)**MS**(Sequence#)
    2. Sequence numbers shall be three digits and begin with 101.
    3. Sequence numbers shall be a numeric or alphanumeric value based on the criteria stated above. The letter shall associate the motor with the corresponding driven equipment.
    4. For example: “1MS101A” and “1MS101B” are starters feeding “A” and “B” motors, respectively.

Local Control Stations

8. A station serving as local control for driven equipment such as a motor, valve, actuator, or other device shall be named a “Control Station.” Control stations may consist of push-buttons, lights, stop lock-out buttons, and/or selector switches used to locally drive near-by equipment. Note that a local control station is not a control panel (no integrated controls located within the device).
9. The same tag criteria as Motors shall apply but the equipment letter shall be “N.”
    1. (Unit#)**N**(Bus#)(Cubicle#)

Emergency Generators

Emergency Diesel Generators

10. Low and medium voltage emergency generators shall be generally referred to as “Emergency Diesel Generator.” Preceding the name “Emergency Diesel Generator” a description of the associated service shall be used. For these projects this term shall be assigned by the contractor based on the logical purpose for which the generator is used. Following the name “Emergency Diesel Generator” the tag shall be included. This may be abbreviated as “EDG.”
    1. For example: “(System Name) Emergency Diesel Generator 1G101” for a generator which services a system and is tagged as 1G101.
11. Generator tags shall contain the generating unit number followed by the equipment letter “G” followed by a sequential number:
    1. (Unit#)**G**(Sequence#)
    2. Sequence numbering shall begin at 101.

DC Systems

DC Systems

12. DC systems are comprised of a DC battery, chargers, panels, and breakers. The battery is the emergency supply to the DC circuits should AC power fail. DC equipment shall follow the same nomenclature requirements as other equipment except for the particular items listed in this section.

13. Unlike the sequential numbering for other equipment, each separate DC system tag shall increment numbering by a factor of 20.
    1. For example, the starting sequence for the first DC system main panel is 101. The next DC system's main panel would start at 121, the next at 141, and so on. The same applies to the battery tag numbers. The purpose of this jump in numbering is to accommodate the additional DC equipment that must be numbered sequentially following the main panels.

Main DC Panels

1. A main DC panel is a panel which contains breakers connecting the battery, charger, and sub-panel or large DC load (such as motors) feeds. This type of panel shall be named a "DC Main Panel."
2. Preceding the name "DC Main Panel" the corresponding DC voltage shall be included. Following the name "DC Main Panel" the panel tag shall be included. See below for tagging instructions.
    1. For example: "125VDC Main Panel 1D101" for the main panel supplying equipment associated with Unit 1 and tagged as 1D101.
3. Ameren Missouri's standard is to have three main DC panels per DC system. :
    1. The main DC panel which ties the battery to the other two main DC panels shall be a numeric tag only. The tag shall contain the generating unit number followed by the equipment letter "D" followed by a sequence number:
        1. (Unit#)**D**(Sequence#)
        2. Sequence numbers shall be three digits and begin with 101. As described above, the next DC system's main panel numbering would begin at 121.
        3. For example: "1D101"
    2. The main DC panels which tie the chargers in and also feed subpanels or larger DC loads shall have the same numeric tag
        1. (Unit#)**D**(Sequence# following the main panel)
        2. Sequence numbers shall be the same as the main DC panel which ties the battery to these panels.
        3. For example: "1D103" for the main panel associated with the "A" side of the system and "1D104" for the main panel associated with the "B" side of the system (both of which are tied to main panel 1D101).
4. Main DC panel circuit breakers shall be named according to the same convention used for other power panel breakers.

DC Sub-Panels

5. A DC sub-panel is a panel which contains breakers serving loads such as protective relaying. The sub-panels are fed from the main panels. This type of panel shall be named a "DC Panel."
6. Preceding the name "DC Panel" the corresponding DC voltage shall be included. Following the name "DC Panel" the panel tag shall be included. See below for tagging instructions.
    1. For example: "125VDC Panel 1D105" for the main panel supplying equipment associated with Unit 1 and tagged as 1D105.
7. The DC sub-panel tag shall contain the generating unit number followed by the equipment letter "D" followed by a sequence number:
    1. (Unit#)**D**(Sequence# following the main panels)
    2. The sequence number will be three digits and immediately follow the main DC panel tag numbers.
    3. For example: "1D105" is a sub-panel fed from main DC panel 1D103
8. DC sub-panel circuit breakers shall be named according to the same convention used for other power panel breakers.

DC Batteries

9. A DC battery which supplies emergency power to low voltage DC circuits shall be named a "Battery."
10. Preceding the name "Battery" the corresponding DC voltage shall be included. Following the name "Battery" the numeric tag shall be included.
    1. For example "125VDC Battery 102" for the battery associated with U1 and tagged as 102.
11. The battery tag shall contain the generating unit number followed by the equipment letter "D" followed by a sequence number:
    1. (Unit#)**D**(Sequence#)

2. Sequence numbers shall be three digits and begin with 102. As described above, the next DC system's battery numbering would begin at 122.

DC Battery Chargers

12. A battery charger which supplies receives an AC supply and converts it to DC to supply low voltage DC circuits shall be named a "Charger."
13. Preceding the name "Charger" the corresponding DC voltage shall be included. Following the name "Charger" the charger tag shall be included.
14. Ameren Missouri's standard DC system design includes two chargers for each battery bank. Therefore, following the name "Charger" an alphanumeric value referencing the unit and letter designation of the switchgear it feeds shall be included. The letter shall be either "A" or "B."
    1. For example: "125VDC Charger 1D112A" for the "A" side battery charger supplying equipment associated with Unit 1 which is tagged as charger 1D112A.
15. The charger tag shall contain the generating unit number followed by the equipment letter "D" followed by a sequence number and letter:
    1. (Unit#)**D**(Sequence#)(Letter A or B)
    2. Sequence numbers shall be three digits and immediately follow the sequence number of the associated battery.
    3. For example: "1D112A" and "1D112B" are chargers feeding "A" and "B" sides of the DC system associated with Battery 1D102 respectively.

Raceway

Conduit

16. All conduits shall be given an alpha-numeric tag on drawings and in the field.
17. Conduit tags shall match the tag of the device or equipment which the conduit runs to. When more than one conduit runs to the same location or tees off, letters shall be added to the end of the tag to differentiate between the different conduits.
    1. For example a conduit running straight from tray to motor 1M35102 shall be named "1M35102." Two conduits running to junction box 1JB101 shall be named "1JB101A" and "1JB101B."
    2. Refer to Bechtel sketches for more examples.
18. Conduits not associated with any single particular equipment or device shall be given a tag starting with the unit number followed by an area letter and then a sequence number.
    1. (Unit#)(Area Letter)(Sequence#)
    2. Area letters are available in the Bechtel reference material.
    3. The contractor shall add area letters as necessary for the new system areas based on a logical separation of locations and/or systems – these proposed area letters shall be approved by Ameren.
    4. Refer to Bechtel sketch for more examples.

Cable Tray

19. Cable tray shall be assigned an alpha-numeric tag that begins with the unit number followed by the voltage system code letter, main section letter, branch section letter, and sequence number.
    1. (Unit#)(VoltageSystemLetter)(MainSectionLetter)(BranchSectionLetter)(Sequence#)
    2. Voltage system code letters:
        1. A for 6900V power
        2. B for 480V/277V power only
        3. C for 120V to 240V power and control
        4. D for low level signals such as instrumentation and communications
        5. H for 13,800V power
    3. Main sections shall be lettered (beginning with "A"). Each new independent main run shall increment by one letter.
    4. Branch sections shall be lettered (beginning with "A") and increment for each tee off a main run.
    5. Sequence numbers shall be three digits and begin with 101. The sequence will increment for the following cases:

1. After the tray tees or branches
2. Change in cable tray size
3. Transition from a vertical to horizontal run (or vice versa).

6. For example a unit 1 main tray run carrying 13,800V power is named "1HAA101." The tray enters a tee which is named "1HAB101" and then the main tray becomes "1HAA102" after the tee. Refer to Bechtel sketch for more examples.
7. On drawings, following the tray number the tray width/size and elevation shall be shown.

Trench

20. A cable trench is a covered raceway which runs underground, with a removable cover at grade level for access to cabling within. Pre-cast trench is commonly referred to as Trenway but it may also be field fabricated, poured concrete, or metal formed.
21. Cable trench shall be assigned a tag beginning with the unit number followed by the letters "TR" and then a sequence number.
    1. (Unit#)**TR**(Sequence#)
    2. Sequence numbers shall be three digits and begin with 101. The sequence will increment upon a tee/split or change in size.
    3. For example: "1TR101" is a trench associated with unit 1 and is sequence 101.

Junction Boxes

22. A junction box or pull box is an enclosure where cables pass through between raceway points and devices. Typically no terminals, splices, or devices are made inside a junction box (see terminal box).
23. Junction boxes shall be named "Junction Box" followed by the alphanumeric tag designation. This name and tag shall appear on drawings and on the enclosure itself in the field
24. Junction boxes shall be assigned a tag beginning with the unit number followed by the letters "JB" and then a sequence number
    1. (Unit#)**JB**(Sequence#)
    2. Sequence numbers shall be three digits and begin with 501.
    3. For example: "1JB501" is a box associated with unit 1 and is sequence 501.
    4. Boxes shall be labeled with the voltage level of the cables in the field.

Terminal Boxes

25. A terminal box is an enclosure where cables enter and land on terminals. Sometimes referred to as marshaling cabinets. Note that a terminal box is not a control panel since it does not contain control devices or equipment.
26. Terminal box names and tags shall be the same as Junction Box except the name shall be "Terminal Box" and the tag designation letters shall be "TB."

Electrical Manholes

27. An electrical manhole is an enclosed underground facility which facilitates the pulling of underground cables, with a removable cover at grade level for access to cabling within.
28. Manhole names and tags shall be the same as Junction Box except the name shall be "Electrical Manhole" and the tag designation letters shall be "MH."

Cables, Bus, and Wiring

Cable

29. All cable shall be named with a unique tag identifier and will be called out on all drawings and labels.
30. Cable labels:

1. All cables shall have the cable number clearly labeled in large (as possible) font on each end of the cable. The label shall be clearly visible after installation and dressing out without having to twist, move, or peer around the cable.
2. Slighter outer-diameter cables may be labeled with tags (or extended labels) should the small size of the cable be prohibitive to providing clear/readable labeling.
3. For Rush Island: All cable labels shall contain both the "to" location and the "from" location information on each end. The "to/from" information shall be the tags of both pieces of equipment the cable terminates in, and shall be a separate label from the cable number. Also on that same label the associated schematic drawing number shall be included. The schematic number may also be included on a third separate label if more room is required.
4. For Labadie: Same methods as above but the cables shall not include the "to/from" location label.

31. The tag identifier shall begin with the circuit or scheme number of the associated devices. The scheme number will be followed by a slash and then a letter designation.
    1. (Circuit/Scheme#)/(Letter Designation)
    2. The "A" cable will be utilized for the power supply unless there is no power circuit. For example, a motor power cable fed from MCC bucket 1B21302 shall be tagged as "1B21302/A." The pushbutton station cable would be "1B21302/B."
    3. A cable not supplied from a breaker (or associated with a breaker cubicle) would fall under the appropriate scheme designation. For example, general duty cables associated with the transformer 1X201 (and not fed from a breaker) shall be named 1X201/A, 1X201/B, and so on.
    1. Note that schemes shall be approved by Ameren as stated previously.
    4. In the event the quantity of cables making up a scheme exceeds twenty-six, then the cable tags will roll over to double letters starting with "AA," "AB," "AC" and so on.
    5. To minimize confusion in similar looking letters the contractor shall not use the letters I, J, O, and Q.
    6. Cable blocks shall be included as shown on the standard schematics.

Bus

1. A bus is an enclosed conductor typically utilized for carrying high currents at medium and low voltages for power distribution between large transformers and switchgear. For these projects it is assumed only non-segregated bus may be utilized.
2. Non-segregated bus shall be named "Non-Segregated Bus" followed by a number corresponding to the unit. Preceding "Non-Segregated Bus" the operating voltage shall be listed.
    1. For example a segment of non-seg between a Unit 1 transformer and Unit 1 switchgear operating at 13,800V shall be named "13,800V Non-Segregated Bus 1."
3. In the event separate runs of non-seg supply "A" or "B" switchgear line-ups, following the name "Non-Segregated Bus" an alphanumeric value referencing the unit and letter designation corresponding to the voltage level and switchgear shall be included.
    1. For example: "13,800V Non-Segregated Bus 1HA" feeding a Unit 1 13,800V "A" designated line-up and "13,800V Non-Segregated Bus 1HB" for bus which supplies the "B" side line-up.
4. Non-segregated bus shall be assigned a tag beginning with the unit number followed by the letters "NSB" and then a sequence number.
    1. (Unit#)**NSB**(Sequence#)
    2. Sequence numbers shall be three digits and begin with 101. The sequence will increment upon a tee/split or change in size.
    3. For example: "1NSB101" is bus with unit 1 and is sequence 101.

Wiring

5. Wiring whether it be single conductor or part of a multi-conductor cable shall be labeled with wire numbers on drawings and in the field where terminations take place.
6. Refer to standard schematics for control wiring numbers.

Terminals

7. Strips of terminals within terminal boxes, control panels, buses, and other equipment shall be named “Terminal Block” followed by the tag numeric designation.
8. Terminal strips shall be tagged as “TB” followed by a sequential number. The sequence number shall be specific only to the box or equipment which the terminal blocks reside.
    1. **TB**(Strip Sequence#)
    2. For example: A terminal box has three terminal block strips, the terminal strips shall be named TB1, TB2, and TB3.
    3. In the field, the label shall be at the top of the block.
    4. Number from top to bottom and left to right. If there are terminal blocks located on a cabinet door, the contractor shall begin with the top of the left-side door, move into the panel, and then continue on with the right-side door.
    5. Tags shall be consistent between drawings and field labeling.
9. Terminals shall be labeled sequentially within the terminal strip from top to bottom or from left to right. Include enough digits to encompass the total number of terminals.
    1. **TB**(Strip Sequence#)-(Terminal Sequence#)
    2. For example: Terminal strip TB1 contains 30 terminals. The terminals shall be designated TB1-01 thru TB1-30.
    3. In addition, for informational purposes, terminal blocks shall also be labeled in the field with corresponding wire numbers.
10. Shorting terminal strips shall be tagged as above but the name shall be “Shorting Terminal Block” and the tag “SCTB” instead of “TB.”

Cathodic Protection

Rectifiers

1. Cathodic protection rectifiers are AC-powered electrical equipment that provide direct current for impressed current cathodic protection systems. Rectifiers shall be named “Rectifier” followed by the tag.
2. Rectifiers shall be assigned an alpha-numeric tag that begins with the letters “CP-R” followed by a sequential #.
    1. **CP-R**(Sequence#)
    2. Sequence numbers shall be three digits and begin at 101.
    3. For example: CP-R101 is Rectifier #101

Anodes

3. An anode is an electrode at which oxidation of its surface or some component of the solution is occurring. Anodes shall be named “Cathodic Protection Anode” followed by the tag.
4. Anodes shall be assigned an alpha-numeric tag that begins with the letters “CP-A” followed by a sequential #and the shunt number
    1. **CP-A**(Sequence#)(Anode Shunt Number, 1 through 10)
    2. Sequence numbers shall be three digits and begin at 101.
    3. For example: CP-A101-2 is anode 101 and the 2nd shunt

Test Station

1. Test Stations shall be assigned an alpha-number tag that begins with “CP-TS” followed by a sequential #. Test stations shall be named “Cathodic Protection Test Station” followed by the tag.
    1. **CP-TS** (Sequence#)
    2. Sequence numbers shall be three digits and begin at 101.
    3. For example: CP-TS 101 is Cathodic Protection Test Station #101

Reference Electrode

1. A reference electrode is a device whose open circuit potential is constant under similar conditions of measurement. Reference electrodes shall be named “Cathodic Protection Reference Electrode” followed by the tag.
2. Reference Electrodes shall be assigned an alpha-numeric tag that begins with the letters “CP-E” followed by a sequential #.
    1. **CP-E**(Sequence#)

2. Sequence numbers shall be three digits and begin at 101.
3. For Example: CP-E101 is Reference Electrode #101

Communication Systems

Plant Party Paging System (Gaitronics)

1. Handsets shall be assigned an alpha-numeric tag that begins with the Unit # followed by the letter "H", device type code, and a sequential #.
    1. (Unit#)**H**(Code)(Sequence#)
    2. Sequence numbers shall be three digits and begin at 201.
    3. Handset Device Type code letters:
        1. A for Indoor Wall or Column Mounting – No Receptacle
        2. B for Indoor Wall or Column Mounting – Receptacle
        3. C for Outdoor Wall or Column Mounting
        4. D - Not Used
        5. E for Explosion Proof Wall or Column Mounting
        6. F for Desktop

2. Speakers shall be assigned an alpha-numeric tag that begins with the Unit # followed by the letter "S" and a sequential #.
    1. (Unit#)**S**(Code Letter)(Sequence#)
    2. Sequence numbers shall be three digits and begin at 201.
    3. Speaker Device Type code letters:
        1. R for Industrial Loud Horn
        2. S for Flush Mounted Ceiling
        3. T for Wall Mounted with Volume Control
        4. U for Explosion Proof

3. Amplifiers shall be assigned an alpha-numeric tag that begins with the Unit # followed by the letter "A", type, and a sequential #.
    1. (Unit#)**A**(Code)(Sequence#)
    2. Sequence numbers shall be three digits and begin at 201.
    3. Amplifier Device Type code letters:
        1. M for Indoor
        2. N for Outdoor
        3. P for Explosion Proof

Jacks (Permanent)

1. Phones Jacks shall be labeled "PHJ" followed by a sequential #.
    1. **PHJ**(Sequence#)
    2. Sequence numbers shall be three digits and begin at 101.

Grounding and Bonding

Grounding System

2. The grounding system is also referred to the ground grid and provides a safe return path to Earth for fault currents and neutral reference point.
3. Bare copper grounding and bonding conductors are not required to be labeled in the field but drawings shall clearly note where conductors are grounded via proper symbols and "GND" for wire numbering. In the event a ground conductor is insulated the wire shall be labeled similar to other wiring as with the label "GND." Other grounding related hardware such as compression connectors, ground rods, and stub-ups are not required to be labeled in the field but shall be clearly called out on drawings as such.

Ground Test Stations

4. Ground Grid Test Stations or Ground Wells shall be assigned an alpha-number tag that begins with “G-TS” followed by a sequential #. The test stations shall be named “Ground Test Station” followed by the tag.
    1. **G-TS** (Sequence#)
    2. Sequence numbers shall be three digits and begin at 101.
    3. For example: G-TS 101 is Ground Test Station #101

Lightning Protection System

5. The purpose of a lightning protection system is to conduct lighting strike current safely to ground to help protect the integrity of site structures.

6. Bare copper down conductors are not required to be labeled in the field but drawings shall clearly note where conductors are grounded via proper symbols and “GND” for wire numbering. In the event a down conductor is insulated the wire shall be labeled similar to other wiring as with the label “GND.” Other lightning protection related hardware such as compression connectors, ground rods, and air terminals are not required to be labeled in the field but shall be clearly called out on drawings as such.

Power Distribution Switches

Manual Power Distribution Disconnect Switch

7. A standard medium or low voltage power disconnect switch shall be named “Disconnect Switch” followed by the tag name. Preceding the name “Disconnect Switch” the operating voltage and function of the switch shall be included.
    1. For example: A disconnect switch feeding the 480V Water Pump Motor 1A shall be named “480V Water Pump Motor 1A Disconnect Switch 1S301.”
8. Transfer switches shall be named as above but instead of “Disconnect Switch” the name shall be “Manual Transfer Switch” or “Automatic Transfer Switch” depending on the transfer switch is manual or automatic.
    1. For example a manual transfer switch feeding 480V Absorber Power Panel 1A shall be named “480V Absorber Power Panel 1A Manual Transfer Switch 1S301.”
9. The switch tag shall contain the generating unit number followed by the equipment letter “S” followed by a sequence number:
    1. (Unit#)**S**(Sequence#)
    2. Sequence numbers shall be three digits and begin with 301.

Lighting and Receptacles

Lighting Fixtures

10. A standard lighting fixture name and tag shall be the same.
11. The tag for a light fixture shall be the supplying circuit number followed by a sequence number for each light fed from the same circuit:
    1. (Circuit#)(Sequence#)
    2. Sequence numbers shall be two digits and begin with -01.
    3. For example, suppose there are six lighting fixture fed from circuit breaker 1L30101, each light shall be tagged 1L30101-01, 1L30101-02, up to 1L30101-06.

480V Welding Receptacles

12. A 480V receptacles which is typically 3-phase and 60A or 100A rated. A 480V receptacle shall be named “480V Welding Receptacle” followed by the tag name. Even though a 480V receptacle may not necessarily be used for welding purposes, the name Welding Receptacle shall still be applied for consistency.
13. The welding receptacle tag shall contain the generating unit number followed by the equipment letter “R” followed by a sequence number:
    1. (Unit#)**R**(Sequence#)
    2. Sequence numbers shall be three digits and begin with 501.

General Purpose low voltage Receptacles

14. A standard 240V or 120V general purpose receptacle name and tag shall be the same.
15. The tag for these receptacle shall be the supplying circuit number followed by a sequence number for each receptacle fed from the same circuit:
    1. (Circuit#)(Sequence#)
    2. Sequence numbers shall be two digits and begin with -01.
    3. For example, suppose there are six 120V receptacles fed from circuit breaker 1P30101, each receptacle shall be tagged 1P30101-01, 1P30101-02, up to 1P30101-06.
    4. Note that duplex or other receptacles with multiple plugs shall be considered a single receptacle for tagging purposes.

Uninterruptable Power Supplies (UPS)

Uninterruptible Power Supply Module (UPS)

16. An uninterruptible power supply is a low voltage module consisting of batteries, switches, and controls meant to serve critical equipment with power in the event of a black-out. These devices shall be named “Uninterruptible Power Supply.” This may be abbreviated as “UPS.”
17. Preceding the name “UPS” a description of the associated system shall be used. For these projects this term shall be assigned by the contractor based on the logical system or location for which (most) of the feeders service. Following the name “UPS” a numeric value referencing the unit and letter designation of the equipment it feeds shall be included.
    1. For example: “Absorber UPS 1” for an Absorber system load center associated with U1.
18. In the event the system comprises of two or more redundant UPS servicing the same types of equipment, following the name “UPS” an alphanumeric value referencing the unit and letter designation shall be included.
    1. For example: “Absorber UPS 1A” for a plant’s UPS 1“A” designated equipment and “Absorber UPS 1B” for the “B” side equipment.
19. UPS tags shall contain the generating unit number followed by the equipment letters “UPS” followed by a sequence number:
    1. (Unit#)**UPS**(Sequence#)
    2. Sequence numbers shall be three digits and begin with 101. In the event a group of UPS’ comprises of two or more redundant pairs, the sequence numbering will be sequential (starting with the “A” UPS).
    3. For example: “1UPS101 and “1UPS102” are the “A” and “B” UPS’, respectively.
    4. UPS sequence numbers shall also match the sequence number of the instrument transformer feeding the UPS (only if there is a transformer directly feeding the UPS).

Control Panels

Control Panels

20. Control panels are stand-alone panels that contain low voltage process controls such as DCS/PLC hard-ware, control wire terminals, relays, instruments, power supplies, fire protection, and other associated devices which control process equipment.
21. Control panels shall be named “Control Panel.” Preceding the name “Control Panel” a description of the associated system or function shall be included. The contractor shall select the term based on the logical system, location, or function of the control panel. Following the name “Control Panel” the tag shall be included.
    1. For example, “Absorber Sump Control Panel 1C2001” would be the name of a control panel containing devices which control the Absorber Sump process and is tagged as 1C2001.
22. Control panel tags shall contain the generating unit number followed by the letter “C” and then followed by a sequence number:
    1. (Unit#)**C**(Sequence#)
    2. Sequence numbers shall be three digits and begin with 2001.
    3. For example: “1C2001.”

Devices and Miscellaneous Electrical Components

Electrical Devices and Components in Panels, Breaker Cubicles, and other Equipment

23. Electrical monitoring and control components are all functional devices located on or within equipment including but not limited to transformers, control panels, unit buses, load centers, UPS, and MCC cubicles. These devices typically consist of breakers, relays, fuses, starters, meters, instruments, test switches, buttons, and other items which facilitate monitoring and control.
    1. Device nomenclature shall be consistent between design documents and field labels. A device table shall be included on applicable drawings.
24. Devices shall be tagged using the ANSI/IEEE C37.2 designation, followed by the circuit number. A dash shall separate the two.
    1. (ANSI Designation)**–**(Circuit)
    2. For example: "27-1AD01" is an under-voltage relay in 6900V cubicle 1AD01. "49-1B11101" is an overload relay and "52-1B11101" is the AC circuit breaker in MCC bucket 1B11101.
    1. Note: In existing Ameren medium voltage switchgear, some devices in breaker cubicles have a "1" preceding the device tag (for example, 152-1AA03).
    3. Elements which have no ANSI designation shall be abbreviated per the Ameren abbreviation table. If no abbreviation exists the Contractor shall propose one to Ameren.
    4. In some cases instrumentation or other devices already have nomenclature assigned by Ameren. Where there is a discrepancy between ANSI and Ameren, the Ameren method shall be used.
    5. In some cases multiple designations may be listed in ANSI C37.2. The contractor shall be consistent with Ameren schematics and diagrams (or propose an alternative to Ameren in the case of an unresolved conflict).
    6. Where an ANSI designation number is not available for certain types of components they shall be abbreviated appropriately. For example the following shall be used:
    1. Power supply designation shall be "PS."
    2. Transducer designation shall be "XDCR."
25. Except for circuit breakers, duplicate component types in the same cubicle or panel shall be give a sequential number after the ANSI device with a "#" sign. Circuit breaker sequencing shall be as already described in previous sections of this document and correspond with the circuit number.
    1. (ANSI Designation)**#**(Sequence#)**-**(Circuit)
    2. For example: 11#1-1AD201 is a primary relay and 11#2-1AD201 is the secondary relay in the same cubicle.
    3. Sequence numbers shall begin at 1. If more than 10 devices are in the cubicle sequence number should begin at 01 (or 001 for more than 100 devices, and so on).
26. The addition of prefixes and suffixes shall be applied to the device tags per the ANSI C37.2 designations.
    1. For devices with an ANSI number, the tag shall be: (ANSI Designation#)(ANSI Device Suffix)(Sequence#)-(Circuit).
    1. For example: 42X-1B350101 is an auxiliary relay for the motor starter in MCC bucket 1B350101. Note that X is the ANSI suffix Ameren has chosen to use for aux relays.
    2. For instruments and other devices without an ANSI designation the prefix or suffix shall be applied to the device tag: (Device#)(ANSI Device Suffix).
    1. For example, the aux relay for level switch 1LS-17000 would be tagged as "1LS-17000X."
27. Test devices or test switches are used mainly in protective relay and trip check circuits for isolation of components during testing. The tag for a test switch component shall be "TD" followed by "#" and sequence number, followed by a dash and circuit.
    1. **TD#(**Sequence#)**-**(Circuit/Scheme)
    2. For example: TD#1-1AD201 for test device #1 in breaker cubicle 1AD201. For example 1D#1-1X101 for SAT #1.
    3. Sequence numbers shall begin at 1. If more than 10 devices are in the cubicle sequence number should begin at 01 (or 001 for more than 100 devices, and so on).

Instruments, Control Valves, and Process Devices

Instrumentation and Process Devices

28. Instrumentation and process devices shall be named based on the function of the device followed by the tag. Preceding the function the contractor shall apply a logical name based on the application or service of the device.
    1. For example 'Slurry Tank #1 Level Transmitter 1LT-17000" is a level transmittal serving the slurry tank #1 which is tagged as 1LT-17000.
29. Instrument and process equipment tags shall contain the generating unit number followed by the device function letter (see Table #1 – Process Device Designations), device type letter, high/low function if applicable, and a sequence number:
    1. (Unit#)(Function Letter)(Device Type Letter)(**H** or **L**)(Sequence#)
    2. Sequence numbers shall be four digits and begin with 17000.
    3. For example: "1LT-17000" is a Unit 1 Level Transmitter #17000.
    4. Note that high/low function part of the tag shall contain an additional letter for high-high or low-low functions (HH or LL).
1. Special Instruments such as Density and pH shall be coded as Special (Unclassified Instruments)

Table #1 – Process Device Designations

FUNCITION OF DEVICE		Primary Element	Transmit	Indicate	Record	Control	Control Station Man/Auto	Switch	Solenoid Valve	Final Control Valve		Relay Or Computation	Integrated Or Totalized	Local Visual Device	Test Point	Well	Special (Not Classified)
										Valve	Other						
Measured Variable	Symbol	( ) E	( ) T	( ) I	( ) R	( ) C	( ) K	( ) S	( ) N	( ) V	( ) Z	( ) Y	( ) Q	( ) Q	( ) P	( ) W	( ) X
Analysis	A	AE	AT	AI	AR	AC	AK	AS	AN	AV	AZ	AY			AP	AY	AX
Burner Flame	B	BE	BT	BI	BR	BC	BK	BS	BN	BV	BZ	BY				BY	
Conductivity	C	CE	CT	CI	CR	CC	CK	CS	CN	CV	CZ	CY			CP	CY	
Differential Pressure	D	DE	DT	DI	DR	DC	DK	DS	DN	DV	DZ	DY			DP	DY	
Voltage	E		ET	EI	ER												
Flow	F	FE	FT	FI	FR	FC	FK	FS	FN	FV	FZ	FY	FQ	FQ	FP	FY	FX
Hand	H					HC		HS	HN	HV	HZ						
Current (Amps)	I		IT	I I	IR												
Power (Watts)	J		JT	JI	JR		JK					JY	JQ	JQ		JY	
Level	L	LE	LT	LI	LR	LC	LK	LS	LN	LV	LZ	LY			LP	LY	LX
Moisture	M	ME	MT	MI	MR	MC	MK	MS	MN	MV	MZ	MY			MP	MY	
Pressure	P		PT	PI	PR	PC	PK	PS	PN	PV	PZ	PY			PP	PY	PX
Speed	S	SE	ST	SI	SR	SC	SK	SS	SN	SV	SZ	SY	SQ	SQ		SY	
Temperature	T	TE	TT	TI	TR	TC	TK	TS	TN	TV	TZ	TY			TP	TY	TX
Vibration	V	VE	VT	VI	VR			VS				VY				VY	
Weight	W	WE	WT	WI	WR		WK	WS	WN	WV	WZ	WY	WQ	WQ		WY	
Special (Unclassified)	X	XE	XT	XI	XR	XC	XK	XS	XN	XV	XZ	XY				XY	
Position	Z	ZE	ZT	ZI	ZR			ZS			ZZ	ZY				ZY	

Heat Trace / Freeze Protection / Heat Management Systems

Heat Trace Panels

30. Heat Trace panels are stand-alone panels that contain 120VAC breakers, low voltage process controls, or any other controls used for heat management.
31. Heat Trace panels shall be named “Heat Trace Panel.” Preceding the name “Heat Trace Panel” the function/location of the panel shall be included.
32. The contractor shall select the term based on the logical system, location, or function of the control panel. Following the name “Heat Trace Panel” the tag shall be included.
    1. For example, “(System Name) Heat Trace Panel 3HTP-101” would be the name of a heat trace panel.
33. Heat Trace panel tags shall contain the generating unit number followed by the letter “HTP” and then followed by a sequence number:
    1. (Unit#)**HTP**(Sequence#)
    2. Sequence numbers shall be three digits and begin with 101.
    3. For example: “1HTP101.”
34. The contractor shall follow the same circuit numbering convention for Power Panels as described above.

Heat Trace Power Indicators

1. Heat Trace Power Indicators are LED devices installed on the heat traced piping showing indication that the heat trace is powered up.
2. Heat Trace Power Indicators shall be tagged with the supplying circuit number.

Communication / Network Equipment

Ethernet Switch

1. Any multi-port Ethernet hub shall be named “Ethernet Switch”
2. For Labadie, the Ethernet Switch tag shall contain the letters “ES” followed by a two digit loop designation and incremental sequence number.
    1. ES-(Loop)(Sequence#)
    2. Loop number shall be unique and begin with 15
    3. Sequence numbers shall be two digits and begin with 01
    4. For example “ES-1501”
3. For Rush Island, the Ethernet Switch tag shall contain the letters “ES” followed be an incremental sequence number followed by the Unit designation followed by the system code.
    1. ES(Sequence#)-(Unit#)-(System)
    2. Sequence number shall be one digit and begin with 1
    3. System code shall be a minimum of three characters and match EMPRV designation.
    4. For example “ES1-U1-ABS”

Fiber Patch Panel

1. Fiber Patch panels shall be named “Fiber Patch Panel”
2. Fiber Patch Panel tags shall contain the letters “FO” followed by an incremental sequence number.
    1. FO-(Sequence#)
    2. Sequence numbers shall be three digit and start with 500
    3. For example “FO-500”

PLC

1. Programmable Logic Controllers shall be referenced to as “PLC”. Preceding the name “PLC” a description of the associated service shall be used. For these projects this term shall be assigned by the vendor based on logical purpose for which the PLC is being used. Following the name “PLC” a numeric value referencing the unit and letter designation corresponding to the equipment it services shall be included.
    1. For example: “Air Compressor PLC 1A” for a PLC which controls the Air Compressor 1A
2. PLC tags shall contain the letters “PLC” followed by an incremental sequence number, followed by the Unit designation followed by the system code.
    1. PLC(Sequence#)-(Unit#)-(System)
    2. Sequence number shall be one digit and begin with 1
    3. System code shall be a minimum of three characters and match EMPRV designation.

4. For example “PLC1-U1-(System)”
5.

Ethernet/Modbus Converter

1. Any Media convertor that converts Modbus to Ethernet TCP/IP shall be referenced as an “Ethernet to Serial Converter”
2. For Labadie, the Ethernet to Serial Converter tag shall contain the letters “CB” followed by a two digit loop designation and incremental sequence number.
    1. CB-(Loop)(Sequence#)
    2. Loop number shall be unique begin with 15
    3. Sequence numbers shall be two digits and begin with 01
    4. For example “CB-1501”
3. For Rush Island, the Ethernet to Serial Converter tag shall contain the letters “CB” followed be an incremental sequence number followed by the Unit designation followed by the system code.
    1. CB(Sequence#)-(Unit#)-(System)
    2. Sequence number shall be one digit and begin with 1
    3. System code shall be a minimum of three characters and match EMPRV designation.
    4. For example “CB1-U1-ABS”

Ethernet/Fiber Converter

4. Any Media convertor that converts Fiber Optics to Ethernet shall be referenced as a “Fiber Convertor”
5. The Fiber Converter tag shall contain the letters “F/C” followed by a two digit loop designation and incremental sequence number.
    1. F/C-(Loop)(Sequence#)
    2. Loop number shall be unique and begin with 15
    3. Sequence numbers shall be two digits and begin with 01
    4. For example “F/C-1501”
6. For Rush Island, the Ethernet to Serial Converter tag shall contain the letters “F/C” followed by the Unit designation followed by the system code.
    1. CB-(Unit#)-(System)
    2. System code shall be a minimum of three characters and match EMPRV designation.
    3. For example “F/C-U1-ABS”

END OF APPENDIX J

APPENDIX L
AMEREN CYBER SECURITY TERMS & CONDITIONS
(Please refer to Ameren CyberSafe web page for instructions)

PART 1: Cyber Security Terms and Condition

Contractors and subcontractors agree to perform all work in compliance with Ameren's standard Cyber Security Terms & Conditions (or a mutually agreed upon negotiated alternative set of Cyber Security Terms & Conditions). Example contract language is provided below:

18. **Cybersecurity**.

(a) General Requirements.

(i) To the extent applicable in the performance of the Services, Engineer will implement and maintain physical, procedural, administrative and electronic security controls, to include identity and access, system logging, data protection, vulnerability management, and application security, to protect the confidentiality, integrity and availability of all Owner Data, interfaces, networks, systems, and software consistent with generally-accepted industry best practices.

(ii) In all instances where Engineer has access to electronic Owner Data or Owner's information technology network, systems or software, Engineer shall limit such access only to authorized Personnel who have a need for such access in order to provide the Services under the applicable SOW.

(iii) In the event that Malware is introduced into any Owner Data or Owner network, system, or software through Engineer's or its Subcontractor's fault, then, in addition to any other rights Owner may have under this Agreement or at Law or equity, Engineer shall, promptly upon Owner's request and at Engineer's expense, provide assistance to Owner to remove, quarantine or remedy the effect of such Malware at Engineer's expense.

(iv) In no event shall Engineer store any Owner Data on a cloud-based service without Owner's prior written consent, which may be withheld in Owner's sole discretion.

(b) Breach Notification.

(i) Engineer shall immediately notify Owner of: (i) (1) any unauthorized possession, unauthorized disclosure, unauthorized modification, or unauthorized use, loss, or any other corruption, compromise, or destruction of any Owner Data, or the networks, systems, or software that access, store, or process such Owner Data resulting from, or related to, Engineer's performance of the Services and (2) any complaint, notice or communication received by Engineer that relates directly or indirectly to Engineer's handling of any Owner Data or Engineer's compliance; (ii) the results and effect of such event; and (iii) the corrective action taken in response thereto. Within 48 hours of notification, Engineer and Owner will each identify an incident manager for communications related to the security incident and agree upon a communications cadence, in a format acceptable to Owner, to be followed until the security incident and the associated action plan are fully resolved. During such period, Engineer's incident manager shall provide regular updates and supporting documentation to ensure that the security incident and action plan are being addressed and implemented.

(ii) Engineer acknowledges that Owner or any Owner Affiliate may be required to notify its customers, regulators, and employees of such security incidents and agrees to assist

and cooperate with Owner, at Engineer's expense, with any investigation, disclosures to affected parties, and other remedial measures, in each case, as reasonably requested by Owner or any Owner Affiliate, or required by any applicable regulations or privacy laws. Owner reserves the right to cancel any existing contract with Engineer for a breach by Engineer or its agents (including Subcontractors) of any of the requirements of this Section 18, or related to an incident as described in this Section 18.

(iii) After the occurrence of any event described in Section 18(b)(i), Engineer agrees that it shall provide notice of such event directly to the affected parties only after Owner's prior review and written consent or to the extent required by applicable privacy laws. If disclosure is required by applicable privacy laws, Engineer shall provide Owner with a copy of any such notice no less than three (3) business days (or such lesser amount of time as is possible under the circumstances) prior to providing it to the affected parties.

(c) Standards. In the event the SOW states a higher standard than that set forth in this Section 18, such higher standard shall prevail over those set forth herein.

PART 2: Cyber or Network Liability Insurance

Contractors and subcontractors shall procure a cyber or network liability insurance policy to cover potential damages incurred to Ameren as defined in our standard Engineering Services Terms and Conditions. Typical coverage includes up to $5M per claim, but the value may increase depending on the scope of work. Example contract language is provided below:

15. Insurance. Without limiting the scope or extent of the protection afforded Owner or the liabilities assumed by Engineer, Engineer and each of its Subcontractors shall obtain and maintain in force for the entire life of this Agreement the following insurance and, with the exception of Workers' Compensation and Professional Liability coverage, name Ameren Corporation and its Affiliates as additional insureds on a primary and non-contributory basis and include a severability of interest provision:
[…]

F. Cyber or Network Liability Insurance with limits of not less than $5,000,000 per claim covering:

a) Any act, error or omission (i) in the rendering or the failure to render technology-based Services, or (ii) that results in the failure of software licensed to Owner by Engineer to perform the function or serve the purpose intended;
b) Breaches of security; including but not limited to coverage for consumer notification, whether or not required by law, computer forensic investigations, public relations and crisis management firm fees, credit file or identity monitoring or remediation services in the performance of Services for Owner;
c) Network security and privacy risk, including but not limited to unauthorized access, failure of security, breach of privacy perils, wrongful disclosure, collection or other negligence in the handling of confidential information, privacy perils, and including coverage for related regulatory defense and penalties;
d) Violation of federal, state or foreign security and/or privacy laws or regulations including investigative and notification costs; and
e) Financial loss resulting from a third party using Owner's computer systems or software associated with a denial of service attack.

END OF APPENDIX L

APPENDIX M
GENERAL REQUIREMENTS FOR HAULING HEAVY EQUIPMENT

1.0 INTRODUCTION

This specification outlines the requirements for moving heavy loads more commonly referred to as “Super Loads” by state transportation agencies. The specification will detail Ameren’s responsibility as well as those of the hauler and rigger. The terms “bidder,” “Hauling Contractor” and “Rigger Contractor” are used interchangeably.

Each bidder shall furnish with his bid the route he proposes to use, the estimated time required, and a complete description of the hauling equipment which he proposes to use for the move, including; age, number of axles and wheels, rated capacity of trailer, number, type and pulling capacity of power units, the overall height above grade of the equipment to be moved as it is carried upon the hauling rig, etc. All work required to be performed for the move must be identified prior to the awarding of the contract.

2.0 AMEREN’S RESPONSIBILITIES (Refer to Section 5.0 for project specifics)

Meet with rigger and hauler to review move and address questions.

Provide detailed information for the equipment to be moved. This will include:

- Complete physical information – height, width, depth, and weight of equipment to be moved. Generally, an equipment outline drawing with dimensions will be provided.
- Miscellaneous materials to be moved (fans, bushings, radiators, turrets, conservator or expansion tank, arresters, piping, hardware, etc.). A list of the miscellaneous material that shall be moved will be provided. Transformer oil will be moved by others.
- Physical drawings of the equipment and special lifting or loading manufacturer’s instructions
- Any known conditions that could have an effect on moving the equipment
- Location where the equipment can be picked up
- Final destination for the equipment

Provide impact recorder mounted on equipment.

Arrange for lifting of electric utility wires for the portion of the move that is within Ameren’s service territory.

Provide access to beginning and ending locations.

Provide outages to electrical facilities as required to facilitate the work.

Provide the date when the move can begin.

Provide the date the move must be completed.

In some instances the rigger and the hauler will be the same firm, but in others the two will be different. This specification divides specific responsibilities between the rigging and moving. In those cases where the two are different, the rigger and mover will coordinate and work together.

3.0 HAULER / RIGGER RESPONSIBILITIES

3.1 General

Investigate the originating location and final destinations to determine any special situations that may exist. Make Ameren aware of special situations and note any modifications to Ameren facilities that will be required to successfully complete the move.

Contractor shall provide and be responsible for all necessary cargo insurance, services, labor, equipment, trucks, tools, fuel, power, light, heat, telephone, water sanitary facilities, supervision, permits, bonds, permission to cross private property, insurance, payment of taxes and license fees, right-of-way clearances,

and other personnel, devices & incidentals necessary to load, transport, unload and set in place the designated transformer or equipment, including accessories.

Where required, provide temporary cribbing for equipment to rest on prior to being moved to the final destination.

Secure all required permits or approvals to complete the move from federal, state, and local authorities. Where specific permitting is not required from a local authority such as a city, county, or township road commission, Contractor shall still obtain written permission from the local authority prior to the move. A copy of all permitting including written permission from the local authority shall be provided to Ameren upon request.

Clean up as the work progresses from day to day. All litter, debris, packing materials, etc., shall be disposed of off-site at the hauler's expense.

Repair any and all damage to private, public, or Ameren property at no additional cost to Ameren.

CAUTION: Caution must be observed at all times when working in or around the existing substation/switchyard. The existing substation/switchyard is energized with exposed high voltage substation bus and equipment. Also, there are energized high voltage overhead conductors in close proximity around the substation & switchyard. Coordination with Company Construction Supervisor to have appropriate lines and/or equipment de-energized may be necessary. All outages and releases shall be in accordance with Company's Workman's Protection Assurance (WPA) Procedure. Personnel shall be trained, wear hard hats, protective clothing, safety glasses with side shields, safety shoes and fall protection in accordance with OSHA requirements. The operating substation shall not be left open and unsupervised, due to the common access to energized and de-energized equipment.

3.2 Hauler Specific

Determine a route and request approval from the appropriate governmental agency or agencies to cover the complete move.

Complete a route survey and contact overhead utility companies as required by the permitting authority.

Investigate all weight limitations that may affect the move. This can include but is not limited to seasonal weight requirements imposed by governmental agencies.

Make all necessary arrangements to complete the move.

Taking super loads over railroad tracks can present unique challenges. The mover will investigate any railroad crossing that can pose a problem and develop a plan that will not cause damage to the track or impede the operation of the railroad.

Coordinate any and all requirements with law officials.

Submit OEM load charts for all equipment used.

Provide a detailed Transport Plan to Ameren for review and approval before continuing with the move including but not limited to:

- The proposed route
- The estimated time required for the move
- A complete description of the proposed hauling equipment
- The overall height above grade of the equipment to be moved as it is carried upon the hauling rig
- Axle loading
- Wheel loading
- Center of Gravity of load and trailer
- Calculation
- DOT permit, if applicable

Provide a detailed Safety Plan to Ameren for review and approval before continuing with the move.

All loads that exceed 85% capacity of the hauling equipment shall be reviewed and stamped by a professional engineer.

The Hauling Contractor shall comply with all requirements prescribed by Manufacturer instruction leaflets & drawings related to moving and supporting of the transformer or equipment. No welding on or to the equipment shall be permitted without written approval by Ameren and the equipment manufacturer.

The Hauling Contractor shall also be responsible for replacing or making prompt repairs to the equipment used by the Hauling Contractor which is damaged for any reason, including, but not limited to, broken axles.

Any temporary rocking or temporary roadways that may be necessary for any portion of the move, including, but not limited to, the substation yard, shall be provided by the Hauling Contractor unless other arrangements have been made in advance and are clearly described in the contract.

Removal of temporary rocking or temporary roadways, at Ameren's discretion, will be the responsibility of the Hauling Contractor.

The Hauling Contractor shall be responsible for making arrangement for raising, removal or relocation of all telephone, TV cables and electric utility wires, traffic lights, and other similar obstructions in accordance with the following:

The Hauling Contractor shall make all arrangements directly with the involved utilities and authorities and the cost of such arrangements shall be included in the bid.

The Hauling Contractor shall, where necessary, allow a reasonable amount of time for raising these obstructions, while the move is in progress.

The Hauling Contractor shall be responsible for repairing or replacing any damaged roads or surfaces, equipment, structures, fences and fields and for the restoration of any other damage to public or private property, caused by the move, to the satisfaction of the Ameren Services Company Construction Supervisor.

Any damage done to the transformer, accessories, oil or other equipment being moved (including paint scratches which expose bare metal) by the Hauling Contractor, his employees, subcontractors, contact with trees or overhead obstructions, or any other cause during the progress of this work, shall be the responsibility of the Hauling Contractor and shall be repaired to the satisfaction of the Ameren Services Company Construction Supervisor.

The Hauling Contractor shall provide adequate cargo insurance to cover the complete replacement of the equipment being hauled.

3.3 Rigger Specific

Provide all necessary material, labor, and supervision to move the load to a place where the load can be placed on the mover's truck or rail car.

Load the item on the truck and assist the mover in securing the load to the truck or rail car.

Off load the item at the final destination and locate it as directed by Ameren personnel.

The Rigging Contractor shall comply with all requirements prescribed by Manufacturer instruction leaflets & drawings related to moving and supporting of the transformer or equipment. No welding on or to the equipment shall be permitted without written approval by Ameren and the equipment manufacturer.

The Rigging Contractor shall be responsible for having an ample supply of cables, jacks, planking and other miscellaneous equipment on hand and in good condition, so that the move can be made safely and without delay.

Unless specifically stated in this specification, no pulling anchors will be available. The equipment to be moved shall be handled and positioned solely by use of the equipment furnished by the Hauling Contractor. At no time shall the equipment to be moved, or the equipment furnished by the Hauling Contractor, make contact with or exert a force on (directly or indirectly) any building, structure, **foundation, oil pit**, other improvement, tree, natural formation or vehicle (except those furnished by the Hauling Contractor).

4.0 SCOPE OF WORK

4.1 Ameren Company Representative

An Ameren Company representative will generally observe the move and shall have the authority to immediately stop the work because of hazardous conditions or for any other reason which he deems necessary. This shall in no way relieve the Hauling Contractor of his responsibilities for the proper performance and supervision of the move.

4.2 Inspection of Equipment to be Moved

Prior to the move, Ameren personnel will inspect the equipment. Ameren will furnish all labor and material for this inspection. The Hauling Contractor and Ameren shall coordinate their work so that no unnecessary interference or delays occur during this period.

4.3 Hauling Contractor

The Hauling Contractor shall provide and be responsible for all necessary cargo insurance, services, labor, equipment, trucks, tools, supervision, permits, bonds, permission to cross private property, insurance, payment of taxes and license fees, right-of-way clearances, and other personnel and devices necessary to load, transport, unload and set in place the designated transformer or equipment, including accessories.

END OF APPENDIX M

APPENDIX N
PIPE AND FITTINGS: AMEREN APPROVED MANUFACTURER LIST

1.0 SCOPE

1.1 The Scope of the Ameren Approved Manufacturer's List (AML) encompasses pipe and fittings supplied to Ameren Gas and Power Generation locations.

1.2 AML applies to Critical (QR/CR) and non-Critical items.

1.2.1 Items that are “Restricted” will have manufacturers listed and they shall be supplied as stated. In some cases, manufacturers will not be on the AML.

1.2.2 “Generic” items shall be supplied from the AML regardless of what manufacturer is listed.

2.0 AML REQUIREMENTS

2.1 Ameren-AML shall be initially compiled prior to contract award and be finalized & implemented by 5/1/12.

2.2 All manufacturers on the Ameren-AML shall have a current/active ISO 9001 registration unless approved by Ameren.

2.3 Any new manufacturers or classes of material added to the AML must be approved by Ameren prior to manufacturer being added to the list.

2.4 Unapproved manufactures may be used in emergency situations; however, contact and approval must be obtained from Ameren end-user prior to material being purchased.

2.5 Manufacturers are classified by the following levels with corresponding QA requirements specified:

QA OVERSIGHT LEVEL	MINIMUM QA REQUIREMENTS
1	• CMTR required on all shipments. Documentation sent with materials as required. • Destructive and Non-Destructive Independent Testing completed once per year for each category and manufacturer on the AML (CBN Stl Pipe, Fittings, etc.). • Quality Audit performed at manufacturer once every 2 years.
2	• CMTR required on all shipments. Documentation sent with materials as required. • Destructive and Non-Destructive Independent Testing completed once per year for each category and manufacturer on the AML (CBN Stl Pipe, Fittings, etc.). • Subject to Master Import testing as required. If performed, Ameren is to receive copy of testing. • PMI Testing at Ameren on each heat/lot #.
3	• CMTR required on all shipments. Documentation sent with materials as required. • Third Party testing at Factory on each shipment. • Subject to Master Import testing as required. If performed, Ameren is to receive copy of testing. • Destructive and Non-Destructive Independent Testing completed twice per year for each category and manufacturer on the AML (CBN Stl Pipe, Fittings, etc.). • PMI Testing at Ameren on each heat/lot #.

NOTE: A destructive & non-destructive testing plan shall be finalized by 5/1/12 and fully implemented by 9/1/12.

2.6 All Gas materials must be supplied from approved domestic manufacturers.

2.7 In cases where material must be shipped from an alternate location that does not have the testing equipment available, approval must be obtained from end-user.

2.8 Ameren will conduct yearly audits of material testing and documentation processes.

2.9 Chinese manufactured product shall be only accepted after written pre-approval per Ameren.

2.10 Receipt inspection standards for each type of material shall be created (i.e., fittings, pipe, flanges, valves). At a minimum these should include:

- Proper Identification/Markings (manufacturers markings are present and they are readable/legible and meet applicable manufacturing standards
- Verify Manufacturer is on AML
- Verify CMTRs are received and acceptable
- Check for damage/cleanliness/workmanship
- Verify material matches stock/PO description
- Any unique inspections specific to the item
- Dimensional inspection to sampling plan (to nominal sizes)

Product	Material	ASTM Spec.	Material Grade	Materials Class	Approved Manufacturers	Country	City/State	Approved For	Registrations/ Certifications	Mfr. QA Oversight Level	Comments
PIPE, SEAMLESS	Carbon Steel	A106	Grade B Grade C	Schedule 40 Schedule 80 Schedule 160 XXS	Arcelormittal	South Africa	Vereemiging,	GEN	ISO:9001	2	
					Chung Hung Steel	Taiwan	Kaohsiung City	GEN	ISO:9001	3	
					Dnepropetrovsk	Ukraine	Dneproptrovsk	GEN	ISO:9001	2	
					Hall Longmore	South Africa	Wadeville	GEN	ISO:9001	2	
					Husteel	Korea	Seoul	GEN	ISO:9001	3	
					Hyundai Hysco	Korea	Ulsan	GEN	ISO:9001	3	
					JSC	Ukraine	Dneproptrovsk	GEN	ISO:9001	3	
					Lakeside	USA	US	GEN	ISO:9001	1	
					Maharashtra	India	Raigad	GEN	ISO:9001	3	
					Sun Steel	Vietnam	Binh Duong Province	GEN	ISO:9001	3	
					US Steel	USA	Fairfield, AL	GEN	ISO:9001	1	
					Uvjerne	Croatia	Uvjerne	GEN	ISO:9001	2	
					Wheatland/Sharon	USA	Sharon, PA	GEN	ISO:9001	1	
	Ferritic Steel	A335	P11 P22	Schedule 80 Schedule 160 XXS	JFE	Japan	Chita	GEN	ISO:9001	2	
					Michigan	USA	MI	GEN	ISO:9001	1	
					Productos	Spain	Valle de Trapaga	GEN	ISO:9001	2	
					Sumitumo	Japan	Wakayama	GEN	ISO:9001	2	
					Tenaris	Argentina	Buenos Aires	GEN	ISO:9001	2	
	Austenitic Stainless Steel	A312	**300 Series** 304 304L 316 316L etc.	Schedule 80 Schedule 160 XXS							
					Haynes	USA	IN	GEN	ISO:9001	1	
					Kawasaki	Japan	Fukuyama	GEN	ISO:9001	2	
					Kobe	Japan	Tokyo	GEN	ISO:9001	2	
					Nippon	Japan	Yamaguchi	GEN	ISO:9001	2	
					Productos	Spain	Valle de Trapaga	GEN	ISO:9001	2	
					Pusan	Korea	Janghang	GEN	ISO:9001	3	
					Sandvik	Sweden	Sandviken	GEN	ISO:9001	2	
					Sumitumo	Japan	Kashima City	GEN	ISO:9001	2	
					TaChen	Korea	Taipei	GEN	ISO:9001	3	
					Webco	USA	OK	GEN	ISO:9001	1	
		A376	**TP300 Series**	Schedule 80 Schedule 160 XXS	Bristol	USA	Bristol, TN	GEN	ISO:9001	1	
					Haynes	USA	IN	GEN	ISO:9001	1	
					Outokumpu	USA	Wildwood, FL	GEN	ISO:9001	1	
					Webco	USA	OK	GEN	ISO:9001	1	

Product	Material	ASTM Spec	Material Grade	Material Class	Approved Manufacturers	Country	City/State	Approved For	Registrations/ Certifications	Mfr. QA Oversight Level	Comments
PIPE, WELDED	Austenitic Stainless Steel	A312	300 Series 304 304L 316 316L	Schedule 80 Schedule 160 XXS	Thareus	Thailand	Rayong	GEN	ISO:9001	3	
					Pantech	Malaysia	Kuantan	GEN	ISO:9001	3	
					PreStar	Malaysia	Darul Ehsan	GEN	ISO:9001	3	
					KingMaker Steel	USA	NJ	GEN	ISO:9001	1	
					Kanzen Tetsu	Malaysia	Darul Ehsan	GEN	ISO:9001	3	
					Sonah	Vietnam	Seoul	GEN	ISO:9001	3	
					Bristol Metals	USA	Bristol, TN	GEN	ISO:9001	1	
					Outokumpu	USA	Wildwood, FL	GEN	ISO:9001	1	
FITTINGS Socket Butt Threaded Reducers Unions Ells Elbows Tees Caps Plugs Bushings	Malleable Iron	A197		150# 300#	Ward Manufacturing	USA	Blossburg, PA	GAS	ISO:9001	1	
					Anvil	USA	Columbia, PA	GAS*	ISO:9001	1	*Approved for plugs, unions, elbows and tees only
					Jinan	China	Jinan	GEN	ISO:9001	3	
	Carbon Steel Forgings	A105		Socket Weld Threaded	Capitol	USA	Crowley, LA	GAS**,GEN	ISO:9001	2	** Only Plugs
					Bonney Forge	USA	Mt. Uniom, PN	GAS, GEN	ISO:9001	2	
	Wrought Carbon Steel/Alloy Steel	A234	W Series WPB, WPC, etc.	Butt-Weld Standard XH XXH	Arah Danang	Malaysia	Darul Ehsan	GEN	ISO:9001	3	
					Awaji	Thailand	Sumoto City	GEN	ISO:9001	3	
					Canadoil	Canada	Quebec	GEN	ISO:9001	3	
					Charming	Vietnam		GEN	ISO:9001	3	
					Erne	Austria	Hauptstasse	GEN	ISO:9001	2	
					Hackney Ladish	USA	AR, OK	GAS, GEN	ISO:9001	2	
					Pantech	Malaysia	Seiannor	GEN	ISO:9001	3	
					Teneris	Mexico	De Clorec	GEN	ISO:9001	2	
					TK	Korea	Busan	GEN	ISO:9001	3	
					Weldbend	USA	IL	GAS, GEN	ISO:9001	2	
	Wrought Austenitic Stainless Steel	A403		Butt-Weld Sch 10,40,80,160							
					Kanzen-Tetsu	Malaysia	Darul Ehsan	GEN	ISO:9001	3	
					Tru-Flo	Taiwan	Hsiang	GEN	ISO:9001	3	
					Elin	Philippines	Cavite	GEN	ISO:9001	3	
					Schulz	Brazil	Campos dos Guyacezes	GEN	ISO:9001	2	
					SPI	Malaysia	Darul	GEN	ISO:9001	3	
					SFG	USA	Travelers	GEN	ISO:9001	1	
	Forged or Rolled Alloy Stainless Steel	A182	F9 F11 F22	3000/6000# SW 3000/6000# THRD	Bonney Forge	USA	Mt. Union, PN	GEN	ISO:9001	1	
					Penn Machine	USA	PN	GEN	ISO:9001	1	
			300 Series 304/304L 316/316L	3000/6000# SW 3000/6000# THRD	Bothwell	Taiwan	Hsien	GEN	ISO:9001	3	
					ISE	Japan	Osaka	GEN	ISO:9001	2	
					Enlin Steel	Taiwan	Cavite	GEN	ISO:9001	3	

	Material	ASTM Spec.	Material Grade	Material Class	Approved Manufacturers	Country	City/State	Approved For	Registrations/ Certifications	Mfr. QA Oversight Level	Comments
PIPE NIPPLES	Carbon Steel	A106 A733	Grade B Grade C	Standard (40) Schedule 80 Schedule 160 XXS	Westbrook	USA	Houston, TX	GAS, GEN	ISO:9001	2	
					Wisconsin	USA	Milwaukee, WI	GAS, GEN	ISO:9001	2	
	Austenitic Stainless Steel	A106 A733	**300 Series** 304/304L, 316/316L, etc.	Standard (40) Schedule 80 Schedule 160 XXS	Westbrook	USA	Houston, TX	GEN	ISO:9001	1	
					Merit Brass	USA	Cleveland, OH	GEN	ISO:9001	1	
FLANGE, PIPE	Carbon Steel Forgings	A105	Grade B Grade C	150# 300# 600# 900#	Ameri-Forge	USA	TX	GEN	ISO:9001		
					Balkrishna	India	Gujarat	GEN	ISO:9001	3	
					Bebitz	Germany	Lebendorter	GEN	ISO:9001	2	
					Boltex	USA	Houston, TX	GAS, GEN	ISO:9001	2	
					Galperti	USA	Houston, TX	GAS, GEN	ISO:9001	2	
					Hind	India	Ghaziabad	GEN	ISO:9001	3	
					Metalfar	Italy	Brianza	GEN	ISO:9001	2	
					Munish	India	Ludhiana	GEN	ISO:9001	3	
					Norma	India	Sahibabad	GEN	ISO:9001	3	
					Rangani	India	Gujarat	GEN	ISO:9001	3	
					RNG	India	Ludhiana	GEN	ISO:9001	3	
					Tirupati	India	Ghaziabad	GEN	ISO:9001	3	
					Trilad	USA	Houston, TX	GEN	ISO:9001	1	
					Weldbend	USA	Chicago, IL	GAS, GEN	ISO:9001	2	
	Stainless Steel	A182	**300 Series** 304/304L, 316/316L, etc.	150# 300#	Enlin	Philippines	Cavite	GEN	ISO:9001	3	
					Viraj	India	Maharashtra	GEN	ISO:9001	3	
					Hilton Metal	Mumbai	Ghonsai	GEN	ISO:9001	3	
	Forged or Rolled Alloy	A182	F9 F11 F22	150# 300# 600#	Ameri-Forge	USA	TX	GEN	ISO:9001	1	
					Maas Flange	USA	TX	GEN	ISO:9001	1	
SWAGE NIPPLES and BULL PLUGS	Carbon and Stainless Steel	A234			Capitol Manufacturing	USA	Crowley, LA	GAS	ISO:9001	2	Approved for Weld X Thread
					Westbrook	USA	Houston, TX	GAS	ISO:9001	2	Approved for Thread X Thread

END OF APPENDIX N

APPENDIX Q
QUALITY MANAGEMENT SERVICES APPLICATION AID

This document is an Application Aid for Procurement Service organizations to outline the Bidder/Contractor's Quality Management Program and demonstrate how it meets the requirements of Ameren Missouri's Quality Management System (QMS). This Aid is not a substitute for, nor does it replace AUE-MAN-QMS-1001 - Quality Management System and its requirements.

DO YOU HAVE A WRITTEN QUALITY MANAGEMENT (QM) PROGRAM ?

If NO, how do you intend to meet the QMS requirements?
Click here to enter response.

If YES, what is the basis of your QM (e.g., ISO 9000, NQA-1) **and how does it meet the QMS requirements as outlined below?**
Click here to enter QM Basis.

1.0 GENERAL REQUIREMENTS

1.1 Direct and indirect activities are performed and controlled by written instructions, procedures and drawings, as appropriate. (QMS 1.2.1, 3.2.1)
Click here to enter response.

1.2 Quality programs of suppliers are approved and audited to ensure they meet applicable QMS requirements. (QMS 1.2.3, 4.2.3, 5.2.3)
Click here to enter response.

1.3 The roles and responsibilities of supporting organizations and subcontractors are well defined and coordinated to achieve desired results. (QMS 1.2.4, 18.2.4, 18.2.5)
Click here to enter response.

1.4 The QM is revision controlled and approved by Senior Leadership. (QMS 1.2.5)
Click here to enter response.

2.0 DOCUMENT CONTROL AND RECORDS

2.1 Processes are in place to ensure current revisions of control documents are readily accessible. (QMS 3.2.6, 7.2.9. 13.2.1)
Click here to enter response.

2.2 Records are legible, identifiable, and stored such that they can be retrieved for the durations of the retention time. Record retention times storage requirements are commensurate with importance to safety, quality, and regulatory compliance. (QMS 13.2.2, 13.2.3, 18.2.19)
Click here to enter response.

3.0 PURCHASING

3.1 Critical products and services are procured from approved suppliers. (QMS 4.2.1, 4.2.2)
Click here to enter response.

3.2 Changes to purchase order documents are reviewed and approved to the level of the original document. (QMS 4.2.4)
Click here to enter response.

3.3 Engineering and technical reviews are performed to ensure purchased materials and services meet design requirements. (QMS 4.2.5)
Click here to enter response.

3.4 Labeling, handling, storage, packaging, and traceability requirements of critical materials are identified as part of the procurement document. (QMS 4.2.6, 5.2.1, 12.2.2)
Click here to enter response.

4.0 PRODUCT IDENTIFICATION, MATERIAL HANDLING AND STORAGE

4.1 Material traceability is maintained and records are easily retrieved. (QMS 5.2.2)
Click here to enter response.

4.2 Materials, equipment, and components are packaged, shipped, received, handled, stored and issued in accordance with written procedures. (QMS 12.2.1)
Click here to enter response.

4.3 Materials receive appropriate receipt inspections to ensure they meet the requirements of procurement documents and specifications. Materials awaiting receipt inspection are separated from accepted materials. Non-conforming material is controlled to prevent use. Procedures are established for identifying, documenting and dispositioning non-conformances. (QMS 9.2.2, 12.2.3, 12.2.4, 12.2.5)
Click here to enter response.

4.4 Material handling, rigging and lifting is controlled and performed in a manner to prevent damage or injury. (QMS 12.2.6)
Click here to enter response.

4.5 Materials, equipment, and components are stored in accordance with specified requirements in an environment that preserves their integrity and usability including any preventive maintenance activities. Materials with shelf life limitations are identified and monitored; expired items are dispositioned. Storage areas are periodically inspected to verify the integrity of the facility and that material storage requirements are being met. (QMS 12.2.7, 12.2.8, 12.2.9, 12.2.12)
Click here to enter response.

4.6 Hazardous materials and chemicals are labeled, stored, maintained, packaged and shipped offsite in accordance with regulatory requirements and manufacturer recommendations. (QMS 12.2.10, 12.2.11)
Click here to enter response.

5.0 INSPECTION AND TESTING

5.1 Inspections and tests are performed by qualified personnel in accordance with written procedures, plans, instructions, or work documents. (QMS 7.2.1, 7.2.2, 7.2.3)
Click here to enter response.

5.2 Test plans and instructions are risk assessed, independently reviewed, and approved prior to use. Changes or deviations to test plans and instructions are documented and receive the same review and approval. Design basis, codes and standards and regulatory requirements that need to be verified and documented are incorporated into test procedures and instructions. (QMS 7.2.4, 7.2.5, 7.2.6, 18.2.15)
Click here to enter response.

5.3 Test results are evaluated and approved to ensure the design/project and acceptance criteria have been met before equipment or system is released to operations. Test or inspection results that do not meet acceptance criteria are documented and dispositioned. Records of inspection and tests results are maintained in accordance with approved procedures. (QMS 7.2.7, 7.2.8, 7.2.9)
Click here to enter response.

6.0 MEASURING AND TEST EQUIPMENT (M&TE)

6.1 M&TE is uniquely identified, clearly labeled and controlled in accordance with written procedures. (QMS 8.2.1)
Click here to enter response.

6.2 Calibrations are performed and documented in accordance with written procedures; calibration data is readily retrievable. Calibration standards are traceable to national standards. Where national standards do not exist or are not readily available, the basis for calibration is documented. (QMS 8.2.2, 8.2.3)
Click here to enter response.

6.3 Handling and storage of M&TE is controlled to ensure accuracy is maintained. M&TE is sealed/secured after calibration to prevent unauthorized adjustments. M&TE is checked for calibration whenever damage is suspected. (QMS 8.2.4, 8.2.6, 8.2.7)
Click here to enter response.

6.4 M&TE found outside calibration limits requires effected systems and components to be identified and evaluated for adverse impact. M&TE used on critical components is recorded to provide traceability. (QMS 8.2.8, 8.2.9)
Click here to enter response.

6.5 Inspection and test software is validated prior to use. Process controllers, microprocessors and software, when used as an integral part of the M&TE, are not interchanged without recalibration of the test system. (QMS 8.2.10, 8.2.11)
Click here to enter response.

7.0 CONTROL OF NONCONFORMANCE

7.1 Procedures are established for identifying, documenting, controlling and dispositioning non-conformances. (QMS 9.2.1)
Click here to enter response.

7.2 Dispositions of “Use-as-is” and “Repair” require engineering evaluation and approval prior to use. (QMS 9.2.3)
Click here to enter response.

8.0 CORRECTIVE ACTION (CAP)

8.1 Procedures provide for the prompt identification and documentation of events and conditions adverse to quality, ensure assigned corrective actions are implemented and trended to identify opportunities for continuous improvement. (QMS 10.2.1, 10.2.3, 10.2.8)
Click here to enter response.

8.2 Lessons learned from internal and external operating experience are captured and evaluated by the corrective action process and communicated to appropriate personnel. (QMS 10.2.7, 18.2.18)
Click here to enter response.

9.0 INTERNAL ASSESSMENTS

9.1 Internal assessments are performed by qualified personnel to evaluate the effectiveness of implementation of procedures and programs with findings documented in Corrective Action Program. (QMS 14.2.1, 14.2.2)
Click here to enter response.

10.0 TRAINING

10.1 Training standards and requirements are identified and documented for each functional position. (QMS 15.2.1)
Click here to enter response.

10.2 Initial and on-going training is provided to employees to meet training standards and requirements. Lessons learned and industry best practices are incorporated in the initial and ongoing training programs. (QMS 15.2.2, 15.2.3, 18.2.6)
Click here to enter response.

11.0 SPECIAL PROCESSES

11.1 Special processes are performed using approved procedures, and qualified personnel and equipment to ensure critical process results. (QMS 16.2.1, 16.2.2, 16.2.3)
Click here to enter response.

12.0 PROJECT MANAGEMENT

12.1 Projects are managed in accordance with written policies and procedures. (QMS 18.2.3, 18.2.13, 18.2.14)
Click here to enter response.

12.2 Key stakeholders are identified and involved throughout the development and implementation of projects. Performance metrics for safety, quality, cost, earned value and schedule are established, monitored and communicated to all stakeholders to ensure sufficient resources are provided to complete the project. Project objectives and results are compared to determine the success of each project. (QMS 18.2.8, 18.2.9)
Click here to enter response.

12.3 Project risks are identified and evaluated in terms of probability of occurrence and impact. Recovery strategies are prepared for significant risks, risks are monitored and recovery strategies revised, as necessary, throughout the project. Emergent risks are evaluated and added to the risk management plan. (QMS 18.2.10, 18.2.11)
Click here to enter response.

END OF APPENDIX Q

APPENDIX ??

Add project-specific appendices as project warrants

APPENDIX X
FOREIGN MATERIAL EXCLUSION (FME)REQUIREMENTS
for NonAmeren Contract Construction Personnel

1.0 PURPOSE

A. Energy Center systems must remain free of foreign material contamination to operate properly. The following is an outline of required practices that outside contract personnel must follow to prevent foreign material contamination.

2.0 PRIORITY

A. Foreign material contamination in critical energy center components is very serious and must be addressed. Failure to do so may result in millions of dollars of equipment damage and lost revenue. The consequences could be so great that Ameren will be compelled to recover damages from Contractor.

B. In the event that foreign material is known to have entered a critical system, contact the Construction Project Lead (SPOC) immediately.

3.0 DEFINITION

A. Foreign Material Exclusion (FME) is the practice of preventing the contamination of components in energy center systems.

4.0 EQUIPMENT COVERED BY FOREIGN MATERIAL EXCLUSION PROCEDURES

A. Contractor shall follow FME practices, particularly on systems and components that are critical to the energy center such as the feedwater, condensate, steam, lubricating oil, turbine, and generator. This equipment is likely to suffer component damage if contaminated by foreign material.

B. Examples of critical components include, but are not limited to:

- Boiler tubes, headers and drums
- Condensers
- All lube oil reservoirs
- Pumps
- Generators and seal oil systems
- Electrical cabinets
- Transformers
- In-line flow elements
- Feedwater heaters
- Flash tanks
- All piping systems
- Turbine shells and piping
- Large electric motors
- Switchgear
- Compressed air systems
- Bulk storage tanks

5.0 SOURCES OF FOREIGN MATERIAL CONTAMINATION

A. Common contaminates include, but are not limited to:

- Welding & gas cutting debris
- Corrosion
- Metal chips, shavings & filings created by machining and repair operations
- Materials used for cleaning
- Improper lubricants
- Dirt, fly ash & coal dust
- Contaminants found on shoes & clothing
- Pens, rulers, coins, keys & other typical contents of a shirt pocket
- Tools
- Trash

B. Typical activities that produce foreign material include, but are not limited to:

- Drilling, cutting, grinding, machining, filing and lapping
- Welding thermal cutting activities
- Lubricants or cutting oils
- Use of tape, plugs or seals that may leave a residue
- Sandblasting
- Confined space entry
- Sweeping or using air or water to clean
- Any activity including equipment inspection and testing that requires opening a normally sealed component

6.0 GENERAL FOREIGN MATERIAL EXCLUSION PRACTICES

A. Ameren requires that all Contractors and Subcontractors have an Ameren (SPOC) approved FME plan prior to working on a critical energy center system.

B. Ameren requires that Contractor and Subcontractors discuss FME practices with craft labor at the weekly safety meetings.

C. Contractor and Subcontractor shall maintain good housekeeping practices on the entire construction site.

This will promote a safe work environment plus promote good FME practices. Contractors that work for Ameren should realize that it is not cost effective to allow construction debris to accumulate, create a safety hazard, which could cause a lost time accident, or could cause foreign material to enter a critical system. Employ craft labor to continually keep the work site clean, not just at the end of the project.

D. The following are the Ameren minimum requirements for any Contractor foreign material exclusion plan.

1) Cover all unattended openings into components.

2) Clean dirt, coal, fly ash, or any other form of debris from around covers, caps, and other devices before opening for inspection or servicing.

3) When opening critical components, ensure areas above these components are clean so no debris will drop into openings of these components. If work will be done overhead while the component is open, cover with tarps, etc. to prevent debris that is dislodged or dropped from entering the component.

4) Ensure that welding electrodes, stubs, and broken flux coating material is removed from components.

5) Clean the work area before beginning work; this may include wash down or vacuuming of the area.

6) Orient work so that debris will not drop into components.

7) Openings on the main turbine, generator, hotwell pumps, boiler circulating pumps, high-pressure boiler feed pumps, etc, shall be covered during maintenance activities.

8) All piping and tubing must be free of foreign material before and after installation.

9) Do not introduce material into components that may produce corrosion.

10) Shot and sand blasting will only be done in areas that can be adequately cleaned.

11) Use only approved solvents for cleaning.

12) Use only approved lubricants.

13) Use approved tapes, plugs, or seals. Some tapes may leave residue (adhesive) that can cause damage.

14) Use approved procedures when flushing systems.

15) Define a “FME work area” around turbines, generators, lube oil tanks, or other areas specifically designated by the specification with barricade tape and limit access of personnel, tools and materials to these areas.

16) Track all tools, parts, and materials that are allowed into the FME work area. If something cannot be accounted for, follow a systematic procedure to insure that missing item can be accounted for without causing further problems.

17) Do not allow personal items such as jewelry, change, pens, etc. into the FME area. No material should be allowed in the FME area unless it is absolutely necessary.

18) Secure all tools, safety glasses, badges, gloves, and other loose items with lanyards, tape, or other devices.

19) Stage tools, parts, and materials outside the FME area. Remove all packaging and other unnecessary material before entering the FME area.

20) Inspect tools for parts that might come off the tool during use. Look for items such as loose handles, splintered wood parts, loose wire brush bristles. Clean all tools, materials, and parts before they are allowed into the FME area.

21) Limit the use of clear materials such as face shield visors in the FME area. They will be difficult to see if they are misplaced.

22) Use vacuum or exhaust systems to remove any generated airborne debris from painting, blasting, grinding, flyash, etc.

23) When cutting wires, control the ends that are snipped off.

24) Control all metal debris (screws, connectors, wire strippings, etc.) in all electrical enclosures.

25) Account for all rags, cushions, cardboard, etc., that are used in an FME area.

26) Do not use excessive lubricants. The excess lubricants may collect dirt, ash and other debris.

27) If you suspect anything fell into the tube, use a video camera or other means of inspection prior to closing components to ensure FME. In vertical runs of boiler tubing in the radiant reheater, run a camera up and down the tube, to the nearest header. Contact the Ameren SPOC if this is not possible due to the length or geometry of the tube.

28) Follow Ameren welding practices for removal of tubes and piping

29) All open pipes, tubes or systems, regardless of whether they are new, to be re-used or wrecked out, must have FME covers in place. This rule applies to material lying on the floor, hanging in place or staged in racks, store rooms or lay down areas. The only exception is when the tube or pipe is completely disconnected from the system and color coded with bright orange or pink paint indicating that it is scrap.

30) FME covers, when subject to high traffic, abrasion or other situations that would cause them to fall off or become damaged (such as condensate or residual water draining out of the tube, pipe or system) shall be made of steel, or aluminum (excludes soda cans). For large diameter openings (12" or larger) plywood, canvas or nylon bags shall be used and marked as “NO STEP”. For openings subject to fire fall, grinding, arc air, or any other thermal operation, steel caps shall be used. Large diameter FME covers subject to the support of human weight shall conform to OSHA standards.

31) Water soluble paper, if properly utilized may be used as FME protection during tube or pipe joint prep operations. Sponges may also be used as FME protection during tube or pipe joint operations so long as a sponge log is maintained and implemented. Water soluble cones shall not be used as FME prevention during joint prep operations.

32) On vertical runs of tube or pipe, the first cut must be at the bottom using an abrasive cutoff wheel or other non-thermal means. Then a piece of sheet metal shall be inserted into the kerf created. The upper cut can then be made using a thermal method. For window welds in boiler tubing, follow RWP-1, including the use of FME discs. The discs are available in the Ameren storeroom for multiple tubes sizes. Contact the Ameren SPOC in advance to procure the proper size FME discs prior to cutting the tubes.

33) When thermal cutting is to be used to penetrate a sealed system such as headers, tanks, water boxes or large piping, it should be included in the FME plan (6.0A) and presented to the quality Inspection or Construction Project Lead (SPOC) for approval prior to the start of work.

34) FME plan requires the use of a FME Barrier Log, Foreign Material Drop List, and a Final Closure Inspection signoff record per AUE-FRM-ADM4217-01 and AUE-FRM-ADM4217-02:

35) Failure to follow FME procedure will be addressed through the Deficiency Reporting system described in the following section.

END OF APPENDIX X

DRAFT
MATERIAL SPECIFICATION
CB-SPEC-000004

FOR

MOTOR DRIVEN
GAS COMPRESSOR PACKAGES

AT

CASTLE BLUFF ENERGY CENTER

Prepared by Power Operations Combined Cycle
And Simple Cycle Project Execution Team

for

Rev	Date	Revisions	Originator	Reviewer	Approver
A	*04/25/2024*	*Issued for Review - DRAFT*	*MJV*		
0	*xx/xx/2024*	*Issued for Bid*	*MJV*	*JAB*	*NPP*
1		*Conformed to Contract*			

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I N D E X

SECTION	SECTION TITLE	SHEET NO.
ATTACHMENTS TO THE SPECIFICATION		**PAGES**

REVISION SUMMARY

Revisions are noted only for Revision 1 and later issues of the Specification. Revisions to the Specification are identified by a revision bar (vertical line) in the right hand margin adjacent to the revised lines or paragraphs.

The revision bar indicators are removed upon the issuance of the next revision of the Specification unless further changes are incorporated in the same line or paragraph.

Minor spelling, grammatical, and formatting corrections and/or changes are not noted as revisions.

Revision Number	Section / Paragraph	Description

SECTION 1A
GENERAL CONDITIONS

1.0 GENERAL

1.1 This section of the specification clarifies and supplements the Ameren General Conditions of Contract ("GCC") and other Contract documents. Specific duties set forth herein do not constitute an exclusive list of requirements but complement the Ameren General Conditions of the Contract. In the event of a conflict between this specification and the Ameren General Conditions of Contract, this Specification shall be controlling.

1.2 Contractor/Supplier shall assure that all tiers of their Subcontractors comply with all requirements of Contract documents.

1.3 The Contract Documents shall be interpreted as being complementary. Any requirement occurring in any one of the Contract Documents is as binding as though occurring in all Contract Documents. Generally, specifications address quality, types of materials and contract conditions, while plans show placement, sizes, and fabrication details of materials.

1.4 Any notice, form or document which is stated to be provided by the Owner may, at the Owner's discretion, be revised by the Owner or other notices, forms or documents with similar substance may be provided by the Owner, in each case, without altering the effect of such provision in these Specifications.

2.0 DEFINITIONS

2.1 All capitalized terms used in this Specification which are not defined in the applicable Section have the meaning set forth in Appendix A – Definitions attached hereto. Specific duties set forth herein do not constitute an exclusive list of requirements but complement the Contract. In the event of a conflict between this Specification and the Contract, this Specification shall control.

2.2 The term "Company" means the entity identified in Company's Purchase Order, its agents, employees, representatives, successors, and assigns. The terms "Purchaser," "Owner," and "Buyer," if used in the Contract Documents, are considered synonymous and refer to Company.

2.3 The term "Engineer" means the Engineer duly appointed to represent Company as specified from time to time by Company who may be employed by Company or who may be employed by others.

2.4 The term "Contractor" means the entity identified in Company's Purchase Order, and its agents, employees and authorized representatives undertaking the performance of the Work as defined in this Specification. The terms "Vendor," "Supplier," "Manufacturer," or "Fabricator" if used in the Contract Documents, are considered synonymous and refer to Contractor.

2.5 The term "Sub-Contractor" means any individual, partnership, firm, corporation, or business entity, other than an employee of Contractor, who contracts or agrees with Contractor (or another Sub-Contractor or any tier thereof) to furnish any services, labor, materials, or equipment for, or in connection with, the performance of the Work.

3.0 DRAWINGS, DETAILS & INSTRUCTIONS PROVIDED BY SUPPLIER

3.1 Reference Appendix S – Submittals of this Specification for details of the submittal information (drawings, diagrams, manuals, etc.) that shall be provided as part of this contract.

3.2 Generally, the Supplier shall submit to Company electronic copies of shop drawings, equipment details, installation, operating, and maintenance instructions, wiring diagrams, parts lists, etc. Reference Appendix S – Submittals. The submittal of hardcopies will be specifically defined where required.

3.2.1 These submittals shall cause no delay in the fabrication of the materials or equipment. No purchasing, construction, erection, processing or shipping of the material or equipment may begin until the drawings or details have been reviewed by the Owner.

3.2.2 The Owner will review submittals for general design features. Supplier is responsible for dimensions, quantities, accuracy, fit and adequacy of details.

3.2.3 Changes or deviations from the contract documents must be submitted in writing to the Owner and written approval granted by the Owner prior to the execution of any change.

3.3 Professional Engineering (PE) License Seals

3.3.1 All design documentation meant for fabrication, permitting, erection or construction such as design drawings, specifications and calculations shall have a Professional Engineering (PE) seal applied, signed, and dated by Contractor's registered professional engineer(s).

3.3.1.1 The license shall be current, valid, and in good standing for the appropriate state where the work is taking place.

3.3.2 Documents where seals are not required include review items (not to be constructed), sketches, samples, design control documents, operations manuals, vendor material design documents, engineered product drawings (not related to permitting) and other documents agreed upon in writing between Ameren and Contractor.

3.3.2.1 Contractor shall be responsible to contact the main Ameren contact up-front to clarify the requirements to seal any project specific documentation.

4.0 SHIPPING, DELIVERY, AND STORAGE

4.1 Shipments to the Energy Center site shall be consigned to the Shipping Address as defined in Section 1B of this Specification.

4.2 The Supplier shall include costs of shipping all equipment and associated materials in the price quote.

4.3 The Supplier shall be responsible for delivery to Owner's site F.O.B. This shall include special work required to support delivery of heavy and/or oversized items such as, but not limited to, road repairs, road upgrades or extensions, power line disconnections and reconnections, bridge reinforcements, grade alterations, and the like. The Supplier shall provide and coordinate all special services required to complete all deliveries based on the existing conditions surrounding the site on the Contract Date. Reference Appendix M – General Requirements for Hauling Heavy Equipment of this Specification.

4.3.1 Supplier shall discuss with Owner the routing of shipments and shall reroute the same as indicated by Owner provided the freight rates and overall costs are no greater than by other routes.

4.4 Truck shipments will be accepted weekdays only between the hours of 8:30 A.M. and 2:30 P.M. (Central time). After-hour deliveries not provided for by the Contract may be refused until the next regular workday. Cost incurred by Owner for offloading prior to or after normal working hours will be back charged to the Supplier unless prior authorization has been approved by Owner.

4.4.1 The Owner and their on-site Contractor will work with the Supplier to reach a mutual agreement for special delivery requirements.

4.5 Packages shall be clearly marked with the Contract Number and Purchase Order Number where applicable. Packing lists shall identify Contract Number, Purchase Order Number and item numbers and quantities, bills of lading shall identify the Contract number and Purchase Order Number. Packing lists shall be submitted electronically to Owner prior to shipment.

4.5.1 A weatherproofed itemized list of the contents shall also be attached to the outside of each box.

4.5.2 Supplier shall provide dimensions (H" x W' x D") and weight for each shipping container prior to shipment.

4.5.3 All separately packaged accessory items and parts shall be shipped with the equipment. Containers for separately packaged items shall be marked so that they are identified with the main equipment. An itemized packing slip, indicating what is in that container only, shall be attached to the outside of each container used for packing. A similar list shall be inside of each container. A master packing slip, covering all accessory items for a given piece of equipment which are shipped in separate containers, shall be attached to one container.

4.6 Equipment shall be shipped completely factory assembled, to the greatest extent possible. Preparation for shipment shall be in accordance with Supplier's standards unless otherwise noted in this Specification. Supplier shall be solely responsible for the adequacy of the preparation for shipment to ensure materials are received at their destination in EX-Works (EXW) conditions when handled by commercial carriers.

4.7 Equipment shall be boxed, crated, or otherwise suitably protected during shipment, handling, and storage. Components with moving parts which might be damaged in shipment, shall have all such moving parts securely blocked and braced. All items blocked and braced for shipment must be clearly identified and tagged accordingly. Equipment having antifriction or sleeve bearings shall be protected by weather-tight enclosures.

4.8 Materials required for protection during shipping and storage shall be treated for fire resistance. Wood protection shall be Class A, fire retardant, pressure treated type.

4.9 Coated surfaces shall be protected against impact, abrasion discoloration, and other damages. Surfaces which are damaged shall be repaired.

4.10 Electrical equipment, controls, and insulations shall be protected against moisture and water damage. All external gasket surfaces and flange faces, couplings, rotating equipment shafts, bearings, and like items shall be thoroughly cleaned, coated with rust-preventive compound, and protected with suitable wood, metal, or other substantial type covering to ensure their full protection. Exposed threaded parts shall be greased and protected with metallic or other substantial type protectors. Damages due to insufficient protection shall be repaired by Supplier.

4.11 Returnable containers and special shipping devices shall be returned at Supplier’s expense.

4.12 If the equipment or materials require special fixtures or lifting rigs for offloading, such rigs or fixtures shall be provided at no additional cost with shipment.

4.13 Spare parts shall be protected from damage due to moisture and dirt accumulation during an extended storage period by use of special coatings, airtight membranes, bags of desiccant, or other means acceptable to Owner.

4.14 The Supplier shall provide material storage requirements for short-term and long-term storage. If special conditions are required these conditions shall be clearly communicated to the Owner.

4.15 The Supplier shall be responsible for damaged material prior to acceptance of equipment or material provided at Company’s destination.

5.0 QUALITY REQUIREMENTS

5.1 The Supplier shall provide a copy of Supplier’s quality management program and supportive procedures with the bid submittal if Contractor is not on the Ameren Missouri ‘Generation Approved Supplier List – Critical (GASLC)".

5.2 The Supplier's quality management program and supportive procedures are subject to review and audit by the Owner.

5.3 The Supplier's awarded work scope, including that of its Subcontractors, shall be performed to the requirements of the Supplier's quality management program.

5.4 The Owner or his duly authorized representative or inspector shall be allowed to make quality inspections at the Supplier's and Subcontractor's facilities at no cost to the Owner. Owner will be allowed to view applicable Supplier's and Subcontractor's quality procedures and procedure generated records and documents.

5.5 Design Documents and Calculations:

5.5.1 The Supplier and all Subcontractors shall meet the technical requirements included in Section 1D of this Specification.

5.5.2 All design documents and calculations shall be reviewed by a qualified Approver. The responsibility of the Approver is to ensure that all design documents and calculations are prepared, independently reviewed, and processed in accordance with all applicable procedures. It is not acceptable for the Approver to be the preparer of the design documents.

5.6 The Supplier's quality management system shall include material handling, traceability, and storage requirements.

6.0 OWNER APPROVAL OF PROCEDURE

6.1 The Owner must consent to deviations from the procedures, methods and materials agreed to in the Contract.

7.0 CONFIDENTIALITY

7.1 Contractor shall hold the Owner's Confidential Information confidential and shall not use or disclose to others during or after the performance of the Work (except as is necessary to perform the Work).

7.2 Publication or advertising of information directly derived from the Project or the Work or data obtained in connection with services rendered under the Contract must first be approved in writing by Owner (Owner personnel need approval from Owner Corporate Communications). Supplier shall not release any information for publication or advertising purposes relative to the material, equipment and or services furnished under the Contract Documents without the prior written consent of Owner. Owner reserves the right to release all advertising or publicity concerning the Project or the Work. Except as to signs required by building department regulations or any other governmental requirements, Supplier shall not display or permit any signs or advertisements to be displayed about the Project site nor publicize in any manner its performance of the Work without the express written permission of the Owner.

7.3 Supplier shall restrict the knowledge of all confidential information regarding the Work to as few as possible of its employees who are directly connected with performance of the Work and have a definite need for such knowledge. Upon request by Owner's Representative, Supplier shall cause such persons or groups of persons involved in the Work on Supplier's behalf as Owner may designate to sign individual secrecy agreements in a form satisfactory to Owner.

8.0 WARRANTY

8.1 The Work shall be warranted by Supplier against defects in materials, performance, and workmanship for a period of two (2) years from the date of acceptance by the Owner. Supplier shall include parts, contractor service engineer, and labor to remove and install the necessary parts and equipment.

Note: As used herein “Seller” means Vendor and “Buyer” means Customer.

Seller warrants that its services, including without limitation, its design, inspection, and installation services, and the equipment and materials to be supplied by Seller under this contract, shall be free of defects and shall conform to the requirements of the contract.

9.0 LIQUIDATED DAMAGES

9.1 Liquidated damages shall be assessed at $_____ per day if delivery of the material does not meet the delivery requirements of section of section 1B and 1C of this specification. The liquidated damages shall have a cap of __% of the contract.

9.2 In the event the cap on liquidated damages is reached, and Contractor fails to meet the Schedule within an additional 7 Days, Owner may, in addition to the liquidated damages provided for in this Section and in its sole discretion, terminate this Contract for Contractor default under Article 7.02 of the General Conditions of Contract and seek additional damages Owner may incur as a result.

END OF SECTION 1A

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SECTION 1B
GENERAL SUMMARY OF WORK

1.0 INTRODUCTION

1.1 The Work described in this Specification cover the design and fabrication of equipment to be installed at Ameren's Castle Bluff Energy Center (hereinafter referenced as the job site or plant). The Castle Bluff Energy Center is located in St. Louis County, Missouri on the west bank of the Mississippi River.

1.2 The job site's mailing/shipping address is:

Ameren Missouri
Castle Bluff Energy Center
8200 Fine Road
St. Louis, MO 63129

1.3 Contacts

1.3.1 All commercial matters should be directed to the Ameren purchasing agent/sourcing specialist designated on the Request for Proposal or listed on the purchase order.

1.3.2 All technical questions regarding this specification shall be directed to:

Mr. Mac Voss, PE
Consulting Engineer
Ameren Power Operations Services
11149 Lindbergh Business Court
St. Louis, MO 63123
636-575-5333
mvoss@ameren.com

2.0 SUMMARY OF WORK

2.1. High Level Scope/Project Objectives

The purpose of this project is to provide compressed natural gas for Ameren's new Castle Bluff Energy Center. The Caste Bluff Energy Center will consist of four F-Class simple cycle combustion turbine generating units.

The gas pressure in the pipeline servicing the site is not adequate for the operation of the simple cycle combustion turbines selected for the Energy Center. The natural gas will require additional compression prior to injection into the combustion turbine engines.

Reference Section 15565 – Gas Compressor and Ancillary Equipment for detailed and specific process/compression requirements.

2.2. General Requirements

The Supplier shall be responsible for furnishing all material (except those items of material specifically stated to be furnished by the Owner), tools, equipment, labor, supervision and any other incidental items or services required to provide all equipment and components described herein.

2.2.1. The Supplier shall provide all engineering, design and drafting, equipment procurement, manufacture, supervision, labor, assembly, fabrication, shipping, testing, calibration, training, start-up assistance and related services necessary to supply four (4) fully functional skid mounted motor driven reciprocating or centrifugal compressor packages.

2.2.2. Work by Others:

2.2.2.1. Assembly and installation of the equipment at the job site including installation of off-skids tanks and vessels.

2.2.2.2. Compressor Foundations

2.2.2.3. Compressor Building

2.2.2.4. Electric Sub-Station

2.2.2.5. Station and Unit Control Systems

2.2.2.6. All off-skid mechanical interconnection piping

2.2.2.7. All off-skid electrical and instrumentation connections

2.2.2.8. Bulk fluids, including lubricants and cooling water

2.2.2.9. Suction Filter-Separator

2.2.2.10. Discharge Filter-Separator

3.0 SCHEDULE MILESTONES

3.1. The table below is an estimated list of schedule dates and delivery for project planning purposes:

Milestone*	Date*	Payment	Liquidated Damages
Specification Issued for Bidding		N/A	N/A
Bids Due		N/A	N/A
Contract Award (Tentative)		N/A	N/A
Factory Acceptance Testing	**	N/A	N/A
Factory Ship Date			
Equipment in Service (Substantial Completion)	** (No Later Than)	N/A	N/A
Final Completion	**	N/A	None

* Milestone dates may be revised by the Owner as provided in the Contract.
** The Contractor shall propose a schedule for the completion of the work based on material/equipment deliveries at the time of Contract Award.

3.2. Payment Schedule:

Milestone	Payment
Purchase Oder Released	5% of P.O.
Supplier Approval Drawings Received	15% of P.O.
Material Released for Fabrication	25% of P.O.
Successful Completion of Factory Acceptance Testing	25% of P.O.
Equipment Delivered to the Site	25% of P.O.
Turnover of As-Built Drawings and Final Submittals	5% of P.O.

(SUGGESTED MILESTONE PAYMENT SCHEDULE to be MUTALLY AGREED UPON BETWEEN THE SUPPLIER AND THE OWNER)

4.0 CODES, STANDARDS, AND REGULATIONS

4.1 The latest revisions or addenda to codes, standards and regulations set forth as of the date of the Contract shall apply.

4.2 The Contractor shall comply with the following codes, standards, and regulations:

- AISC American Institute of Steel Construction
- ANSI American National Standards Institute
- API American Petroleum Institute
- ASME American Society of Mechanical Engineer
- ASTM American Society for Testing and Materials
- AWS American Welding Society
- FM Factory Mutual Engineering Corporation
- NFPA National Fire Protection Association
- NETA National Electrical Testing Association
- OSHA Occupational Safety and Health Administration
- UL Underwriters' Laboratories
- SSPC The Society for Protective Coatings
- All Federal, State, County, or Municipal Codes, laws, or applicable ordinances.

5.0 TESTING AND INSPECTIONS

5.1 The Supplier shall provide the Owner with an equipment testing and delivery schedule so that Owner has the opportunity to inspect or elect to waive the right to inspect each piece of equipment and witness testing.

5.2 The Owner reserves the right to observe all tests being performed. The Supplier shall notify Owner of all scheduled tests not less than 10 working days prior to the date of test.

5.3 Certified copies of inspection and test reports shall be provided by the Supplier for all tests and inspections. One (1) copy of each report shall be submitted to the Owner within one (1) week after completion of each such test or inspection. Reference Appendix S – Submittals for further requirements.

5.4 All acceptance tests and other inspections that occur in the Supplier's facility shall be at no additional cost to the Owner.

6.0 COMPONENTS, MATERIALS AND EQUIPMENT FURNISHED BY SUPPLIER

6.1. All components, materials, equipment, tools, and any incidental items described herein shall be furnished by the Supplier. These will include, but not be limited to the following:

6.2 Supplier shall provide a detailed design with a complete drawing package and other information that includes, as a minimum, the following items:

6.2.1 General Arrangement Drawings

6.2.2 Erection Arrangement Drawings

6.2.3 Installation, Operation, and Maintenance Manuals for all Equipment

6.2.4 A complete Materials List or Site Receipt Book for all materials and equipment furnished under this contract. All materials and equipment shall be clearly marked or tagged with an assigned part number or other identification number.

6.2.5 All other document submittals as defined in Appendix S – Submittals.

6.3 Supplier shall supply any special tools required for the installation of any new components and/or equipment proposed and supplied by Supplier.

6.4 Supplier shall provide engineering and technical support services during the installation and commissioning of the equipment and components supplied in accordance with this Specification.

6.5 Supplier shall design, furnish, and deliver all other materials, equipment, components, and services that may be reasonably inferred from the contract documents as being required to produce the objectives outlined by Company whether they are specifically called for in this Specification.

END OF SECTION 1B

SECTION 1C
INFORMATION REQUIRED FROM FABRICATOR

1.0 INFORMATION REQUIRED WITH BID PROPOSAL

1.1 Information Required with the Bids.

The Contractor shall supply the following information with his Bid to the Owner:

Category	Item	Description/Reference
Pricing	Bid	Per RFP – Reference Appendix P – Pricing Sheet
Quality	Contractor's Quality Management Program	Overview/description of Contractor's Quality Management Program and supportive procedures.
	Performance Guarantee Points	Compressor efficiency, horsepower, and capacity
Preliminary Project Execution Plan	Level 2 Project Schedule	See Appendix D – Contractor Scheduling Requirements
	Organizational Chart	Must include identification of Key Personnel with resumes.
	List of Proposed Subcontractors and each one's scope of work	List shall include all planned subcontractors and subcontractor cost mark-ups.
Diversity	Diverse Supplier Business Plan	Contractor shall complete and submit a Diverse Supplier Business plan as required in the RFP.

1.2 General Supplier Information

1.2.1 Supplier shall provide a list of all Sub-Contractors and suppliers of materials or services for all equipment proposed to be furnished. Descriptive information of this material shall also be provided.

1.2.2 The Supplier shall provide the location or locations of the manufacturing facilities proposed to fabricate the specified equipment/material.

1.2.3 The Supplier shall provide a complete listing of all factory tests that shall be performed.

1.3 Alternatives / Options

1.3.1 Any alternatives or options proposed by Supplier shall be fully described and priced.

1.3.2 Any deviations from this Specifications shall be FULLY outlined in the Supplier's Proposal.

1.3.3 Deviations from the specifications not outlined in the proposal will not be considered as valid exceptions/deviations from the specifications.

1.4 Exceptions

1.4.1 Any contact award resulting from this Specification will incorporate all the provisions specified herein. It is understood that the Supplier agrees to all the provisions of this Specification unless exceptions are specifically listed in his bid proposal.

1.5 Technical Services

1.5.1 The Supplier shall provide a lump sum price for all necessary supervision/technical services to perform on-site calibration and testing of the equipment, systems, and devices as needed to check-out and start-up the equipment supplied as part of this contract. The lump sum price shall include labor expense, per diem and transportation expenses for the number of days recommended by the Supplier for check-out and start-up of the equipment.

1.5.2 The Supplier shall provide a lump sum price for complete and detailed documented on-site training on the normal operation, troubleshooting, and maintenance of all systems and equipment provided. The lump sum price shall include labor expense, per diem and transportation expenses for the number of days recommended by the Supplier for the training.

1.5.3 The Supplier shall provide per diem rates for their technical services representatives. Per diem rates shall include all costs associated with the service representative's work at the site, including local travel, local travel time wages and living expenses. The round trip rate shall include all expenses for travel to and from Manufacturer's facilities and the site, including any salary costs for travel time. Owner will not reimburse Supplier for airfare costs exceeding tourist class airfare unless unusual circumstances exist. Supplier shall notify Owner in advance of such circumstances.

1.5.4 A day of service (per diem) is defined as 10 man-hours at the site. The total number of days of service shall be defined as the total regular time man-hours at the site divided by eight.

2.0 INFORMATION REQUIRED AFTER CONTRACT AWARD

2.1 The Supplier shall supply to Owner the following information after the Contract is awarded:

Category	Item*	Description/Reference	Due Date
Diversity	Diverse Supplier 2nd Tier Report	Attachment provided in RFP.	10 Weeks after the notice to proceed.
Schedule	Progress Reports	Report detailing equipment design and manufacturing progress.	Bi-weekly starting 4 Weeks after the notice to proceed.
Quality	Project Specific Quality Plan		8 Weeks after the notice to proceed.

* All items submitted by the Supplier are subject to the Owner's review and approval.

2.2 Reference Appendix S – Submittal for detailed information on information required after award of the contract.

2.3 Supplier shall notify the Owner immediately upon any significant change in the fabrication schedule especially if the scheduled delivery date is affected.

2.4 Fabrication Plant

2.4.1 Supplier shall state, within twenty-one (21) calendars after award of the contract, all proposed fabrication plants (including sub-contractor plants) for all the components, materials, and equipment. Owner reserves the right to review and approve any proposed fabrication facilities.

2.4.2 The Supplier shall notify the Owner of any changes to the fabrication location after award of contract.

2.5 The Supplier shall provide a list of and an option to purchase recommended spare parts for all equipment provided by the Supplier as part of this Specification. Information required on the spare parts list includes, but is not limited to:

2.5.1 Long Description of the Part

2.5.2 Noun (i.e., valve, breaker, pump, etc.)

2.5.3 Modifier (i.e., check, control, circuit, etc.)

2.5.4 Characteristic (i.e., type, size, material, etc.)

2.5.5 Standard Package Quantity

2.5.6 Quantity per Unit

2.5.7 Manufacturer Name

2.5.8 Manufacturer Part Number

2.5.9 Supplier Name

2.5.10 Supplier Part Number

2.5.11 Lead time ARO

2.5.12 Authorized Distributor

2.5.13 Estimated Price

END OF SECTION 1C

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SECTION 1D
TECHNICAL REQUIREMENTS

1.0 TECHNICAL REQUIREMENTS

1.1 This specification technical section together with attached appendices, covers the requirement for procurement of a Motor Driven Compressor Package.

1.2 Codes, Standards, and Regulations

1.2.1 Supplier shall, as a minimum, perform the necessary work to meet the requirements of the codes, standards and regulations set forth in this Specification. In the exercise of his experience and knowledge of the equipment, materials and work covered by this Contract, Supplier shall perform all work and provide materials and equipment in accordance with other codes, standards, and regulations consistent with providing a safe and reliable product.

1.2.2 Any deviations from this Specification shall be documented by the submittal of an alternate proposal. Alternate proposal shall list exception by specification section in numerical order on the first page of the alternate proposal. Alternate proposal shall list section from specification after exception sheet. Manufacturing schedule, delivery date, and price shall follow the proposal data sheets. Individual manufacturer specification technical selling points shall be listed at the end of the proposal along with the terms and conditions.

1.2.3 Supplier shall plan on having one design review meeting conference call with the Owner. Supplier shall electronically submit all drawings and documents for review a minimum of 5 days prior to this meeting. Supplier is responsible for setting up meeting and coordinating conference call.

1.3 Equipment and materials shall be complete in all respects within the limits herein outlined. Errors or omissions required to be corrected in the field shall be done by Supplier or its duly authorized representative at Supplier's expense.

1.4 The latest revisions or addenda to codes, standards and regulations set forth as the date of the Contract shall apply. The following codes, standards, and regulations, with the issue dates noted, shall be complied with except as modified by this Specification. Materials not specified shall be in accordance with references within the codes and standards listed, or if not listed, with the latest applicable industry standard wherever possible. Conflicts between either the codes, standards, or this Specification shall be brought to the attention of the Engineer for resolution.

1.4.1 American Society for Testing and Materials (ASTM)

1.4.2 America Institute of Steel Construction (AISC)

1.4.3 American National Standards Institute (ANSI)

1.4.4 American Society of Mechanical Engineers (ASME)

1.4.5 Environmental Protection Agency (EPA)

1.4.6 National Fire Protection Association (NFPA)

1.4.7 Occupational Safety and Health Administration (OSHA)

1.4.8 American Welding Society (AWS)

1.4.9 American Society of Heating, Refrigeration, and Air Conditioning Engineers (ASHRAE)

1.4.10 Underwriters Laboratories, (UL)

1.4.11 Institute of Electrical and Electronic Engineers (IEEE)

1.5 Any discrepancies found within the specifications shall be brought to the attention of the Owner.

1.5.1 The stricter specification shall prevail unless Supplier receives written notification from the Owner stating otherwise.

2.0 DESIGN AND MATERIAL

2.1 Design change, material change/substitution or information requests require Supplier to submit request to the Owner for approval prior to project changes. Written approval is required from the Owner.

2.2 When supplying a skid of pre-assembled equipment containing valves, gauges, and other general instrumentation in addition to the main component (compressor, pump, blower, etc.) as part of Supplier's scope of supply, Supplier shall label all skid devices for clear identification in the field.

2.3 Equipment supplied by Supplier shall have a P&ID diagram with equipment identifications, critical settings and pressure ratings identified. The valves, instruments and other equipment shall have labels attached with the device number shown on the P&ID. The device numbers will be provided by Owner and be compatible with Energy Center equipment labels and numbering schemes.

3.0 TECHNICAL SERVICES

3.1 Manufacturer's technical service representatives shall be technically competent; factory trained; experienced in the installation and operation of the equipment; and authorized by Manufacturer to perform any work stipulated.

3.2 Manufacturer's technical service representatives shall furnish written certification to Owner that the equipment has been field inspected and adjusted by them or under their direction and that it is ready for service, all of which shall be done before initial operation of the equipment.

3.2.1 Providing technical advice to assist the installation contractor in installing the equipment.

3.2.2 Inspecting and testing the equipment after installation and directing any changes or adjustments required to assure proper operation.

3.2.3 Providing technical direction during start-up and initial operation of the equipment.

3.2.4 Directing the correction of any design or manufacturing errors.

3.2.5 Instructing/training the energy center personnel in the operation and maintenance of the equipment.

3.2.6 Providing services required as a condition to providing the warranties and guarantees specified.

3.3 When, in the judgment of Owner, a field service representative's time is required under Section 1D, Paragraph 3.1 above, solely and expressly for the purpose of correcting design or manufacturing errors covered under warranty, no payment will be made, nor will the time spent at the site while correcting such errors apply toward the days of service or round trips specified for Section 1D, Paragraphs 3.2.1, 3.2.2, 3.2.3, 3.2.4, 3.2.5, and 3.2.6 above.

4.0 TESTING

4.1 The Supplier shall provide a list of all additional standard testing requirements for their equipment that are not specifically requested by the Owner.

4.2 Owner reserves the right to observe any and all testing being performed.

4.3 Witnessing of Factory Acceptance Testing (FAT) is at the discretion of the Owner and is included in the scope of the material specification.

4.4 Supplier shall notify Owner of all tests not less than 10 working days prior to the date of test to allow Owner to observe testing of the equipment if so desired.

4.5 Certified copies of inspection and test reports shall be provided by Supplier for all test and inspections conducted on the specified equipment. One (1) copy of each report shall be submitted to Owner within one (1) week after completion of each test or inspection as specified in Item 3.2 above.

4.6 An on-site acceptance test will be performed to verify the performance of the equipment.

5.0 PRE-SHIPMENT INSPECTION

5.1 Owner reserves the right to inspect the equipment prior to shipment.

5.2 Supplier shall notify Owner of all Shipments not less than 10 working days prior to the date of shipment to allow Owner to inspect the equipment if so desired.

6.0 RECEIPT INSPECTION

6.1 Materials or equipment purchased under this contract may be inspected at the specified receiving points and there accepted or rejected. Inspection will include the necessary testing for determining compliance with the specifications. All expense of initial acceptance tests will be borne by Owner. The expense of subsequent test due to failure of materials or equipment first offered will be charged against Vendor. Owner may reject damaged materials or equipment at any point along the line of shipment with the return and shipment costs to Supplier's account.

END OF SECTION 1D

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SECTION 05120
STRUCTURAL STEEL

1.0 GENERAL

1.1 Scope

1.1.1 Structural steel framing members, support members, struts, and fasteners.

1.2 References

1.2.1 ASTM A6 – General Requirements for Delivery of Rolled Steel Plates, Shapes, Sheet Piling & Bars for Structural Use

1.2.2 ASTM A992 – Standard Specification for Structural Steel Shapes

1.2.3 ASTM A36 – Standard Specification for Carbon Structural Steel

1.2.4 ASTM A307 – Carbon Steel Externally Threaded Standard Fasteners

1.2.5 ASTM A325 – High Strength Bolts for Structural Steel Joints

1.2.6 ASTM A500 – Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Round & Shapes

1.2.7 ASTM A501 –- Hot-Formed Welded and Seamless Carbon Steel Structural Tubing

1.2.8 ASTM A53 – Standard Specification for Steel Pipe

1.2.9 AWS A2.4 – Standard Welding Symbols

1.2.10 AWS D1.1 – Structural Welding Code

1.2.11 AISC Manual for Steel Construction LRFD 13th Edition – Specification for the Design, Fabrication and Erection of Structural Steel for Buildings

1.2.12 AISC Manual for Steel Construction ASD 13th Edition – Specification for the Design, Fabrication and Erection of Structural Steel for Buildings

1.2.13 AISC – Code of standard practice for steel buildings and bridges

1.2.14 AISC – Specification for Structural Joints using ASTM A325, or A490 Bolts approved by the Research Council on Riveted and Bolted Structural Joints of the Engineering Foundation and endorsed by AISC.

1.3 Submittals

1.3.1 Submit under provisions of Contract.

1.3.2 Shop Drawings

1.3.2.1 Submit shop drawings prepared under supervision of a registered professional engineer, licensed in the state of Site including complete details and schedules for fabrication and assembly of structural steel and all other materials specified in this Section.

1.3.2.2 Verify by taking onsite measurements, dimensions for existing conditions and for items requiring coordination with other trades before fabrication. Show dimensions on the Shop Drawings and note that they have been verified.

1.3.2.3 Indicate profiles, sizes, spacing and locations of structural members, openings, connections, attachments, and fasteners.

1.3.2.4 Indicate welded connections with AWS A2.0 welding symbols. Indicate net weld lengths.

1.3.2.5 Show surface preparation and painting requirements.

1.3.3 Welder's Certificates: Submit qualification record of procedures, tackers, welders, and welding operators to the Engineer. Provide certification that welders to be employed in work have satisfactorily passed AWS qualification tests within the previous 12 months. If re-certification of welders is required, re-testing will be Contractor's responsibility.

1.3.4 Product Data: Submit producer's or manufacturer's specifications and installation instructions for all products specified. Include data to show compliance with specifications (including specified standards).

1.4 Quality Assurance

1.4.1 Fabricate structural steel members in accordance with AISC – Specification for the Design, Fabrication and Erection of Structural Steel for Buildings, Load & Resistance Factor Design, Second Edition.

1.4.2 Maintain one copy of document onsite.

1.5 Qualifications

1.5.1 Fabricator: Company specializing in performing the work of this Section with minimum 5 years' documented experience.

1.5.2 Erector: Company specializing in performing the work of this Section with minimum 10 years' documented experience.

1.6 Field Measurements

1.6.1 Verify that field measurements are as shown on Drawings.

1.7 Delivery, Storage And Handling

1.7.1 Store materials to permit easy access for inspection and identification. Keep steel members off ground, using pallets, platforms, or other supports. Protect steel members and packaged materials from corrosion and deterioration.

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

2.0 PRODUCTS

2.1 Materials

2.1.1 Wide Flange sections and Structural Tees cut from Wide Flange sections: ASTM A992

2.1.2 M shapes, S shapes and Structural Tees cut from M or S Sections, HP shapes, Channels and Angles: ASTM A36

2.1.3 Structural Plates and Bars: ASTM A36 or ASTM A992

2.1.4 Steel Pipe: ASTM A53, Type E or S, Grade B or ASTM, A501

2.1.5 Cold-Formed Steel Tubing: ASTM A500, Grade B

2.1.6 Unfinished (Machine) Threaded Fasteners: ASTM A307, regular low-carbon steel bolts and nuts with hexagonal heads. SAE Grade bolts may not be used in any connections.

2.1.7 High-Strength Threaded Fasteners: ASTM A325, heavy hexagon structural bolts, hot formed heavy hexagon nuts, and hardened washer. Bolts, nuts, and washers shall conform to the AISC Specification for structural joints using ASTM A325 or A490 bolts. Bolts, nuts, and washers shall be hot dipped galvanized to conform to ASTM A153 or mechanically galvanized to conform to ASTM B695.

2.1.8 Welding Materials: AWS D1.1; Welding electrodes shall be low hydrogen type electrodes compatible with the type of steel welded. An E70 electrode shall be used for all Carbon Steel to Carbon Steel welds. Weld materials shall match or exceed the base metal in strength.

2.2 Fabrication

2.2.1 Fabricate items of structural steel in accordance with AISC Specification for the Design, Fabrication and Erection of Structural Steel for Buildings and in accordance with the final shop drawings.

2.2.2 Connections of new steel to existing steel shall typically be welded. Connection of new steel to new steel will be either bolted or welded, as indicated.

2.2.2.1 Provide high-strength threaded fasteners for bolted connections, except where unfinished (machine) bolts are indicated.

2.2.3 All existing bolts shown to be removed and replaced shall be replaced with new ASTM A325 bolts, unless noted otherwise.

2.2.4 All bolted joints shall be in accordance with AISC Specification for Structural Joints using ASTM A325 or A490 bolts. All bolted connections shall have a minimum of two bolts.

2.2.5 All welded construction shall comply with the building and tubular provisions of AWS D1.1 Code.

2.2.5.1 Assemble and weld built-up sections by methods which will prevent warping.

2.2.5.2 Use welding procedures and sequences that prevent locked-in stresses or distortions.

2.2.6 All connections will be subject to the Engineer's review.

2.3 Finish

2.3.1 Painted steel: Clean, prepare, shop prime and finish coat structural component surfaces in accordance with Section 9900 – Painting. Do not prime surfaces that will be field welded. Field touch-up painted steel as required per Section 09900 – Painting.

2.3.2 Galvanized steel: Where noted on drawings or in specification, fabricated steel shall be hot-dip galvanized after fabrication per ASTM A123. Zinc coating thick shall be a minimum of 0.45 oz. per sq. ft. or 0.76 mils thick. Equivalent to G90 coating thickness of 0.90 oz. per sq. ft. on two sides of steel. Field touch-up galvanized steel as required per Section 09900 – Painting.

2.3.3 Painted fasteners: Unfinished carbon steel fasteners, and unfinished ends of tension control fasteners at removed splines, shall be touched up painted per spec Section 09900 – Painting.

2.4 Source Quality Control and Tests

2.4.1 Testing of components will be performed as defined in this Specification. Reference Appendix F – Piping, Welding, NDE, & Excavation Requirements for further information on inspection and testing requirements.

3.0 EXECUTION

3.1 Examination

3.1.1 Verify that field connections are acceptable and are ready to receive work.

3.1.2 Beginning of installation means erector accepts existing conditions.

3.2 Erection

3.2.1 Erect structural steel in accordance with AISC Specification, Bolting Specification and Code of Standard Practice as herein specified.

3.2.2 Allow for erection loads, and for sufficient temporary bracing to maintain structure safe, plumb, and in true alignment until completion of erection and installation of permanent bracing.

3.2.3 Field weld components indicated on Drawings.

3.2.4 Do not field cut or alter structural members without approval of the Engineer.

3.2.5 Provide temporary planking, scaffolding, and working platforms as necessary to effectively complete work.

3.2.6 Do not enlarge unfair holes in members by burning or by use of drift pans. Ream holes that must be enlarged to admit bolts.

3.2.7 Immediately after erection, prime welds, abrasions, and surfaces not shop primed, except surfaces to be in contact with concrete.

3.3 Field Quality Control

3.3.1 Field inspection will be performed under the provisions of Section 1A, Paragraph 2.8.

END OF SECTION 05120

SECTION 05500
METAL FABRICATIONS

1.0 GENERAL

1.1 Work Included

This Work includes all items necessary and reasonably incidental to the completion of the overall metal fabrication job. Work generally includes metal fabrications made from iron and steel shapes, plates, bars, strips, tubes, pipes, and castings which are not a part of structural steel or other metal systems specified elsewhere.

1.2 References

1.2.1 Hot-Rolled Structural Steel Wide-flange Shapes: Comply with ASTM A992. All other Hot-Rolled Structural Steel Shapes shall conform to ASTM A36 or A992.

1.2.2 Hollow Structural Sections: Rectangular, square, or round; comply with ASTM A500, Grade B.

1.2.3 Hot-Formed Welded and Seamless Carbon Steel Hollow Structural Sections in Round and Shapes: Comply with ASTM A501 Grade B.

1.2.4 Steel Pipe: Comply with ASTM A53.

1.2.5 Steel Members Fabricated from Plate or Bar Stock: Provide 42,000 psi min yield strength. Comply with ASTM A529 or ASTM A570.

1.2.6 Steel Members Fabricated by Cold Forming: Comply with ASTM A607, Grade 50.

1.2.7 Cold-Rolled Carbon Steel Sheet: Comply with requirements of ASTM A366 or ASTM A568.

1.2.8 Hot-Rolled Carbon Steel Sheet: Comply with requirements of ASTM A568 or ASTM A569.

1.2.9 Bolts, Nuts and Washers for Structural Framing: Comply with ASTM A325 for design loads and connection details.

1.2.10 Welding Materials: AWS D1.1; type required for materials being welded.

1.3 Submittals

1.3.1 Product Data: Submit manufacturer's specifications, anchor details and installation instructions for products used in miscellaneous metal fabrications, including paint products and grout.

1.3.2 Shop Drawings: Submit shop drawings for fabrication and erection of miscellaneous metal fabrications. Include plans, elevations and details of sections and connections. Show anchorage and accessory items. Provide templates for anchor and bolt installation by others.

1.3.2.1 Where materials or fabrications are indicated to comply with certain requirements for design loadings include structural computations, material properties and other information needed for structural analysis.

2.0 PRODUCTS

2.1 Materials: Ferrous Metals

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

2.1.2 Structural Steel Wide-Flange Shapes: ASTM A992.

2.1.3 All other structural steel shapes plate and bar: ASTM A36 or A992.

2.1.4 Provide bolts, washers and shims as required.

2.2 Paint

See Section 09900 – Painting

2.3 Fabrication, General

2.3.1 Workmanship: Use materials of size and thickness indicated or, if not indicated, as required to produce strength and durability in finished product for use intended. Work to dimensions indicated or accepted on shop drawings, using proven details of fabrication and support. Use type of materials indicated or specified for various components of Work.

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

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

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

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

2.3.2 Shop Painting

See Section 09900 – Painting

2.4 Rough Hardware

2.4.1 Furnish bent or otherwise custom fabricated bolts, plates, anchors, hangers, dowels and other miscellaneous steel and iron shapes as required for framing and support of other work and for anchoring or securing to concrete or steel.

3.0 EXECUTION

3.1 Preparation

3.1.1 Field Measurements: Take field measurements prior to preparation of shop drawings and fabrication, where possible. Do not delay Work progress; allow for trimming and fitting in the field where taking field measurements before fabrication may delay Work.

3.2 Installation, General

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

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

3.2.3 Fit exposed connections: Accurately together to form tight hairline joints. Weld connections which are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Grind exposed joints smooth and touch-up shop paint coat. Do not weld, cut or abrade the surfaces of exterior units which have been hot-dip galvanized after fabrication, and are intended to for bolted or screwed field connections.

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

3.3 Adjust And Clean

3.3.1 Touch-Up Painting: Cleaning and touch-up painting of field welds, bolted connections, and abraded areas of the shop paint on miscellaneous metal is specified in Section 09900 – Painting of this Specification.

END OF SECTION 05500

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SECTION 09900
PAINTING

PART 1 GENERAL

1.1 WORK INCLUDED

Work includes providing finishes for new structural and miscellaneous steel framing. This will also include all items necessary and reasonably incidental to the completion of the overall job. The work generally includes:

1.1.1. Prepare surfaces that are to receive finish.

1.1.2 Shop finish new steel, field touch-up for damaged coatings and field coating of field welded connection areas. Finish surfaces as indicated in schedule at end of this Section.

1.1.3 Color selection schedule.

1.2 RELATED WORK

1.2.1 Section: 05120 Structural Steel
05500 Metal Fabrications

1.3 QUALITY ASSURANCE

1.3.1 Product Manufacturer: Company specializing in manufacturing quality paints and finish products with 10 years' experience.

1.3.2 Applicator: Company specializing in industrial painting and finishing with 5 years' documented experience.

1.4 REFERENCES

1.4.1 ASTM D16 - Standard Terminology for Paint, Related Coatings, Materials, and Applications

1.5 DEFINITIONS

1.5.1 Conform to ASTM D16 for interpretation of terms used in this Section.

1.6 REGULATORY REQUIREMENTS

1.6.1 Conform to applicable code for flame/fuel/smoke rating requirements for finishes.

1.6.2 All coatings, thinners, etc. shall be lead and chromate free and VOC compliant. Volatile organic compounds per gallon of coating shall be limited to less than 3.5 pounds/gallon (preferably less than 2.8 pounds/gallon) in the coatings thinned, ready to apply state.

1.6 3 Zinc Dust Powder shall be ASTM D520, Type II Zinc Version.

1.7 SUBMITTALS

1.7.1 Submit product data under provisions of Appendix S – Submittals.

1.7.2 Provide product data on all finishing products.

1.7.3 Submit manufacturer's application instructions under provisions of Appendix S – Submittals.

1.7.4 Provide color samples.

1.8 DELIVERY, STORAGE AND HANDLING

1.8.1 Deliver products to site in a timely manner to avoid delays in construction.

1.8.2 Store and protect products from weather, extremes in temperatures and direct sun.

1.8.3 Paint materials shall be received in sealed original labeled containers, bearing manufacturer's name, type of paint, brand name, color designation and instructions for mixing and/or reducing.

1.8.4 Store paint materials at minimum ambient temperature of 45°F and a maximum of 90°F, in well-ventilated area, unless required otherwise by manufacturer's instructions.

1.8.5 Take precautionary measures to prevent fire hazards and spontaneous combustion.

1.9 ENVIRONMENTAL REQUIREMENTS

1.9.1 Ensure surface temperatures or the surrounding air temperature is above 50°F, below 90°F and a minimum of 5°F above dewpoint before applying finishes, unless manufacturers product data sheet allows for low temperature cure conditions.

1.9.2 Provide adequate continuous ventilation and sufficient heating facilities to maintain temperatures above 50°F for 24 hours before, during and 48 hours after application of finishes, unless required otherwise by manufacturer's instructions.

1.9.3 Do not apply exterior coatings during rain or snow, or when relative humidity is above 50%, unless required otherwise by manufacturer's instructions.

PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS - PAINT

2.1.1 Exterior Steel and Uninsulated Piping (new materials)

2.1.1.1 Three Coat System – Organic Zinc-Epoxy-Polyurethane

Blome International / PPG Protective & Marine Coatings (as represented by Blome Int'l.)

Shop Coatings:	Prime Coat	–	Amercoat 68HS
	First Coat	–	Amerlock 2 / 400
	Finish Coat	–	Amercoat 450H
Field Touch-Up:	Prime Coat	–	Amerlock 2 / 400
	First Coat	–	Amerlock 2 / 400
	Finish Coat	–	Amercoat 450H

2.1.1.2 Three Coat System – Organic Zinc-Epoxy-Polyurethane

Carboline

Shop Coatings:	Prime Coat	–	Carbozinc 859
	First Coat	–	Carboguard 890
	Finish Coat	–	Carbothane 134 HG
Field Touch-Up:	Prime Coat	–	Carboguard 890
	First Coat	–	Carboguard 890

2.1.1.3 Two Coat System – Epoxy-Polyurethane (if noted on drawings or specified elsewhere)

Blome International / PPG Protective & Marine Coatings (as represented by Blome Int'l.)

Shop Coatings:	Prime Coat	–	Amerlock 2 / 400
	Finish Coat	–	Amercoat 450H
Field Touch-Up:	Prime Coat	–	Amerlock 2 / 400
	Finish Coat	–	Amercoat 450H

Finish Coat – Carbothane 134 HG

2.1.2 Exterior Steel and Uninsulated Piping (existing materials, rusted)

2.1.2.1 Blome International / PPG Protective & Marine Coatings (as represented by Blome Int'l.)

Field Coatings: Prime Coat – Blome EC-2500
First Coat – Amerlock 2 / 400
Finish Coat – Amercoat 450H

2.1.2.2 Carboline

Field Coatings: Prime Coat – Rustbond or Rustbond FC
First Coat – Carboguard 60
Finish Coat – Carbothane 134 HG

2.1.3 Exterior Steel (galvanized touch-up)

2.1.3.1 Blome International / PPG Protective & Marine Coatings (as represented by Blome Int'l.)

Field Coatings: Prime Coat – Blome EC-2500
First Coat – Amerlock 2 / 400
Finish Coat – Amercoat 450H

2.1.3.2 Carboline

Field Coatings: Prime Coat – Rustbond or Rustbond FC
First Coat – Carboguard 890
Finish Coat – Carbothane 134 HG

2.1.4 Interior Steel (new)

2.1.4.1 Blome International / PPG Protective & Marine Coatings (as represented by Blome Int'l.)

Shop Coatings: Prime Coat – Amercoat 68HS

Field Touch-Up: Prime Coat – Amerlock 2 / 400

2.1.4.2 Carboline

Shop Coatings: Prime Coat – Carbozinc 859

Field Touch-Up: Prime Coat – Carboguard 890

2.1.5 Interior Concrete or Haydite Block Walls

2.1.5.1 Blome International / PPG Protective & Marine Coatings (as represented by Blome Int'l.)

Hole Repair: Repair Mortar – Blome 925

Field Coatings: Prime / Fill Coat – Amerlock 400 BF (Epoxy Block Filler)
First Coat – Aquapon WB Epoxy 98-1 Series (Waterborne Epoxy)
Second Coat (if required) – Aquapon WB Epoxy 98-1 Series (Waterborne Epoxy)

2.1.5.2 Carboline

Hole Repair: Repair Mortar – Carboguard 510

Field Coatings: Prime / Fill Coat – Sanitile 600 (Epoxy Block Filler)
First Coat – Sanitile 555 (Waterborne Epoxy)
Second Coat (if required) – Sanitile 555 (Waterborne Epoxy)

2.1.6 Interior Concrete or Haydite Block Walls – Chemical exposure areas

2.1.6.1 Blome International / PPG Protective & Marine Coatings (as represented by Blome Int'l.)

Hole Repair:	Repair Mortar	–	Blome 925
Field Coatings:	Prime / Fill Coat	–	Amerlock 400 BF (Epoxy Block Filler)
	First Coat	–	Aquapon WB Epoxy 98-1 Series (Waterborne Epoxy)
	Second Coat	–	Aquapon WB Epoxy 98-1 Series (Waterborne Epoxy)

2.1.6.2 Carboline

Hole Repair:	Repair Mortar	–	Carboguard 510
Field Coatings:	Prime / Fill Coat	–	Sanitile 600 (Epoxy Block Filler)
	First Coat	–	Sanitile 555 (Waterborne Epoxy)
	Second Coat	–	Sanitile 555 (Waterborne Epoxy)

2.1.7 Interior Structural Steel and Metal Wall Panels – Chemical exposure areas

2.1.7.1 Blome International / PPG Protective & Marine Coatings (as represented by Blome Int'l.)

Field Coatings:	Prime	–	Amerlock 2 / 400
	First Coat	–	Aquapon WB Epoxy 98-1 Series (Waterborne Epoxy)
	Second Coat	–	Aquapon WB Epoxy 98-1 Series (Waterborne Epoxy)

2.1.7.2 Carboline

Field Coatings:	Prime Coat	–	Carboguard 890
	First Coat	–	Sanitile 555 (Waterborne Epoxy)
	Second Coat	–	Sanitile 555 (Waterborne Epoxy)

2.1.8 Interior Metal Stud and Drywall Partition Walls – Chemical exposure areas

2.1.8.1 Blome International / PPG Protective & Marine Coatings (as represented by Blome Int'l.)

Field Coatings:	Prime Coat		
	-Metal Substrates	–	Pitt-Tech 90-712 Series
	-Previously Painted	–	Seal Grip 17-921 Series
	First Coat	–	Aquapon WB Epoxy 98-1 Series (Waterborne Epoxy)
	Second Coat	–	Aquapon WB Epoxy 98-1 Series (Waterborne Epoxy

2.1.8.2 Carboline

Field Coatings:	Prime Coat	–	Sanitile 120
	First Coat	–	Sanitile 555 (Waterborne Epoxy)
	Second Coat	–	Sanitile 555 (Waterborne Epoxy)

Substitutions: Owner will consider comparable products from the following manufacturers: Ameron, Tnemec and Sherwin Williams.

Contractor shall indicate weight of V.O.C. compounds per gallon as well as percent of zinc in dry film thickness on substitutions (any substitution should have a minimum of 80% zinc). Products must be V.O.C. compliant.

2.2 MATERIALS

2.2.1 Coatings: Ready mixed, except field catalyzed coatings. Ensure associated pigments and/or aggregate are free of clumps.

2.2.2 Coatings: Spray, squeegee, roller, trowel, and brush properties; capable of producing an installation meeting specification requirements.

2.2.3 Accessory Materials: Paint thinners and other materials not specifically indicated but required to achieve the finishes specified, of commercial quality.

2.3 FINISHES

2.3.1 Refer to schedule at end of Section for surface finish and color schedule.

PART 3 EXECUTION

3.1 INSPECTION

3.1.1 Thoroughly examine surfaces scheduled to be painted prior to commencement of work. Report in writing to Engineer any condition that may potentially affect proper application. Do not commence until such defects have been corrected.

3.1.2 Correct defects and deficiencies in surfaces which may adversely affect work of this Section.

3.1.3 Shop finish new structural steel, except around field welded connections.

3.1.4 Upon delivery of steel to the site, all surfaces shall be free of defects. Surfaces shall be inspected by the Construction Supervisor upon receipt and unloading. If defects are found, the Construction Supervisor shall determine the extent of the touch-up work will be done at Contractor's expense.

3.1.5 For field touch-up work Contractor shall notify the Construction Supervisor and allow him to inspect surfaces after cleaning and before primer or paint is applied.

3.2 PREPARATION FOR SHOP PAINTING

3.2.1 Correct minor defects and clean surfaces which affect work of this Section.

3.2.2 Remove grease, rust, scale, dirt and dust form steel and iron surfaces. Remove oil and grease with solvents, in compliance with Solvents, in compliance with SSPC-SP1-82, Solvent Cleaning. Prepare surfaces to be painted with a Commercial Blast SSPC-SP-10 achieving a 2 to 3 mil anchor profile, not to exceed 3.5 mils. Ensure steel surfaces are at the specified preparation level immediately prior to paint application.

3.3 PREPARATION FOR FIELD PAINTING

3.3.1 Correct minor defects and clean surfaces that affect work of this Section.

3.3.2 Remove grease, rust, scale, dirt and dust from steel and iron surfaces. Remove oil and grease with solvents, in compliance with SSPC-SP1-82, Solvent Cleaning. Prepare surfaces to be field painted to a hand or power tool cleaning in accordance with SSPC-SP-2 or 3. Feather edges to make touch-up patches inconspicuous. Ensure steel surfaces are at the specified preparation level immediately prior to paint application.

3.3.3 Remove electrical plates, hardware, light fixture trim and fittings prior to preparing surfaces or finishing.

3.3.4 Mask-off or shield all mill finish aluminum or items not to be painted.

3.3.5 Impervious Surfaces: Remove mildew by scrubbing with solution of tri-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.

3.3.6 Pervious (concrete or haydite block) Surfaces: Remove old paint and clean surface by 5000psi vacuum water blast method. Collect paint chips and blasting water for proper disposal. Coordinate disposal of existing lead based paints with the Plant EHS representative. Allow surface to dry. Fill holes with repair mortar prior to paint application.

3.4 PROTECTION

3.4.1 Protect elements surrounding the work of this Section from damage or disfiguration.

3.4.2 Repair damage to other surfaces caused by work of this Section.

3.4.3 Furnish drop cloths, shields, and protective methods to prevent spray or droppings from disfiguring other surfaces.

3.4.4 Remove empty paint containers from site.

3.5 APPLICATION

3.5.1 Apply products in accordance with manufacturer's instructions.

3.5.2 Do not apply finishes to surfaces that are not dry.

3.5.3 Apply each coat to uniform finish.

3.5.4 Apply each coat of paint slightly darker than preceding coat unless otherwise approved.

3.5.5 Allow applied coat to dry before next coat is applied.

3.5,6 Contractor shall notify Ameren Missouri one day prior to applying the primer and each coat of paint. Ameren Missouri shall have the Construction Supervisor and/or a Technical representative from the painting manufacture inspect the application of each coat of paint.

3.5.7 Sand down and repaint sags and other deficiencies.

3.5.8 Strictly observe materials stated pot life. Discard mixed materials beyond their pot life.

3.6 CLEANING

3.6.1 As work proceeds, promptly remove paint where spilled, splashed, or spattered.

3.6.2 During progress of Work maintain premises free of unnecessary accumulation of tools, equipment, surplus materials, and debris.

3.6.3 Collect cotton waste, cloths and material which may constitute a fire hazard, place in closed metal containers, and remove daily from site.

3.7 PAINT SCHEDULE

3.7.1 Shop paint structural steel and piping as follows:

AREAS & ITEMS TO BE PAINTED	PRIME COAT	FIRST COAT	FINISH COAT	COLOR
All new structural steel, including miscellaneous plates, angles, etc. and uninsulated piping. NOTE: All back-to-back angles shall be blasted and primed prior to fabrication and full primer application.	3-5 mils DFT	4-5 mils DFT (exterior only)	2-3 mils DFT (exterior only)	Medium Gray (Carboline C703) (PPG C703)
Two coat paint system on all new structural steel, including miscellaneous plates, angles, etc. and uninsulated piping. NOTE: All back-to-back angles shall be blasted and primed prior to fabrication and full primer application.	6-8 mils DFT	NONE	2-3 mils DFT (exterior only)	Medium Gray (Carboline C703) (PPG C703)
Grating, grip strut, checker plate (Galvanized)				
Ladders, handrails, bumper posts & toe plates	3-5 mils DFT	4-5 mils DFT	2-3 mils DFT (exterior only)	ANSI Safety Yellow (Carboline 6666) (PPG 6666)

3.7.2 Field touch-up paint structural steel and piping as follows:

AREAS & ITEMS TO BE PAINTED	PRIME COAT	FIRST COAT	FINISH COAT	COLOR
Touch-up for field welded connections and other damaged areas.	5 mils DFT	5 mils DFT	2-3 mils DFT (exterior only)	Match colors as applicable.

3.7.3 Field paint exterior structural steel and piping (existing, rusted) as follows:

AREAS & ITEMS TO BE PAINTED	PRIME COAT	FIRST COAT	FINISH COAT	COLOR
All existing exterior structural steel, including miscellaneous plates, angles, etc.	1.5 mils DFT	5 mils DFT	2-3 mils DFT or 3-5 mils DFT	Match colors as applicable.

3.7.4 Field paint interior concrete / haydite block as follows:

AREAS & ITEMS TO BE PAINTED	PRIME COAT	FIRST COAT	SECOND COAT	COLOR
All new and/or existing concrete or haydite block walls	20 mils DFT	3-4 mils DFT	3-4 mils DFT	As selected by Plant

3.7.5 Field paint interior concrete or haydite block walls – Chemical exposure areas as follows:

AREAS & ITEMS TO BE PAINTED	PRIME COAT	FIRST COAT	FINISH COAT	COLOR
All new or existing interior concrete or haydite block walls in chemical exposure areas	2 - 20 mils DFT	3 - 4 mils DFT	3 – 4 mils DFT	Match colors as applicable.

3.7.6 Field paint Interior structural steel and metal wall panels – Chemical exposure areas as follows:

AREAS & ITEMS TO BE PAINTED	PRIME COAT	FIRST COAT	SECOND COAT	COLOR
All new or existing interior structural steel or metal panel walls in chemical exposure areas.	4 – 6 mils DFT	3-4 mils DFT	3 - 4 mils DFT	As selected by Plant

3.7.7 Field paint Interior metal stud and drywall partition walls – Chemical exposure areas as follows:

AREAS & ITEMS TO BE PAINTED	PRIME COAT	FIRST COAT	SECOND COAT	COLOR
All new or existing interior metal stud and drywall partition walls in chemical exposure areas.	1 – 2 mils DFT	3-4 mils DFT	3 - 4 mils DFT	As selected by Plant

3.8 WARRANTY

3.8.1 Contractor shall warrant his work to be free from all defects in material and workmanship for a period of five years from the date of written acceptance by Ameren Missouri.

3.8.2 Warranty shall cover the prepared existing coatings and new coatings (i.e., from steel substrate out). Warranty shall be based on zero percent (0%) failure rate. Warranties based on percentage failure per year, or which are prorated or conditional warranties, shall be deemed unacceptable.

3.8.3 As a portion of the Contract covering the work of this specification, Contractor shall be responsible for correction of all coating's defects and failures. All repairs shall be scheduled and completed within four (4) months of written Contractor notification of required repairs.

3.8.4 All required repairs shall be in accordance with the provisions of the original coatings work.

PART 4 CLEAN-UP

4.1. All project and plant generated wastes/debris shall be and remain unmixed and separate.

4.2 Blast and coating residue shall be removed from the enclosure to the appropriate waste storage containers daily unless otherwise directed by the Construction Supervisor.

4.3 Provide prompt removal and proper disposal of all Contractor generated debris and trash as required, maximum weekly interval.

4.4 Remove all tools, surplus materials, equipment, scrap, debris, and waste from the plant site immediately upon completion of the project.

4.5 Blast wastes may remain on site until proper waste classifications is determined. Blast/paint residue shall be removed within one week of the receipt of analytical data.

4.6 Contractor generated solvent wastes and coatings application waste is the sole responsibility of Contractor. All such wastes shall be managed by Contractor in accordance with the appendix.

4.7 Correct and restore to original condition any property and equipment damaged as a result of project operations.

END OF SECTION 09900

SECTION 15565
RECIPROCATING GAS COMPRESSORS AND ANCILLARY EQUIPMENT

PART 1 – GENERAL

1.1 SCOPE OF SUPPLY

The Work as defined in this Section includes all items necessary and reasonably incidental to the completion of the overall job, whether specifically defined or not. The Work generally includes the following items:

1.1.1 The Supplier shall size, furnish, and deliver to the job site to supply four (4) fully functional skid mounted motor driven reciprocating compressor packages, complete with all accessories as specified and as necessarily required for a complete installation.

1.1.2 The Contractor shall provide for all shop testing of the supplied equipment as defined in this Section and as defined elsewhere in this Specification.

1.2 QUALITY ASSURANCE AND REFERENCES

1.2.1 The design, fabrication, and testing of the materials, components, and equipment (the Work) as defined in this Section shall be done in accordance with the codes and standards as listed below. Unless otherwise specified, the applicable governing edition and addenda to be used for all referenced 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 or addenda in effect at the date of this Specification shall apply. These references shall govern the work except where there is a conflict with the Owner's specifications. In the case of a conflict the Supplier shall contact the Owner for resolution.

1.2.1.1. ANSI – American National Standards Institute

1.2.1.2. ASME – American Society of Mechanical Engineers

1.2.1.3. ASTM – American Society for Testing and Materials

1.2.1.4. AFBMA – Anti-Friction Bearing Manufacturer's Association

1.2.1.5. CAGI – Compressed Air & Gas Institute

1.2.1.6. NEMA – National Electric Manufacturers Association

1.2.1.7. ISA – Instrument Society of America (ISA)

1.2.1.8. API – American Petroleum Institute

1.2.1.9. AWS – American Welding Society

1.2.2 Equipment bid and supplied by the Supplier shall have satisfactory proven performance in similar type installations in the United States.

PART 2 – PRODUCTS

2.1 GENERAL

2.1.1 The gas compressors shall be of the oil-flooded, reciprocating type directly connected to an electric motor driver.

2.1.2 Each gas compressor and motor driver shall be mounted on a common baseplate.

2.1.3 The gas compressors shall be of the heavy-duty type designed and constructed to operate at the continuous rated load or any partial load over the designed lifetime of the equipment with minimum maintenance required and maximum reliability.

2.1.4 The gas compressors shall be designed and constructed for the most severe service conditions under which the units will be required to operate. All materials of construction shall be suitable for the specified service and identified with ASTM or ANSI standard numbers.

2.1.5 The equipment manufacturer/packager shall be responsible for assuring that each compressor and driver combination operates in dynamic balance as a unit without undue vibration.

2.1.6 The gas compressors will be installed inside a heated building.

2.1.7 Site Conditions and Operating Points:

2.1.7.1 Gas Analysis:

	Min	**Max**
Gas Property		
Specific Gravity	0.5815	0.5882
Heating Value (HHV)	1007	1027
Pressure	290 psig	590 psig
Temperature	60° F	100° F
Gas Component	% Mole	% Mole
C6+	0.0003	0.0043
Propane	0.0432	0.2256
I-Butane	0.0016	0.1340
N-Butane	0.0021	0.0297
I-Pentane	0.0	0.0046
N-Pentane	0.0	0.0
Nitrogen	0.2794	0.6211
Methane	94.5337	96.2189
CO2	1.0521	1.7796
Ethane	1.7146	3.4961

The gas supplier posts a daily Gas Sample Analysis on their website. The gas analysis can be found at: https://pipelines.energytransfer.com/ipost/MRT/gas-quality/egt-daily samples-report. The report associated with the new Energy Center is MRT M/L @ MERAMEC_STR 3.

2.1.7.2 Operating Points:

Table 2.1.7.2 – Operating Points

	Units	Minimum	Normal Minimum	Maximum	Design Point
Suction Pressure Range	psig	250	295	365	295
Suction Temperature	°F	60	60	100	80
Suction Flow(1)	#/hr	0	52,920	88,200	88,200
Discharge Pressure Range	Psig	490	490	500	500
Discharge Temperature Range	°F	45	45	125	120
Discharge Flow(1)	#/hr	0	52,920	88,200	88,200
Ambient Temperature Design Point	°F	---	---	---	95
Rate of Gas Flow Change	#/s/min	0	1	4	---
Horsepower	hp	(2)	(2)	(2)	(2)

1) Minimum flow shown is normal minimum, but the cooling system shall be designed to handle 100% recirculation. The flow control system shall be designed for operation from 100% recirculation to 0% recirculation and meet pressure, flow and steady state pressure regulation requirements.
2) Provided by the Supplier.

2.1.8.2 Guarantee Points

2.1.8.2.1 The Supplier shall include with his proposal guarantee commitments for efficiency, capacity, and horsepower at each design point (operating point) listed in Paragraph 2.1.7.2.

2.1.8.2.2 The guaranteed figures shall be submitted as specific values.

2.1.8.2.3 If a plus or minus range is offered, the least efficient value shall become the Supplier's guarantee commitment.

2.1.8.2.4 The combined efficiency of all design points, as documented by the field test, shall determine guarantee compliance and/or the percent efficiency deviation.

2.1.8.2.5 The efficiency number shall be rounded off in tenths of a percent.

2.1.8.2.6 Maximum Permissible Noise Levels:

1. Impulsive noise shall not exceed the OSHA limit of 140 dB peak, sound pressure level.

2. Steady state and interrupted steady state sound levels shall be limited to 90 dBA or less.

3. The noise levels shall be for all accessible areas of the equipment being furnished at a three-foot distance from its periphery.

2.1.8.2.7 Reference Paragraph 2.3.6 for oil carry-over limitations and requirements.

2.1.8.3 Site Environmental Design Conditions

Table 2.1.8.3 – Site Design Conditions

Parameter	Value
Minimum Ambient Design Temperature:	-20° F
Maximum Ambient Design Temperature:	125° F
Relative Humidity Range:	0 to 100%
Site Elevation:	423 ft
Wind Risk Category:	III
Wind Exposure:	C
Basic Wind Speed:	120 mph

Seismic Criteria (per IBC 2015 / ASCE 7-10):	S_s = 0.48g, S_1 = 0.18g
Seismic Importance Factor:	I_E = 1.25
Seismic Stie Class:	Class E, S_{DS} = 0.544, S_{D1} = 0.384
Seismic Design Category:	SDC = D
Snow Load:	20 psf
Snow Importance Factor:	I_S = 1.10
Ice Load (per IBC 2015 / ASCE 7-10):	1 in.
Concurrent Temperature:	5° F
Gust Speed:	40 mph

2.2 GAS COMPRESSOR CHARACTERISTICS

2.2.1 General Requirements

2.2.1.1 Flanged connections for the suction and discharge nozzles shall conform to the dimensions and finishes as specified in ANSI standards appropriate for the specified design conditions of the equipment.

2.2.1.2 All flange bolt holes shall straddle the horizontal and vertical center lines of the equipment.

2.2.1 Compressor Component Requirements

2.2.1.1 The compressor shall be furnished with an accessible shaft, running at the same RPM as the compressor, for compressor analyzer hook-up.

2.2.1.2 Distance pieces shall conform to API 618 Type B. Distance piece drains shall be connected to a common header and piped to a drain pot.

2.2.1.3 The drain pot shall be equipped with a drain valve located at skid edge, a level gauge, and a vent connection.

2.2.1.4 Distance piece vents shall be connected into a common header and terminated at the edge of the skid. The drain pot vent shall tie into this header.

2.2.1.5 Packing vents shall be connected via a local three-way valve to a common vent header. The three-way valve shall have a drilled hole in valve handle so that the valve position can be “locked” open to the common vent header.

2.2.1.6 The common vent header shall be terminated at the edge of the skid. Each package shall have an individual vent system.

2.2.1.7 Indicator valves shall be installed on the compressor cylinders on the head ends and crank ends.

2.2.1.8 All compressor cylinders shall have spacers installed between the flanges and the bottles, which can be exchanged for orifices, should they be needed in the future.

2.2.1.9 All cylinder components including valves, seats, seals, and rings shall be suitable for high temperature service.

2.2.1.10 Unloaders shall be pneumatically operated.

2.2.1.11 Crankcase shall come equipped with a relief device with flame arrester per API 618.

2.2.1.12 Vibration switches shall be included.

2.2.1.13 The crank end and head end of each cylinder shall be equipped with a 1/2” pressure monitor port for performance monitoring. Each pressure port shall include a Kiene Model KN-22 indicator valve for service temperatures over 250°F, or CV-72 for service temperatures below 250°F. All Kiene valves shall be complete with a POS-I-SEAL cap.

2.2.2 Baseplate or Mounting Skid Requirements

2.2.2.1 The skid shall be designed and constructed with adequate stiffness and strength so equipment can be mounted flat with no movement, bending, or twisting during operation and/or shipment.

2.2.2.2 The skid should provide sufficient mass to help counteract unbalanced forces and couples.

2.2.2.3 The skid shall be designed to be installed on a full length and width flat/level concrete foundation or pad.

2.2.2.4 The skid shall be constructed with multiple full skid length continuous heavy-duty standard wide flanged structural steel beams.

2.2.2.5 All flange-to-flange welds shall be full penetration, single V grove welds. All web to web and web to flange welds are to be seal welded.

2.2.2.6 The beams shall be crossed braced and have gussets at all supports points.

2.2.2.7 All major equipment shall be mounted on full depth steel members.

2.2.2.8 Skid open areas shall be covered with 5/16” (minimum) non-skid diamond floor plate that is seal welded on the top of the skid.

2.2.2.9 The skid decking shall include 12” minimum diameter access plates to accommodate grouting of skid without having to cut deck plating.

2.2.2.10 No piping, tubing or conduit should be located below floor plate without Owner approval.

2.2.2.11 The skid shall be equipped with a pollution ring (2” lip around top perimeter of skid) and four corner sumps to contain all runoff on the skid.

2.2.2.12 The sump openings should be covered with removable grating.

2.2.2.13 The sumps shall be piped together with a single lockable valve discharge point or two discharge points, one on each side.

2.2.2.14 The skid shall include appropriately designed and located hold down bolt holes.

2.2.2.15 A leveling jacking bolt shall be provided adjacent to each hold down bolt hole to allow leveling of the skid prior to grouting.

2.2.2.16 All bolt holes shall be drilled. The burning of bolt holes is not permitted.

2.2.2.17 The skid shall be sufficiently sized to accommodate mounted equipment. No on-skid equipment shall extend beyond perimeter of skid.

2.2.2.18 Access to equipment shall not be obstructed by items such as piping, tubing, conduit, or structural supports.

2.2.2.19 There shall be sufficient room for normal maintenance such as piston removal, filter replacement, removal of heat exchanger tube bundles or pump/motor removal and reinstallation.

2.2.2.20 Major equipment shall be located on the skid such that it can be easily maintained or removed without interference from other equipment, piping, conduit, etc.

2.2.2.21 Unless directed otherwise in this Specifications, all process, auxiliary, drain, and vent lines shall be run to edge of skid and terminate with a flanged connection.

2.2.2.22 The equipment manufacturer’s required rotating equipment mounting and alignment requirements shall be clearly identified in the submittal data.

2.2.3 Compressor Driver

2.2.3.1 The driver (motor) shall be provided and mounted by the compressor manufacturer/packager. All shims required for pump/driver alignment shall be stainless steel.

2.2.3.2 The driver (motor) shall comply with the requirements as defined in Section 16061.

2.3 ANCILLARY EQUIPMENT

2.3.2 Couplings and Guards

2.3.2.1 Couplings covered by this Specification shall be designed, fabricated, inspected, and tested in accordance with API Standard 618, except as modified in this Section and individual data sheets.

2.3.2.2 Couplings shall be non-lubricated, flexible, steel disc type.

2.3.2.3 Coupling shall have a minimum rating of 200% of the rated motor horsepower.

2.3.2.4 All couplings and coupling hubs shall be removable without major equipment removal/relocation.

2.3.2.5 Bolting Considerations - The bolts shall be individually weight balanced to +/-0.1 gram of each other.

2.3.2.6 Gear couplings are not allowed.

2.3.2.7 An assembly balance shall be performed on the coupling assembly and the components shall be match marked. Balance holes are not allowed without written approval from the Owner.

2.3.2.8 Coupling Accessories

2.3.2.8.1 The prime equipment supplier shall furnish the necessary pump(s), hose and fittings, pressure gages, instructions on mounting fixture tools, and a recommendation as to the hydraulic fluid required for the installation and removal of hydraulically fitted coupling hubs.

2.3.2.8.2 The tubing or hose fittings that are employed should be of the standard type that are readily available at normal supply houses.

2.3.2.9 A calculation, or diagram, showing the direction and magnitude of shaft(s) axial and radial growth for all operating conditions, complete with a schematic of the shaft anchor points (thrust bearings) and equipment anchor points shall be provided. The coupling selected for each shaft connection shall have maximum allowable axial growths that are at least 20 percent in excess of the calculated growth values. These values shall be shown on the documentation.

2.3.2.10 The prime equipment packager shall have the coordination responsibility for the supply of all coupling guards in the equipment train.

2.3.2.11 Whenever possible, flanged cylindrical shell guards are required.

2.3.2.12 Guards shall be designed for dry flexible disk couplings so that guard skin temperature does not exceed 150°F at maximum continuous speed.

2.3.2.13 The guards shall be connected on the fixed end by a minimum of four (4) bolts.

2.3.2.14 The guards shall be axially split in such a manner that they can be removed without dismantling any other parts of the driver or driven machine.

2.3.2.15 All guards shall be painted safety yellow.

2.3.3 Pulsation Bottles

2.3.3.1 General Acoustic Design Requirements

2.3.3.1.1 An acoustic analysis shall be performed on all reciprocating gas compression equipment.

2.3.3.1.2 Pulsation bottles and support systems shall be designed in conformance with the design recommendations from a Company approved “analysis modeling firm” using API 618 Approach 3.

2.3.3.1.3 The analysis shall be performed using analog or digital software modeling techniques. At a minimum, the scope of the analysis shall include all on-skid piping and pulsation bottles.

2.3.3.1.4 The analysis shall include:

2.3.3.1.4.1 Pulsation and Performance (Acoustic) Analysis per API 618. Mechanical Analysis per API 618.

2.3.3.1.4.2 In conjunction with the API 618 Approach 3 analysis, the “Analysis Modeling Firm” shall perform an API 618 analysis on the piping system subjected to process gas temperatures of greater than 120° F.

2.3.3.2 Performance Requirements – The performance of the pulsation bottle designs shall achieve an installed compressor system capable of meeting or exceeding the following guidelines:

2.3.3.2.1 Peak-to-peak pulsation levels and unbalanced shaking forces shall be within API allowable limits.

2.3.3.2.2 Pulsation bottle pressure drop (loss) shall not exceed 1% of the process gas pressure.

2.3.3.2.3 System component design vibration level in any direction shall not exceed the most stringent of the following velocity or displacement limits:

Compressor Frame:	0.3 in/sec or 5 mils peak to peak.
Compressor Cylinders:	0.4 in/sec or 7 mils peak to peak.
Process Piping:	0.5 in/sec or 10 mils peak to peak.

2.3.3.3 Analysis Report – A final report of the acoustical analysis shall be prepared and shall include summary of the project, a detailed description of the analysis methods used, the expected pulsation bottle performance, conclusions, and recommendations.

2.3.3.4 Mechanical Design Requirements

2.3.3.4.1 Preference is for Volume-Choke-Volume type pulsation bottles.

2.3.3.4.2 Pulsation bottles shall be designed, fabricated, tested, and code stamped in conformance with the ASME Boiler and Pressure Vessel Code Section VIII Division 1.

2.3.3.4.3 National Board numbers are required.

2.3.3.4.4 Minimum design metal temperature shall be -20° F.

2.3.3.4.5 The minimum reinforcing pad diameter shall be 1.75 times nozzle diameter for outlets greater than NPS 4 and 2.0 times nozzle diameter for NPS 4 and smaller outlets.

2.3.3.4.6 The minimum reinforcement pad thickness shall be 0.500-inch; reinforcement pads having a thickness less than 0.500-inch must be approved by the Owner in writing. Reinforcing pads shall have a 1/2-inch diameter vent hole.

2.3.3.4.7 Full radiography shall be performed as defined in ASME Boiler and Pressure Vessel Code Section VIII Division 1 Paragraph UW-11.

2.3.3.4.8 Inspection openings, drains, pressure gauge connections, and thermometer wells shall be Class 6000# minimum, ASTM A105 forged steel half couplings with hex-head plugs NPS 2 or smaller.

2.3.3.4.9 The following connection ports shall be included on the pulsation bottles as a minimum:

Quantity	Description
1	1/2-inch connection (half coupling) on each compressor nozzle for temperature (RTD)
1	3/4-inch connection (half coupling) on each compressor nozzle for pressure ports
1	1/2-inch connection (half coupling) on the bottle main inlet/outlet nozzle for test port
1	1-inch drain (half coupling) on the bottom of each end of the bottle
1	2-inch inspection port on the bottle head end
1	1-inch inspection port centered for each chamber; also serves as test ports
1	1-inch vent port on the top of each bottle

2.3.3.4.10 Each pulsation bottle shall be provided with a lifting eye on each side of the bottle.

2.3.3.4.11 Approval drawings for the pulsation bottles shall be submitted per the requirements defined in Appendix S – Submittals of this Specification.

2.3.3.5 Fabrication Requirements

2.3.3.5.1 Tolerances

2.3.3.5.1.1 Fabrication tolerances shall be maintained after stress relief.

2.3.3.5.1.2 Cylinder flange raised faces can be machined after stress relief to meet the specified tolerances.

2.3.3.5.1.3 Maximum flange tilt shall be 1/4° for cylinder flanges and 1/2° for other flanges.

2.3.3.5.1.4 The centerline of each cylinder nozzle shall be within 1/16-inch of the dimension from the work line.

2.3.3.5.1.5 The height difference of cylinder nozzles shall be ±1/32-inch.

2.3.3.5.1.6 Longitudinal seam-to-seam dimensions shall be within ±1/4-inch.

2.3.3.5.2 Preheating for Welding – Preheating to 250° F minimum immediately before welding shall be required if any of the following conditions exist:

2.3.3.5.2.1 The carbon content of the steel exceeds 0.32%.

2.3.3.5.2.2 The carbon equivalent (CE) of the steel exceeds 0.42 percent per the equation CE= C%, + %Mn/6.

2.3.3.5.2.3 The wall thickness exceeds 0.450 inch.

2.3.3.5.2.4 The ambient temperature is lower than 40° F.

2.3.3.5.2.5 Shielded metal arc welding is conducted with cellulosic electrodes.

2.3.3.5.2.6 Welding is interrupted.

2.3.3.5.2.7 Before repair welding.

2.3.3.5.2.8 When reinforcing pads or saddles are welded to the bottle shell.

2.3.3.5.3 Welding

2.3.3.5.3.1 When the shell consists of two or more cylinders with longitudinal weld seams, the seams shall be positioned at least 45° apart.

2.3.3.5.3.2 Longitudinal and circumferential welds in the shell shall be separated from nozzles, couplings, and reinforcing pads by at least 4-inches.

2.3.3.5.3.3 Internals shall be attached to the shell using full penetration welds.

2.3.3.5.3.4 Seal welding of threaded connections is prohibited.

2.3.3.5.3.5 Welding back-up rings are prohibited.

2.3.3.5.3.6 Permanent stamping of the vessel shall only be conducted with U-shaped or dot interruptible low stress stamping dies.

2.3.3.5.3.7 Welds shall have a workmanlike appearance free of undercutting, craters, and arc burns.

2.3.3.5.3.8 Couplings shall be plugged during welding and threads shall be chased after welding.

2.3.3.5.3.9 Where fillet welds attach a reinforcing pad to the shell or head, the weld toe adjacent to the shell or head shall be contour ground to remove slag and undercut to provide a smooth contour.

2.3.3.5.4 Stress Relieving

2.3.3.5.4.1 Pulsation bottles shall be stress relieved, regardless of thickness.

2.3.3.5.4.2 Stress relief heating and cooling rates, hold time, and temperature shall be in conformance with ASME Section VIII Division 1 Paragraph UCS-56.

2.3.3.5.5 Nameplates

2.3.3.5.5.1 Pulsation bottles shall be provided with a stainless steel identification nameplate permanently attached.

2.3.3.5.5.2 Nameplates shall contain information as required by ASME Section VIII Code.

2.3.3.5.5.3 Nameplates shall include the year built, design pressure (psig), hydrostatic test pressure (psig), manufacturer's name, and Company purchase order number.

2.3.3.5.5.4 Units on nameplates shall be US customary.

2.3.3.5.6 Preparation for Shipment

2.3.3.5.6.1 The vessel shall be cleaned, dried, and blown out with air.

2.3.3.5.6.2 Flanges shall be protected during shipment with bolt-on covers.

2.3.3.5.6.3 Couplings shall have hex head plugs installed.

2.3.3.5.7 Nondestructive Examination Requirements

2.3.3.5.7.1 ASME Code vessels shall be examined in conformance with ASME Boiler & Pressure Vessel Code Section VIII Division 1.

2.3.3.5.7.2 Technicians performing nondestructive testing shall have Level II certifications in the test method per ASNT SNT-TC-1A.

2.3.3.5.7.3 A Level III individual, nationally certified per ASNT SNT-TC-1A in the specific NDE test method, shall write the inspection procedures.

2.3.3.5.7.4 Technicians shall conduct inspections in conformance with these written procedures.

2.3.3.5.7.5 Single-wall x-radiography shall be the preferred method of examination.

2.3.3.5.7.6 Kodak AA, Agfa D7, or other film with equal or lower relative film speed and lead screens shall be used for single-wall x-radiography.

2.3.3.5.7.7 Kodak M, Agfa D4, or other film with equal or lower relative film speed and lead screens shall be used for double-wall x-radiography and all gamma radiography.

2.3.3.5.7.8 The developed radiographs shall have a density between 2.0 and 3.8 in the weld.

2.3.3.5.7.9 Iridium gamma radiation shall not be used for wall thicknesses less than 3/8-inch.

2.3.3.5.7.10 Cobalt gamma radiation shall not be used for wall thicknesses less than one inch.

2.3.3.5.7.11 Oblique radiography shall only be used on pipe butt welds up to NPS 3.

2.3.3.5.7.12 If the radiation source is external, a minimum of three exposures shall be used on pipe butt welds NPS 8 or less and a minimum of four exposures shall be used on pipe butt welds over NPS 8.

2.3.3.5.7.13 Welds that are not examined by radiography (other than internal components) shall be examined by ultrasonic or magnetic particle methods.

2.3.3.5.7.14 The minimum hydrostatic test pressure shall be 1.5 times design pressure.

2.3.3.5.7.15 Minimum holding time for hydrostatic tests shall be four hours.

2.3.3.5.7.16 Pressure and Temperature test charts shall be kept and furnished to the Owner's inspector.

2.3.3.5.8 Choke Tube Design Requirements

2.3.3.5.8.1 Internal choke tubes, if used, shall be supported so that they accommodate choke tube growth without causing unacceptable thermally induced bending stress.

2.3.3.5.8.2 The support design shall:

1. Consider the difficulty of welding supports in place.
2. Prevent cracking (which could render the support ineffective and propagate into the shell).

2.3.3.5.8.3 The design shall specify only pre-bent straps, 1/2-inch thick, oriented so that growth of the choke will bend the strap through the thickness (not through the width), and concave to whatever end is accessible to the welder.

2.3.3.5.8.4 The choke-to-strap weld shall be performed before the baffle is welded to shell. Said weld shall be full penetration, with small equal leg fillet weld all around (to minimize stress concentration).

2.3.3.5.8.5 Final weld of strap to shell weld shall be a single-sided full penetration TIG, producing maximum burn through (~3/16-inch projection on back side), followed with 3/16-inch fillet weld all around (subject to access to back side).

2.3.3.5.8.6 Unless otherwise specified, two straps at 30° below horizontal (120° included angle) shall be used for chokes less than 5 feet.

2.3.3.5.8.7 For locations where resonance of longer chokes is a concern, three straps at 120° spacing shall be used.

2.3.3.5.8.8 When using two straps, the width of choke tube support straps shall be 3/8 of the choke tube diameter or greater.

2.3.3.5.8.9 When using three straps, the width of choke tube support straps shall be 1/4 of the choke tube diameter or greater.

2.3.4 Lube Oil System

The Supplier shall provide a full lube oil system for the motor, cylinders, and compressor frame for each unit. Components of the lube oil system to include:

2.3.4.1 Cooling in the form of either a shell and tube heat exchanger or Fin- Fan Cooler for remote installation/piping by the end user.

2.3.4.2 Lubrication oil day tank(s) to be shipped loose. Lube oil system shall integrate with these tanks. The lubrication oil day tanks and the interconnection piping will be installed by others.

2.3.4.3 Level switches to be provided by Vendor for installation on day tanks.

2.3.4.4 Electric pre and post lube oil pumps.

2.3.4.5 Strainers and Filters with differential pressure switches.

2.3.4.6 Sample tap with valve and plug upstream and downstream of the LO Filter.

2.3.4.7 These sample locations shall also be downstream of the LO pump.

2.3.4.8 Kenco (or approved equal) level controller.

2.3.4.9 Lubricator reservoir heating device with thermostatic control

2.3.4.10 Metering

2.3.4.11 Force feed T.F. Hudgins (or approved equal) lubricator pump and system driven by crankshaft.

2.3.4.12 Distribution block.

2.3.4.13 Rupture discs.

2.3.4.14 Check valves.

2.3.4.15 No-flow switch.

2.3.4.16 Compressor lube oil temperature 3-way control valve(s), to be self-contained.

2.3.5 Cylinder/Jacket Water Cooling System

The Supplier shall provide a full cylinder cooling system for each unit. Components of the cooling water system to include:

2.3.5.1 Aerial fin fan cooler(s) w/hail guard and no louvers. Belt-driven, galvanized frame, painted headers, preference for two fans. This unit will be installed outside.

2.3.5.2 Pumps

2.3.5.3 Cooling water day tank with level gauge and level switch shall be shipped loose. The cooling water day tanks and the interconnection piping will be installed by others.

2.3.5.4 A 50/50 solution of water and ethylene glycol will be used as the cooling medium.

2.3.5.5 Compressor cylinder cooling water temperature 3-way control valve(s) to be self-contained.

2.3.6 Oil Carryover Removal

Utilization of an oil lubricated compressor that may pass hydrocarbon / lube oil mists downstream are permitted for heavy duty gas turbines, but only with a series of requirements as defined below.

2.3.6.1 The gas compressor package shall incorporate a two-stage oil separating system with the oil carry over designed and demonstrated to not exceed 3 ppmw.

2.3.6.2 An additional after-filter, capable of reliability filtering out oil carry-over to less than 0.05 ppmw (50 ppb), shall be provide for installation downstream of the compressor package.

2.3.6.3 Mechanical Design Requirements for Filters.

2.3.6.3.1 After-filter housings shall be designed, fabricated, tested, and code stamped in conformance with the ASME Boiler and Pressure Vessel Code Section VIII Division 1.

2.3.6.3.2 National Board numbers are required.

2.3.6.3.3 Minimum design metal temperature shall be -20° F.

2.3.6.3.4 The minimum reinforcing pad diameter shall be 1.75 times nozzle diameter for outlets greater than NPS 4 and 2.0 times nozzle diameter for NPS 4 and smaller outlets.

2.3.6.3.5 The minimum reinforcement pad thickness shall be 0.500-inch; reinforcement pads having a thickness less than 0.500-inch must be approved by the Owner in writing. Reinforcing pads shall have a 1/2-inch diameter vent hole.

2.3.6.3.6 Full radiography shall be performed as defined in ASME Boiler and Pressure Vessel Code Section VIII Division 1 Paragraph UW-11.

2.3.6.3.7 Filter housings shall be provided with lifting eyes/lugs.

2.3.6.3.8 Approval drawings for the filter housings shall be submitted per the requirements defined in Appendix S – Submittals of this Specification.

2.3.7 Control System and Instrumentation Requirements

2.3.7.1 The compressor package shall be provided with a failsafe, energized, PLC based control system. The control system shall include the following:

1. Local Control Panel (LCP) in a free standing NEMA 4 enclosure purged to meet the area classification (Class 1, Division 1, Gas Group C&D). The LCP shall be shipped loose to be installed by others near the compressor package.
2. The LCP shall have front access with an HMI mounted in the door. The PLC, interface relays and terminals shall be back panel mounted.
3. The operator interface (HMI) shall be a touch screen color display panel.
4. The remote I/O modules shall be installed in NEMA 4 enclosures mounted on the skid for connection to the LCP using a data communication cable.
5. Compressor vibration, compressor bearing temperatures, drive motor vibration, drive motor bearing temperature, and drive motor winding temperatures shall be monitored by the PLC in the LCP.

6. On skid instrumentation shall be wired to the remote I/O modules installed in skid mounted junction boxes.

2.3.7.2 The Programable Logic Controller (PLC) shall be supplied with a CPU, power supply, and communications link. The I/O modules shall include discrete inputs, discrete outputs, 4-20 mA analog inputs, RTD inputs, and 4-20 mA analog outputs.

The control system shall automatically monitor and control the seal, lubrication, and process systems and provide start/stop commands for the main driver and ancillary systems. The control system shall allow the compressor to start or to continue to operate only if certain key machine parameters are within acceptable limits. The HMI shall indicate if any monitored parameter exceeds the set point. If the parameter is critical to the health and continued operation of the equipment the compressor shall shut down automatically.

The PLC shall provide compressor operation with pressure control (control of the compressor package discharge pressure), gas recirculation, and logic for start/stop function, alarm monitoring, and tripping of the compressor.

2.3.7.3 The PLC shall include an Ethernet Modbus TCP/IP communication link for data to the plant DCS. All values monitored by the PLC shall be available for display, trending, and archiving by the DCS. The status of all alarms and shutdowns shall also be available over tis communications link. A communications data map shall be provided for referencing the points, including descriptions, values, scaling, and status. The I/O shall be hardwired to/from the DCS to provide remote start/stop, remote reset, common alarm, and common shutdown.

2.3.7.4 The HMI displays shall show the operating parameters of the compressor package. The HMI shall contain a graphical display of each system (seal, lube oil, process, vibration, etc.) organized into pages or screens. The value of monitored points shall be shown relative to their location on the graphic. The value of first out alarms and other subsequent alarms shall be indicated on the graphic. Acknowledged alarms shall be displayed until the alarm condition subsides. If an automatic shutdown occurs the display shall remain frozen until the reset button is pressed so the condition of the trip can be reviewed. The alarm history screens shall display current and past alarms with a date and time stamp. Text messages shall be displayed on the HMI to show the status of the compressor and ancillaries; for example, "Compressor is Starting / Stopped / Loaded / Unloaded / Ready / Not Ready / Running" or "Aux Pump is Running / Stopped".

Adjusting set points and tuning of the control loop shall be accomplished through the HMI. A password protection system shall be utilized to control access to the screens to change set points and tuning.

2.3.7.5 The compressor package shall be provided with a Bently Nevada vibration monitoring system, complete with vibration probes, cables, and transmitters for monitoring the compressor and main driver vibration. The transmitters shall be installed in skid mounted junction boxes for connection to the PLC. Vibration alarms and trips shall be generated by the PLC and displayed on the HMI.

2.3.7.6 Motor Starters and Switchgear

2.3.7.6.1 All medium voltage switchgear, disconnects, cable, and installation will be by others.

2.3.7.6.2 The low voltage motor control centers will be by others. Any local motor control stations will be by others. Cable, raceway, and supports between the motor control centers and the compressor skid will be by others.

2.3.7.7 Electrical and Instrumentation Requirements for Skid Mounted Equipment

2.3.7.7.1 On skid wiring shall be per NEC methods/requirements using rigid galvanized steel conduit for most of the runs and liquid tight flexible conduit for final connections.

2.3.7.7.2 The minimum size of conduit shall be ¾” or the size required per the applicable code, whichever is greater.

2.3.7.7.3 Supports for conduit shall be UNISTRUT type with U-bolts and/or clamps.

2.3.7.7.4 Instrument tubing shall be routed to a common vibration-free bulkhead at the edge of the skid.

2.3.7.7.5 Tubing runs shall be made in channel iron or along skid floor.

2.3.7.7.6 All on skid raceways, conduits, and flexible conduits shall be segregated to separate AC and DC cables and wiring.

2.3.7.7.7 Conduit runs shall contain at least 25% spare conductors and shall not contain more than the equivalent of four 90-Degree bends.

2.3.7.7.8 All on skid DC voltage I/O points shall be wired to a common on-skid DC Marshalling Panel. Terminal blocks shall be Pheonix OTTA.

2.3.7.7.9 All on skid AC voltage I/O points shall be wired to a common on-skid AC Marshalling Panel. Terminal blocks shall be Pheonix OTTA.

2.3.7.7.10 Reference Division 16 sections for other electrical requirements.

2.3.7.7.11 Wire, cable, and supports between the skids and control panels will be by others.

PART 3 – EXECUTION

3.1 ON-SITE TRAINING AND START-UP

3.1.1 The Supplier shall provide all necessary supervision and technical services to perform on-site calibration and testing of the equipment, systems, and devices as needed to check-out and start-up the equipment.

3.1.2 The Supplier shall provide details as to the expected number of days and number of trips to the job site recommended for check-out and start-up activities.

3.1.3 The Supplier technical service representative shall coordinate pre-startup safety reviews for all equipment provided.

3.1.4 The Supplier shall provide complete and detailed documented on-site training on the normal operation, troubleshooting, and maintenance of all systems and equipment provided.

3.1.5 Training shall be completed as soon after the in-service date as possible. Applicable Owner personnel will be made available for the training.

3.1.6 Supplier shall provide a schedule for the training no later than six (6) weeks after shipment of the equipment.

3.1.7 The schedule shall include a description of the type, level, detail, and documentation to be included or covered by the training.

3.1.8 The Owner shall be notified of any preparation needed by Owner personnel prior to training.

3.2 FACTORY TESTING

3.2.1 The gas compressor manufacturer shall submit a list and description of all standard quality checks, testing, and inspections that he plans to complete during the fabrication process.

3.2.2 The Supplier shall submit copies of his shop testing procedures for review by the Owner.

3.2.3 Owner shall be given ten (10) days notification of any performance test run on the compressor. The Owner shall have the option to witness all performance tests.

3.2.4 A written report describing the test procedures and results shall be furnished. The report shall include compressor test curves. All information and formulas used for corrections shall also be submitted.

3.2.5 When the frame is completed and all bearing fits have been made, elevations shall be taken on a machined surface on the top of the compressor frame at the four corners and at each compressor throw.

3.2.6 These elevation points shall be permanently marked on the frame. These frame elevations shall be supplied to the Owner.

3.2.7 All mechanical as-left clearances of the machine assembly shall be supplied to Owner in the shop test documentation.

3.3 FIELD TESTING

3.3.1 Field tests will be run to determine compressor performance.

3.3.1.1 Field tests will be conducted by Owner personnel or a third party using Owner instrumentation; representatives from the Supplier will be invited to witness and assist with the field test at no cost to the Owner.

3.3.2 Owner will vary the field test points to match the design points listed in the specifications as close as possible.

3.3.3 Capacities and power requirements at the test points shall be compared to the curves furnished by the Supplier covering the range of operation.

3.3.4 The Owner will use the data to evaluate the unit in comparison to the stated and guaranteed performance.

3.3.5 Compressor Efficiency

3.3.5.1 Compressor efficiency shall be expressed as a percent of adiabatic efficiency.

3.3.5.2 The calculation shall be based on the Benedict-Webb-Rubin (BWR) equation of state. The following field data shall be used:

Gas Composition-

1. A gas sample shall be collected before testing to determine the gas composition during the test data collection.
2. This preliminary data shall be used to perform calculations during the actual test.
3. A second gas sample shall be collected during the test period to determine variation in composition and determine the composition.

Gas Temperature-

1. A common suction gas temperature shall be taken as close to the compressor inlet flange as possible.
2. Discharge gas temperature shall be taken as close to the compressor outlet flange as possible.
3. An RTD shall be used to measure the gas temperatures, and recorded to within one tenth of one degree F.
4. A second sensor, if available by the installation, shall be utilized to measure and verify all temperatures.

Gas Pressures-

1. A common suction gas pressure shall be taken from the suction gas piping.

2. A discharge gas pressure shall be taken as close to the discharge flange as practical.

3. A digital deadweight shall be used to measure the pressures and record to within 0.5 PSIG.

4. A second sensor, if the installation allows, shall be utilized to measure, and verify all pressures.

Measured Flow-

1. Gas flow shall be measured using an orifice plate, ultrasonic, or other method designed with the installation.

3.3.5.3 Compressor Gas Horsepower – Shall be derived from the compressor flow and by applying the BWR equations to solve for Hp/MMscf.

3.3.5.4 Compressor Shaft Horsepower – Shall be calculated using the actual (total) losses determined from the manufacturers shop test(s).

3.3.6 Noise level testing will be conducted by the Owner or by a third party representing the Owner. The following shall be considered the minimum requirements for test procedures and calculations:

3.3.6.1 All measurements shall be taken in accordance with ANSI S12.51 and ANSI S1.13.

3.3.6.2 All sound readings will be taken using octave band sound measurement equipment meeting all the requirements of ANSI S1.4.

3.3.6.3 For all noise tests, the ambient noise level of the Vendor's test area at the test instrument points are to be at least 10 dB below the sound readings of the equipment being tested.

3.3.6.4 Sound readings are to indicate the equipment load(s) and the sound pressure level at each octave band and the overall A-weighted sound level.

3.3.6.5 Conversions of octave band sound pressure to A-weighted sound level shall be made by an acceptable-method such as given in ANSI S1.4.

3.3.7 In the event the field tests document that the compressor package does not attain the compressor performance and capacity guarantees, emission guarantees, and/or noise guarantees, it shall be the Supplier’s responsibility to take whatever action is necessary to obtain the guaranteed commitments. The corrective actions shall be accomplished in an expeditious manner and at the expense of the Supplier. Corrective actions must have Owner approval.

3.4 CLEANING AND PAINTING

3.4.1 Prior to shipment all components, materials, and equipment shall be thoroughly cleaned internally and externally of oil, grease, scale, rust, chips, organic matter, loose particles, and all potentially harmful foreign matter. Cleaning processes shall be controlled to assure effective cleaning without injuring the surface finishes, material properties, or metallurgical structure of the materials.

3.4.2 All external, un-machined ferrous metal surfaces shall be coated with a coating/paint system as defined in Section 09900 – Painting. The Manufacturer's standard corrosion resistant coating system may be acceptable (especially for supplied components such as motors, valves, instruments, etc.) with the approval of the Owner.

3.4.3 Machined surfaces such as mounting locations on the baseplate shall not be painted, but instead they shall be coated with a suitable rust-preventative coating.

3.5 NAMEPLATES

3.5.1 Each compressor, pulsation bottle, and other major components shall have a stainless steel nameplate permanently fixed to the housing/shell. The nameplate shall contain as a minimum the following information clearly stamped or printed on it:

1. Manufacturer's Name
2. Manufacturer's Model Number
3. Manufacturer's Serial Number
4. Operating Design Point

END OF SECTION 15565

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SECTION 15566
CENTRIFUAL GAS COMPRESSORS AND ANCILLARY EQUIPMENT

PART 1 – GENERAL

1.1 SCOPE OF SUPPLY

The Work as defined in this Section includes all items necessary and reasonably incidental to the completion of the overall job, whether specifically defined or not. The Work generally includes the following items:

1.1.1 The Supplier shall size, furnish, and deliver to the job site to supply four (4) fully functional skid mounted motor driven centrifugal compressor packages, complete with all accessories and ancillary equipment as specified and as necessarily required for a complete installation.

1.1.2 The Supplier shall provide for all shop testing of the supplied equipment as defined in this Section and as defined elsewhere in this Specification.

1.2 QUALITY ASSURANCE AND REFERENCES

1.2.1 The design, fabrication, and testing of the materials, components, and equipment (the Work) as defined in this Section shall be done in accordance with the codes and standards as listed below. Unless otherwise specified, the applicable governing edition and addenda to be used for all referenced 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 or addenda in effect at the date of this Specification shall apply. These references shall govern the work except where there is a conflict with the Owner's specifications. In the case of a conflict the Supplier shall contact the Owner for resolution.

1.2.1.1. ANSI – American National Standards Institute

1.2.1.2. ASME – American Society of Mechanical Engineers

1.2.1.3. ASTM – American Society for Testing and Materials

1.2.1.4. AFBMA – Anti-Friction Bearing Manufacturer’s Association

1.2.1.5. CAGI – Compressed Air & Gas Institute

1.2.1.6. NEMA – National Electric Manufacturers Association

1.2.1.7. ISA – Instrument Society of America (ISA)

1.2.1.8. API – American Petroleum Institute

1.2.1.9. AWS – American Welding Society

1.2.2 Equipment bid and supplied by the Supplier shall have satisfactory proven performance in similar type installations in the United States.

PART 2 – PRODUCTS

2.1 GENERAL

2.1.1 The gas compressors shall be of the integrally geared centrifugal type directly connected to an electric motor driver.

2.1.2 Each gas compressor and motor driver shall be mounted on a common baseplate.

2.1.3 The gas compressors shall be of the heavy-duty type designed and constructed to operate at the continuous rated load or any partial load over the designed lifetime of the equipment with minimum maintenance required and maximum reliability.

2.1.4 The gas compressors shall be designed and constructed for the most severe service conditions under which the units will be required to operate. All materials of construction shall be suitable for the specified service and identified with ASTM or ANSI standard numbers.

2.1.5 The equipment manufacturer/packager shall be responsible for assuring that each compressor and driver combination operates in dynamic balance as a unit without undue vibration.

2.1.6 The gas compressors will be installed inside a heated building.

2.1.7 Site Conditions and Operating Points:

2.1.7.1 Gas Analysis:

	Min	**Max**
Gas Property		
Specific Gravity	0.5815	0.5882
Heating Value (HHV)	1007	1027
Pressure	290 psig	590 psig
Temperature	60° F	100° F
Gas Component	% Mole	% Mole
C6+	0.0003	0.0043
Propane	0.0432	0.2256
I-Butane	0.0016	0.1340
N-Butane	0.0021	0.0297
I-Pentane	0.0	0.0046
N-Pentane	0.0	0.0
Nitrogen	0.2794	0.6211
Methane	94.5337	96.2189
CO2	1.0521	1.7796
Ethane	1.7146	3.4961

The gas supplier posts a daily Gas Sample Analysis on their website. The gas analysis can be found at: https://pipelines.energytransfer.com/ipost/MRT/gas-quality/egt-daily samples-report. The report associated with the new Energy Center is MRT M/L @ MERAMEC_STR 3.

2.1.7.2 Operating Points:

Table 2.1.7.2 – Operating Points

	Units	Minimum	Normal Minimum	Maximum	Design Point
Suction Pressure Range	psig	250	295	365	295
Suction Temperature	°F	60	60	100	80
Suction Flow(1)	#/hr	0	52,920	88,200	88,200
Discharge Pressure Range	Psig	490	490	500	500
Discharge Temperature Range	°F	45	45	125	120
Discharge Flow(1)	#/hr	0	52,920	88,200	88,200
Ambient Temperature Design Point	°F	---	---	---	95
Rate of Gas Flow Change	#/s/min	0	1	4	---
Horsepower	hp	(2)	(2)	(2)	(2)

1) Minimum flow shown is normal minimum, but the cooling system shall be designed to handle 100% recirculation. The flow control system shall be designed for operation from 100% recirculation to 0% recirculation and meet pressure, flow and steady state pressure regulation requirements.
2) Provided by the Supplier.

2.1.8.2 Guarantee Points

2.1.8.2.1 The Supplier shall include with his proposal guarantee commitments for efficiency, capacity, and horsepower at each design point (operating point) listed in Paragraph 2.1.7.2.

2.1.8.2.2 The guaranteed figures shall be submitted as specific values.

2.1.8.2.3 If a plus or minus range is offered, the least efficient value shall become the Supplier's guarantee commitment.

2.1.8.2.4 The combined efficiency of all design points, as documented by the field test, shall determine guarantee compliance and/or the percent efficiency deviation.

2.1.8.2.5 The efficiency number shall be rounded off in tenths of a percent.

2.1.8.2.6 Maximum Permissible Noise Levels:

1. Impulsive noise shall not exceed the OSHA limit of 140 dB peak, sound pressure level.

2. Steady state and interrupted steady state sound levels shall be limited to 90 dBA or less.

3. The noise levels shall be for all accessible areas of the equipment being furnished at a three-foot distance from its periphery.

2.1.8.2.7 Reference Paragraph 2.3.6 for oil carry-over limitations and requirements.

2.1.8.3 Site Environmental Design Conditions

Table 2.1.8.3 – Site Design Conditions

Parameter	Value
Minimum Ambient Design Temperature:	-20° F
Maximum Ambient Design Temperature:	125° F
Relative Humidity Range:	0 to 100%
Site Elevation:	423 ft
Wind Risk Category:	III
Wind Exposure:	C
Basic Wind Speed:	120 mph

Seismic Criteria (per IBC 2015 / ASCE 7-10):	S_s = 0.48g, S_1 = 0.18g
Seismic Importance Factor:	I_E = 1.25
Seismic Stie Class:	Class E, S_{DS} = 0.544, S_{D1} = 0.384
Seismic Design Category:	SDC = D
Snow Load:	20 psf
Snow Importance Factor:	I_S = 1.10
Ice Load (per IBC 2015 / ASCE 7-10):	1 in.
Concurrent Temperature:	5° F
Gust Speed:	40 mph

2.2 GAS COMPRESSOR CHARACTERISTICS

2.2.1 General Requirements

2.2.1.1 Flanged connections for the suction and discharge nozzles shall conform to the dimensions and finishes as specified in ANSI standards appropriate for the specified design conditions of the equipment.

2.2.1.2 All flange bolt holes shall straddle the horizontal and vertical center lines of the equipment.

2.2.1 Compressor Component Requirements

2.2.1.1 The compressor shall be furnished with an accessible shaft, running at the same RPM as the compressor, for compressor analyzer hook-up.

2.2.1.2 The compressor gear case shall be a cast iron horizontal split case.

2.2.1.3 Gear lubrication shall be the spray type with labyrinth and carbon ring seals.

2.2.1.4 The internal gearing shall be the manufacturer's high quality single helical design (AGMA Q13 quality class) with a minimum 1.4 AGMA service factor.

2.2.1.5 The high speed (pinion) radial bearings shall be of the tilting pad type made from babbitt-faced steel. The high speed (pinion) thrust bearings shall be the tapered land, double acting type made from babbitt-faced steel.

2.2.1.6 The low speed (bull gear) radial bearings shall be sleeve type made from babbitt-faced steel. The low speed (bull gear) thrust bearings shall be flat face, double acting made from babbitt-faced steel.

2.2.1.7 The impellers shall be the open, backward facing type milled from stainless steel material.

2.2.1.8 The diffuser shall be of the vaned design machined from stainless steel material.

2.2.1.9 The housing and shroud shall be a scroll deign from cast steel material.

2.2.1.10 The gas shaft seal shall be an integrated design with single dry face seal with a carbon ring backup.

2.2.2 Baseplate or Mounting Skid Requirements

2.2.2.1 The skid shall be designed and constructed with adequate stiffness and strength so equipment can be mounted flat with no movement, bending, or twisting during operation and/or shipment.

2.2.2.2 The skid should provide sufficient mass to help counteract unbalanced forces and couples.

2.2.2.3 The skid shall be designed to be installed on a full length and width flat/level concrete foundation or pad.

2.2.2.4 The skid shall be constructed with multiple full skid length continuous heavy-duty standard wide flanged structural steel beams.

2.2.2.5 All flange-to-flange welds shall be full penetration, single V grove welds. All web to web and web to flange welds are to be seal welded.

2.2.2.6 The beams shall be crossed braced and have gussets at all supports points.

2.2.2.7 All major equipment shall be mounted on full depth steel members.

2.2.2.8 Skid open areas shall be covered with 5/16" (minimum) non-skid diamond floor plate that is seal welded on the top of the skid.

2.2.2.9 The skid decking shall include 12" minimum diameter access plates to accommodate grouting of skid without having to cut deck plating.

2.2.2.10 No piping, tubing or conduit should be located below floor plate without Owner approval.

2.2.2.11 The skid shall be equipped with a pollution ring (2" lip around top perimeter of skid) and four corner sumps to contain all runoff on the skid.

2.2.2.12 The sump openings should be covered with removable grating.

2.2.2.13 The sumps shall be piped together with a single lockable valve discharge point or two discharge points, one on each side.

2.2.2.14 The skid shall include appropriately designed and located hold down bolt holes.

2.2.2.15 A leveling jacking bolt shall be provided adjacent to each hold down bolt hole to allow leveling of the skid prior to grouting.

2.2.2.16 All bolt holes shall be drilled. The burning of bolt holes is not permitted.

2.2.2.17 The skid shall be sufficiently sized to accommodate mounted equipment. No on-skid equipment shall extend beyond perimeter of skid.

2.2.2.18 Access to equipment shall not be obstructed by items such as piping, tubing, conduit, or structural supports.

2.2.2.19 There shall be sufficient room for normal maintenance such as impeller/gear removal, filter replacement, removal of heat exchanger tube bundles or pump/motor removal and reinstallation.

2.2.2.20 Major equipment shall be located on the skid such that it can be easily maintained or removed without interference from other equipment, piping, conduit, etc.

2.2.2.21 Unless directed otherwise in this Specifications, all process, auxiliary, drain, and vent lines shall be run to edge of skid and terminate with a flanged connection.

2.2.2.22 The equipment manufacturer's required rotating equipment mounting and alignment requirements shall be clearly identified in the submittal data.

2.2.3 Compressor Driver

2.2.3.1 The driver (motor) shall be provided and mounted by the compressor manufacturer/packager. All shims required for pump/driver alignment shall be stainless steel.

2.2.3.2 The driver (motor) shall comply with the requirements as defined in Section 16061.

2.3 ANCILLARY EQUIPMENT

2.3.2 Couplings and Guards

2.3.2.1 Couplings covered by this Specification shall be designed, fabricated, inspected, and tested in accordance with API Standard 618, except as modified in this Section and individual data sheets.

2.3.2.2 Couplings shall be non-lubricated, flexible, steel disc type.

2.3.2.3 Coupling shall have a minimum rating of 200% of the rated motor horsepower.

2.3.2.4 All couplings and coupling hubs shall be removable without major equipment removal/relocation.

2.3.2.5 Bolting Considerations - The bolts shall be individually weight balanced to +/-0.1 gram of each other.

2.3.2.6 Gear couplings are not allowed.

2.3.2.7 An assembly balance shall be performed on the coupling assembly and the components shall be match marked. Balance holes are not allowed without written approval from the Owner.

2.3.2.8 Coupling Accessories

2.3.2.8.1 The prime equipment supplier shall furnish the necessary pump(s), hose and fittings, pressure gages, instructions on mounting fixture tools, and a recommendation as to the hydraulic fluid required for the installation and removal of hydraulically fitted coupling hubs.

2.3.2.8.2 The tubing or hose fittings that are employed should be of the standard type that are readily available at normal supply houses.

2.3.2.9 A calculation, or diagram, showing the direction and magnitude of shaft(s) axial and radial growth for all operating conditions, complete with a schematic of the shaft anchor points (thrust bearings) and equipment anchor points shall be provided. The coupling selected for each shaft connection shall have maximum allowable axial growths that are at least 20 percent in excess of the calculated growth values. These values shall be shown on the documentation.

2.3.2.10 The prime equipment packager shall have the coordination responsibility for the supply of all coupling guards in the equipment train.

2.3.2.11 Whenever possible, flanged cylindrical shell guards are required.

2.3.2.12 Guards shall be designed for dry flexible disk couplings so that guard skin temperature does not exceed 150°F at maximum continuous speed.

2.3.2.13 The guards shall be connected on the fixed end by a minimum of four (4) bolts.

2.3.2.14 The guards shall be axially split in such a manner that they can be removed without dismantling any other parts of the driver or driven machine.

2.3.2.15 All guards shall be painted safety yellow.

2.3.3 Not used.

2.3.4 Lube Oil System

The Supplier shall provide a full lube oil system for the motor, gear box, impellers, and compressor frame for each unit. Components of the lube oil system shall include:

2.3.4.1 Cooling in the form of a Fin-Fan Cooler for remote installation/piping by the end user.

2.3.4.2 Lubrication oil day tank(s) to be shipped loose. Lube oil system shall integrate with these tanks. The lubrication oil day tanks and the interconnection piping will be installed by others.

2.3.4.3 Level switches to be provided by the Supplier for installation on day tanks.

2.3.4.4 Electric pre and post lube oil pumps.

2.3.4.5 Strainers and Filters with differential pressure switches.

2.3.4.6 Sample tap with valve and plug upstream and downstream of the LO Filter.

2.3.4.7 These sample locations shall also be downstream of the LO pump.

2.3.4.8 Kenco (or approved equal) level controller.

2.3.4.9 Lubricator reservoir heating device with thermostatic control

2.3.4.10 Metering

2.3.4.11 Force feed T.F. Hudgins (or approved equal) lubricator pump and system driven by crankshaft.

2.3.4.12 Distribution block.

2.3.4.13 Rupture discs.

2.3.4.14 Check valves.

2.3.4.15 No-flow switch.

2.3.4.16 Compressor lube oil temperature 3-way control valve(s), to be self-contained.

2.3.5 Gas After/Recycle Cooler System

The Supplier shall provide a forced draft air cooled fin-fan cooler for the discharge gas flow (both after cooler and recycle cooler):

2.3.5.1 Aerial fin fan cooler(s) w/hail guard and no louvers. Belt-driven, galvanized frame, painted headers, preference for two fans.

2.3.5.2 The cooling fans shall be 2x50% capacity.

2.3.5.3 This unit will be installed outside and mounted/piped by others.

2.3.6 Oil Carryover Removal

Utilization of an oil lubricated compressor that may pass hydrocarbon / lube oil mists downstream are permitted for heavy duty gas turbines, but only with a series of requirements as defined below.

2.3.6.1 The gas compressor package shall incorporate a two-stage oil separating system with the oil carry over designed and demonstrated to not exceed 3 ppmw.

2.3.6.2 An additional after-filter, capable of reliability filtering out oil carry-over to less than 0.05 ppmw (50 ppb), shall be provide for installation downstream of the compressor package.

2.3.6.3 Mechanical Design Requirements for Filters.

2.3.6.3.1 After-filter housings shall be designed, fabricated, tested, and code stamped in conformance with the ASME Boiler and Pressure Vessel Code Section VIII Division 1.

2.3.6.3.2 National Board numbers are required.

2.3.6.3.3 Minimum design metal temperature shall be -20° F.

2.3.6.3.4 The minimum reinforcing pad diameter shall be 1.75 times nozzle diameter for outlets greater than NPS 4 and 2.0 times nozzle diameter for NPS 4 and smaller outlets.

2.3.6.3.5 The minimum reinforcement pad thickness shall be 0.500-inch; reinforcement pads having a thickness less than 0.500-inch must be approved by the Owner in writing. Reinforcing pads shall have a 1/2-inch diameter vent hole.

2.3.6.3.6 Full radiography shall be performed as defined in ASME Boiler and Pressure Vessel Code Section VIII Division 1 Paragraph UW-11.

2.3.6.3.7 Filter housings shall be provided with lifting eyes/lugs.

2.3.6.3.8 Approval drawings for the filter housings shall be submitted per the requirements defined in Appendix S – Submittals of this Specification.

2.3.7 Control System and Instrumentation Requirements

2.3.7.1 The compressor package shall be provided with a failsafe, energized, PLC based control system. The control system shall include the following:

1. Local Control Panel (LCP) in a free standing NEMA 4 enclosure purged to meet the area classification (Class 1, Division 1, Gas Group C&D). The LCP shall be shipped loose to be installed by others near the compressor package.
2. The LCP shall have front access with an HMI mounted in the door. The PLC, interface relays and terminals shall be back panel mounted.
3. The operator interface (HMI) shall be a touch screen color display panel.
4. The remote I/O modules shall be installed in NEMA 4 enclosures mounted on the skid for connection to the LCP using a data communication cable.
5. Compressor vibration, compressor bearing temperatures, drive motor vibration, drive motor bearing temperature, and drive motor winding temperatures shall be monitored by the PLC in the LCP.
6. On skid instrumentation shall be wired to the remote I/O modules installed in skid mounted junction boxes.

2.3.7.2 The Programable Logic Controller (PLC) shall be supplied with a CPU, power supply, and communications link. The I/O modules shall include discrete inputs, discrete outputs, 4-20 mA analog inputs, RTD inputs, and 4-20 mA analog outputs.

The control system shall automatically monitor and control the seal, lubrication, and process systems and provide start/stop commands for the main driver and ancillary systems. The control system shall allow the compressor to start or to continue to operate only if certain key machine parameters are within acceptable limits. The HMI shall indicate if any monitored parameter exceeds the set point. If the parameter is critical to the health and continued operation of the equipment the compressor shall shut down automatically.

The PLC shall provide compressor operation with pressure control (control of the compressor package discharge pressure), gas recirculation, and logic for start/stop function, alarm monitoring, and tripping of the compressor.

2.3.7.3 The PLC shall include an Ethernet Modbus TCP/IP communication link for data to the plant DCS. All values monitored by the PLC shall be available for display, trending, and archiving by the DCS. The status of all alarms and shutdowns shall also be available over tis communications link. A communications data map shall be provided for referencing the points, including descriptions, values, scaling, and status. The I/O shall be hardwired to/from the DCS to provide remote start/stop, remote reset, common alarm, and common shutdown.

2.3.7.4 The HMI displays shall show the operating parameters of the compressor package. The HMI shall contain a graphical display of each system (seal, lube oil, process, vibration, etc.) organized into pages or screens. The value of monitored points shall be shown relative to their location on the graphic. The value of first out alarms and other subsequent alarms shall be indicated on the graphic. Acknowledged alarms shall be displayed until the alarm condition subsides. If an automatic shutdown occurs the display shall remain frozen until the reset button is pressed so the condition of the trip can be reviewed. The alarm history screens shall display current and past alarms with a date and time stamp. Text messages shall be displayed on the HMI to show the status of the

compressor and ancillaries; for example, "Compressor is Starting / Stopped / Loaded / Unloaded / Ready / Not Ready / Running" or "Aux Pump is Running / Stopped".

Adjusting set points and tuning of the control loop shall be accomplished through the HMI. A password protection system shall be utilized to control access to the screens to change set points and tuning.

2.3.7.5 The compressor package shall be provided with a Bently Nevada vibration monitoring system, complete with vibration probes, cables, and transmitters for monitoring the compressor and main driver vibration. The transmitters shall be installed in skid mounted junction boxes for connection to the PLC. Vibration alarms and trips shall be generated by the PLC and displayed on the HMI.

2.3.7.6 Motor Starters and Switchgear

2.3.7.6.1 All medium voltage switchgear, disconnects, cable, and installation will be by others.

2.3.7.6.2 The low voltage motor control centers will be by others. Any local motor control stations will be by others. Cable, raceway, and supports between the motor control centers and the compressor skid will be by others.

2.3.7.7 Electrical and Instrumentation Requirements for Skid Mounted Equipment

2.3.7.7.1 On skid wiring shall be per NEC methods/requirements using rigid galvanized steel conduit for most of the runs and liquid tight flexible conduit for final connections.

2.3.7.7.2 The minimum size of conduit shall be ¾" or the size required per the applicable code, whichever is greater.

2.3.7.7.3 Supports for conduit shall be UNISTRUT type with U-bolts and/or clamps.

2.3.7.7.4 Instrument tubing shall be routed to a common vibration-free bulkhead at the edge of the skid.

2.3.7.7.5 Tubing runs shall be made in channel iron or along skid floor.

2.3.7.7.6 All on skid raceways, conduits, and flexible conduits shall be segregated to separate AC and DC cables and wiring.

2.3.7.7.7 Conduit runs shall contain at least 25% spare conductors and shall not contain more than the equivalent of four 90-Degree bends.

2.3.7.7.8 All on skid DC voltage I/O points shall be wired to a common on-skid DC Marshalling Panel. Terminal blocks shall be Pheonix OTTA.

2.3.7.7.9 All on skid AC voltage I/O points shall be wired to a common on-skid AC Marshalling Panel. Terminal blocks shall be Pheonix OTTA.

2.3.7.7.10 Reference Division 16 sections for other electrical requirements.

2.3.7.7.11 Wire, cable, and supports between the skids and control panels will be by others.

PART 3 – EXECUTION

3.1 ON-SITE TRAINING AND START-UP

3.1.1 The Supplier shall provide all necessary supervision and technical services to perform on-site calibration and testing of the equipment, systems, and devices as needed to check-out and start-up the equipment.

3.1.2 The Supplier shall provide details as to the expected number of days and number of trips to the job site recommended for check-out and start-up activities.

3.1.3 The Supplier technical service representative shall coordinate pre-startup safety reviews for all equipment provided.

3.1.4 The Supplier shall provide complete and detailed documented on-site training on the normal operation, troubleshooting, and maintenance of all systems and equipment provided.

3.1.5 Training shall be completed as soon after the in-service date as possible. Applicable Owner personnel will be made available for the training.

3.1.6 Supplier shall provide a schedule for the training no later than six (6) weeks after shipment of the equipment.

3.1.7 The schedule shall include a description of the type, level, detail, and documentation to be included or covered by the training.

3.1.8 The Owner shall be notified of any preparation needed by Owner personnel prior to training.

3.2 FACTORY TESTING

3.2.1 The gas compressor manufacturer shall submit a list and description of all standard quality checks, testing, and inspections that he plans to complete during the fabrication process.

3.2.2 The Supplier shall submit copies of his shop testing procedures for review by the Owner.

3.2.3 Owner shall be given ten (10) days notification of any performance test run on the compressor. The Owner shall have the option to witness all performance tests.

3.2.4 A written report describing the test procedures and results shall be furnished. The report shall include compressor test curves. All information and formulas used for corrections shall also be submitted.

3.2.5 When the frame is completed and all bearing fits have been made, elevations shall be taken on a machined surface on the top of the compressor frame at the four corners and at each compressor throw.

3.2.6 These elevation points shall be permanently marked on the frame. These frame elevations shall be supplied to the Owner.

3.2.7 All mechanical as-left clearances of the machine assembly shall be supplied to Owner in the shop test documentation.

3.3 FIELD TESTING

3.3.1 Field tests will be run to determine compressor performance.

3.3.1.1 Field tests will be conducted by Owner personnel or a third party using Owner instrumentation; representatives from the Supplier will be invited to witness and assist with the field test at no cost to the Owner.

3.3.2 Owner will vary the field test points to match the design points listed in the specifications as close as possible.

3.3.3 Capacities and power requirements at the test points shall be compared to the curves furnished by the Supplier covering the range of operation.

3.3.4 The Owner will use the data to evaluate the unit in comparison to the stated and guaranteed performance.

3.3.5 Compressor Efficiency

3.3.5.1 Compressor efficiency shall be expressed as a percent of adiabatic efficiency.

3.3.5.2 The calculation shall be based on the Benedict-Webb-Rubin (BWR) equation of state. The following field data shall be used:

Gas Composition-

1. A gas sample shall be collected before testing to determine the gas composition during the test data collection.
2. This preliminary data shall be used to perform calculations during the actual test.
3. A second gas sample shall be collected during the test period to determine variation in composition and determine the composition.

Gas Temperature-

1. A common suction gas temperature shall be taken as close to the compressor inlet flange as possible.
2. Discharge gas temperature shall be taken as close to the compressor outlet flange as possible.
3. An RTD shall be used to measure the gas temperatures, and recorded to within one tenth of one degree F.
4. A second sensor, if available by the installation, shall be utilized to measure and verify all temperatures.

Gas Pressures-

1. A common suction gas pressure shall be taken from the suction gas piping.
2. A discharge gas pressure shall be taken as close to the discharge flange as practical.
3. A digital deadweight shall be used to measure the pressures and record to within 0.5 PSIG.
4. A second sensor, if the installation allows, shall be utilized to measure, and verify all pressures.

Measured Flow-

1. Gas flow shall be measured using an orifice plate, ultrasonic, or other method designed with the installation.

3.3.5.3 Compressor Gas Horsepower – Shall be derived from the compressor flow and by applying the BWR equations to solve for Hp/MMscf.

3.3.5.4 Compressor Shaft Horsepower – Shall be calculated using the actual (total) losses determined from the manufacturers shop test(s).

3.3.6 Noise level testing will be conducted by the Owner or by a third party representing the Owner. The following shall be considered the minimum requirements for test procedures and calculations:

3.3.6.1 All measurements shall be taken in accordance with ANSI S12.51 and ANSI S1.13.

3.3.6.2 All sound readings will be taken using octave band sound measurement equipment meeting all the requirements of ANSI S1.4.

3.3.6.3 For all noise tests, the ambient noise level of the Vendor's test area at the test instrument points are to be at least 10 dB below the sound readings of the equipment being tested.

3.3.6.4 Sound readings are to indicate the equipment load(s) and the sound pressure level at each octave band and the overall A-weighted sound level.

3.3.6.5 Conversions of octave band sound pressure to A-weighted sound level shall be made by an acceptable-method such as given in ANSI S1.4.

3.3.7 In the event the field tests document that the compressor package does not attain the compressor performance and capacity guarantees, emission guarantees, and/or noise guarantees, it shall be the Supplier's responsibility to take whatever action is necessary to obtain the guaranteed commitments. The corrective actions shall be accomplished in an expeditious manner and at the expense of the Supplier. Corrective actions must have Owner approval.

3.4 CLEANING AND PAINTING

3.4.1 Prior to shipment all components, materials, and equipment shall be thoroughly cleaned internally and externally of oil, grease, scale, rust, chips, organic matter, loose particles, and all potentially harmful foreign matter. Cleaning processes shall be controlled to assure effective cleaning without injuring the surface finishes, material properties, or metallurgical structure of the materials.

3.4.2 All external, un-machined ferrous metal surfaces shall be coated with a coating/paint system as defined in Section 09900 – Painting. The Manufacturer's standard corrosion resistant coating system may be acceptable (especially for supplied components such as motors, valves, instruments, etc.) with the approval of the Owner.

3.4.3 Machined surfaces such as mounting locations on the baseplate shall not be painted, but instead they shall be coated with a suitable rust-preventative coating.

3.5 NAMEPLATES

3.5.1 Each compressor, pulsation bottle, and other major components shall have a stainless steel nameplate permanently fixed to the housing/shell. The nameplate shall contain as a minimum the following information clearly stamped or printed on it:

1. Manufacturer's Name
2. Manufacturer's Model Number
3. Manufacturer's Serial Number
4. Operating Design Point

END OF SECTION 15566

SECTION 16010
BASIC ELECTRICAL REQUIREMENTS

1.0 INTRODUCTION

1.1 Scope

1.1.1 Electrical Contractor shall be responsible for furnishing all material (except material specifically stated in this Specification to be furnished by others), tools, equipment, labor, supervision, and any other incidental items or services necessary to perform all of the electrical work in accordance with the drawings and Specifications for this scope of work.

1.1.2 Contractor shall also be responsible for complete installation and check-out of all electrical systems, equipment, and accessories included herein. Refer to specific Division 16 Sections contained within this Specification for more detailed information.

1.2 Reference Sections

1.2.1 All Division 16 Sections contained herein.

1.3 Codes and Standards

1.3.1 All equipment and installation shall meet requirements of the current revision of NFPA 70 - National Electrical Code (NEC), and IEEE C2 - National Electric Safety Code (NESC).

1.3.2 Also, in the exercise of Contractor's experience and knowledge of the equipment, materials, and work covered by this Contract, Contractor shall perform all work and provide materials and equipment in accordance with other codes, standards, and regulations consistent with providing a safe and reliable product including but not limited to:

1.3.2.1 National Electrical Manufacturers Association (NEMA)

1.3.2.2 Underwriters' Laboratories, Inc. (UL)

1.3.2.3 American National Standards Institute (ANSI)

1.3.2.4 Occupational Safety and Health Administration (OSHA)

1.3.2.5 International Electrical Testing Association (NETA)

1.3.2.6 Applicable equipment manufacturer or vendor instructions

1.3.3 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 Owner's Specifications. In case of conflict, the latter shall govern to the extent of such difference:

2.0 BASIC ELECTRICAL REQUIREMENTS

2.1 Design

2.1.1 Contractor shall adhere to the design requirements for specific components as documented in subsequent Division 16 sections contained herein.

2.1.2 In addition to installation and provision of materials, Contractor shall be responsible for design of components as indicated by the scope of work documents. At minimum, Contractor is expected to provide design for the following unless provided or excluded by Owner:

2.1.2.1 Field routed raceway sizing, routing and installation details

2.1.2.2 Cable routing

2.1.2.3 Equipment grounding and bonding systems, including tie-ins to existing systems

2.1.2.4 Equipment mounting details

2.1.2.5 Equipment installation and constructability

2.1.3 Design documents may be provided to the Contractor in addition to Specification requirements. This documentation may be prepared directly by Owner or by Owner's representative.

2.1.3.1 Contractor shall report deficiencies, conflicts, and concerns found in provided design documents to the Owner project lead upon discovery.

2.1.4 Contractor shall be responsible for any and all engineering, drafting, field sketches, and field layout required for temporary supports, rigging, removals and installation of all material and equipment.

2.1.5 Contractor located electrical equipment shall be placed in accessible areas and approved by Company.

2.1.5.1 Devices which require periodic maintenance or operation such as switches, breakers, control panels, etc., shall be accessible from grade level or platform levels, without the use of a ladder or stepladder.

2.1.5.2 Maintain proper clearances per NEC.

2.1.6 The plant utilizes a division of raceway which is separated in to classes.

2.1.6.1 Class A is power cable rated 13,800VAC, 6900VAC or 4160VAC.

2.1.6.2 Class B is power cables rated 480VAC.

2.1.6.3 Class C is 120VAC or 125VDC.

2.1.6.4 Class D is instrument cable and low voltage applications.

2.1.6.5 Contractor is required to continue this division if any new cables are added for the projects within this Specification.

2.1.7 Ameren Missouri energy centers utilize typical voltage levels depending on site and application, as shown in Table 16010-01. Any designs, installations, or equipment applications outside of these voltage levels shall be approved by Owner.

TABLE 16010-01 ELECTRICAL EQUIPMENT SYSTEM DESIGN INFORMATION

Power Supply	Continuous Voltage (Volts) – System Output Voltage	Design for Momentary Voltage Dip to X% of Nominal	Frequency (Hz)	Configuration	System Grounding	Transfer to Alternate Source	Max Sym Short-Circuit Amps
Medium Voltage	13800 Nom 14490 Max 13460 Min	80	60 Nom 61.5 Max 58.5 Min	3-Phase, 3 Wire, Wye (3/PE)	Low Resistance (IT)	Fast Transfer	63,000 (3-Ph) 1,500 (L-G)
Medium Voltage	6900 Nom 7240 Max 6730 Min	80	60 Nom 61.5 Max 58.5 Min	3-Phase, 3 Wire, Wye (3/PE)	Low Resistance (IT)	Fast Transfer	50,000 (3-Ph) 1,500 (L-G)
Medium Voltage	4160 Nom 4370 Max 3952 Min	80	60 Nom 61.5 Max 58.5 Min	3-Phase, 3 Wire, Wye (3/PE)	Low Resistance (IT)	Fast Transfer	50,000 (3-Ph) 1,500 (L-G)
Low Voltage (Power)	480 Nom 504 Max 456 Min	80	60 Nom 61.5 Max 58.5 Min	3-Phase, 3 Wire, Wye (3/PE)	Solidly Grounded	Manual with Live Bus Transfer	65,000 (3-Ph) 10,000 (L-G)
Low Voltage (Lighting)	480Y/277 Nom	80	60 Nom 61.5 Max 58.5 Min	3-Phase, 4 Wire, Wye (3/N/PE)	Solidly Grounded (TN)	N/A	65,000 (3-Ph) 10,000 (L-G)

TABLE 16010-01 ELECTRICAL EQUIPMENT SYSTEM DESIGN INFORMATION							
Power Supply	**Continuous Voltage (Volts) – System Output Voltage**	**Design for Momentary Voltage Dip to X% of Nominal**	**Frequency (Hz)**	**Configuration**	**System Grounding**	**Transfer to Alternate Source**	**Max Sym Short-Circuit Amps**
	504Y/291 Max 456Y/263 Min						
Low Voltage (Power)	208Y/120 Nom 218Y/126 Max 197Y/114 Min	80	60 Nom 61.5 Max 58.5 Min	3-Phase, 4 Wire, Wye (3/N/PE)	Solidly Grounded (TN)	N/A	25,000(3-Ph) 10,000 (L-G)
UPS Power	208Y/120 Nom 218Y/126 Max 197Y/114 Min	80	60 Nom 61.5 Max 58.5 Min	3-Phase, 4 Wire, Wye (3/N/PE)	Solidly Grounded (TN)	Static 1/2 Cycle	25,000(3-Ph) 10,000 (L-G)
DC Power	125 Nom 140 Max 105 Min at Battery Terminals	70	N/A	Two-Pole	Ungrounded	N/A	42,000 (P-P)
Control Power (AC)	120 Nom 126 Max 114 Min	80	60 Nom 61.5 Max 58.5 Min	Single-Phase, 2 Wire (1/N/PE)	Solidly Grounded (TN)	N/A	10,000 (L-L) 10,000 (L-G)

Definitions: N = neutral PE = protective earth conductor

IT = unearthed transformer neutral TN = transformer neutral earthed, frame connected to neutral

2.2 Equipment

2.2.1 All materials furnished by Contractor shall be new, high grade and shall comply with the applicable standard in every case where such a standard has been established.

2.2.2 Contractor shall be responsible for receiving, storage, and security of all material and equipment furnished by Contractor.

2.2.3 Unused material supplied by Owner shall be returned to the storeroom.

2.2.4 Electrical equipment supplied by Contractor shall be NEMA rated only. IEC rated or dual NEMA/IEC rated equipment shall not be installed without approval from Owner.

2.2.5 Equipment shall be designed for the ratings for which it will be subject to (i.e., maximum voltage, short circuit current, continuous current, ambient temperatures, environmental conditions, hazardous area conditions, etc.).

2.3 Installation

2.3.1 Equipment installation may include storage and handling at the plant site including moving material to and from Company's storeroom, uncrating, assembly, providing supports, alignment, securing in place, mounting auxiliaries, main and auxiliary connections, and adjusting for successful operation.

2.3.2 Equipment shall be fastened to concrete foundations with expansion anchors where required.

2.3.3 All equipment assembled and subassemblies shall be installed to accurate lines and elevations, aligned, anchored, mounted, or supported so that the complete installation shall be free of foreign strains and shall operate without undue noise and vibration.

2.3.4 Due regard shall be given to flexibility and/or clearance required of electrical devices or services mounted in proximity of, or serving, mechanical devices or systems which are themselves subject to movement in operation or as a result of thermal expansion or contraction.

2.3.5 Do not remove any equipment from service without obtaining permission from Owner. Contractor shall be responsible for providing at least one week's advanced notice and requesting appropriate WPA.

2.3.6 Contractor shall seal any penetrations with appropriate fire stop caulk and blocking.

2.3.7 Contractor will not be allowed to splice cables. If cables are too short extensions may be assembled using ring tong connectors and terminal block mounted in terminal boxes.

2.3.8 Mechanical crimps are extremely critical on these projects. A crimping class will be conducted by Contractor's supervision with all appropriate Contractor's employees that will be performing these crimps in the field.

2.3.8.1 This class will be held in the presence of Owner's Construction Project Lead and/or Owner's Engineer.

2.3.8.2 During this class, Contractor at a minimum will demonstrate the appropriate procedure that will be used for the project. This will include the crimps for all wire sizes, all types of crimps, and the matching tools including wire stripping tools that will be used.

2.3.8.3 All crimps and tools will be submitted for approval before any will be used in the class and field.

2.3.8.4 Generic crimping tools will not be allowed. Specific ratcheting tools, with identifying engraving that identify the dies will be used.

2.3.8.5 All attendees in the class will demonstrate that they can perform the crimps.

2.3.8.6 A 100% pull test will be used in the class and for all crimps in the field.

2.3.8.7 Contractor must submit a list of recent projects indicating that the specific employees have had experience in terminating in these types of panels and cabinets

2.3.9 Electrical drawings supplied with this Specification may be diagrammatic, and all conduit boxes, fittings, etc., may not always be shown.

2.3.9.1 Raceways in some instances are only indicated at their termination point. Final routing of raceways is to be determined in the field.

2.3.9.2 Existing cable trays may be utilized, but Contractor shall be responsible for routing cables, installing conduit and fittings for a complete raceway system.

2.3.9.3 Raceways are to be located so they will not obstruct access to operating equipment.

2.3.10 Field routed and located material shall be subject to the approval of Construction Project Lead.

2.3.11 Should project scope require the identification and relocation (or demolition) of existing cables, precautions shall be taken prior to removal. The Contractor shall obtain authorization from Ameren prior to any disturbance of existing cabling. If unknown cables are discovered, they shall be brought to the attention of Ameren for disposition. If the unknown cables can not be identified by Ameren engineers, the contractor shall trace down the unknown cables to identify end points by using either of the following methods:

2.3.11.1 Induction Method: This method involves injecting a signal down the conductor (or inject signal down the shield if the cable is shielded) or this method involves a clamp-on device that injects a signal around the cable. The signal is traced with locate signal receiving equipment. The clamp-on device does not require OOS. However, an OOS will be needed if injecting signal down the conductor itself (when connecting to the bare conductor to send signal down the cable).

2.3.11.2 Radio Frequency Method: This method involves RF signal locate equipment that picks up energized circuits from the 60 Hz frequency. This method can work well if there are a few cables in surrounding area. This method does not work very well if there are many cables, for example, in a cable tray. Also, this method does not work well if the cable is shielded. Note: OOS is not required for this method.

2.3.12 Contractor shall be responsible for closely coordinating work with the Construction Project Lead, other Contractors, and Company operating and maintenance personnel.

2.3.13 Contractor shall be responsible for ascertaining the exact position of all terminations and to make adjustments in length, line, or grade of his work.

2.3.13.1 Minor deviations in locations shown on drawings shall not be cause for additional payments

2.3.14 For some equipment, Owner may furnish the services of manufacturer's technical representative during installation and set-up.

2.3.14.1 Such equipment shall be installed and set up by Contractor with technical assistance of manufacturer's representative and shall conform in every respect to manufacturer's instructions and Specifications.

2.3.14.2 Equipment in which manufacturer representative's services are not provided shall be installed and set up in conformity with manufacturer's and/or Owner’s drawings and instructions.

2.3.15 Construction Turn-over

2.3.15.1 Contractor shall ensure the integrity of all installed systems and full compliance with the design documents, Specifications, and manufacturer’s instructions. Any deficiencies shall be corrected at no additional cost to Owner prior to turn-over.

2.3.15.2 Contractor shall participate in construction turn-over walk-downs, meetings, and inspections upon Owner’s request.

2.3.15.3 Contractor shall provide construction turn-over documentation in accordance with the requirements of the project scope of work, Owner’s provided procedures and requirements on the design documents/Specifications.

2.3.15.4 At Owner’s discretion, Contractor may be required to create cable termination sign-off sheets by equipment or terminal box. The purpose of sign-off sheets is to document that the cables have been terminated at both ends. Contractor will be required to provide sign-off sheets after cables have been terminated and prior to release of equipment.

END OF SECTION 16010

SECTION 16020
HAZARDOUS (CLASSIFIED) LOCATION REQUIREMENTS

1.0 INTRODUCTION

1.1 Scope

1.1.1 This Specification section includes all design requirements, accepted equipment materials and manufacturers and installation procedures for the following areas in which hazardous (classified) locations occur:

1.1.1.1 Raceway and Boxes

1.1.1.2 Cables and Wiring

1.1.1.3 Transformers and Capacitors

1.1.1.4 Meters, Instruments and Relays

1.1.1.5 Switches, Overcurrent Protection and Control/Communication Equipment

1.1.1.6 Motors and Generators

1.1.1.7 Lighting Fixtures

1.1.1.8 Receptacles and Attachment Plugs

1.1.1.9 Heaters and Heat Tracing

1.1.1.10 Grounding

1.2 Definitions

1.2.1 The following hazardous area classifications are present on this plant site:

1.2.1.1 Class I, Division 1 Group D – Auto Ignition Temperature = 685˚F. An area is classified as Class I, Division 1 when it is (or runs a high risk of being) continuously exposed to significant quantities of flammable fluids. Group D fluids have lower explosion pressures than those in groups A-C and as a result, may meet less stringent explosion proof design requirements.

1.2.1.2 Class I, Division 2 Group D – Auto Ignition Temperature = 685˚F. An area is classified as Class I, Division 2 when flammable fluids are not normally present but may become so in the event of a failure or accident. Areas just outside the perimeter of a Division 1 area may also be included in Division 2. Group D fluids have lower explosion pressures than those in groups A-C and as a result, may meet less stringent explosion proof design requirements. For Class I, Division 2 Group D areas where ammonia is the only fluid present, the auto ignition temperature shall be 928˚F.

1.3 Reference Sections

1.3.1 Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.4 Codes and Standards

1.4.1 Hazardous location requirements shall be in accordance with the applicable standards of:

1.4.1.1 NFPA 70 – NEC, Articles 500, 501, 502, 504 and 515

1.4.1.2 NFPA 497 – Classification of Flammable Liquids, Gases or Vapors and of Class I Hazardous (Classified) Locations for Electrical Installations in Chemical Process Areas

1.4.1.3 NFPA 499 – Classification of Combustible Dusts and of Class II Hazardous (Classified) Locations for Electrical Installations in Chemical Process Areas.

1.4.1.4 ISA S12.24.01 – Electrical Apparatus for Explosive Gas Atmospheres, Classification of Hazardous Areas

2.0 CLASS I, DIVISION 1 GROUP D LOCATIONS

2.1 Design

2.1.1 Raceway and Boxes

2.1.1.1 Materials and Components

2.1.1.1.1 Where flexible connections are required (such as for motors, transformers, etc.), the flexible conduit must be rated for Class I, Division 1 Group D use.

2.1.1.1.2 All junction boxes shall be NEMA 8 explosion proof rated for Class I, Division 1 Group D locations.

2.1.1.1.3 Rigid galvanized steel risers shall be used where an underground conduit enters a Class I, Division 1 Group D above ground location.

2.1.1.2 Conduit Seals

2.1.1.2.1 Conduit seals are required where conduit enters a pressurized enclosure or an enclosure with devices that can produce arcs, sparks, or temperatures greater than 80% of the fluid ignition temperature (in degrees Celsius).

2.1.1.2.2 A seal is also required for conduit 2” and larger entering an enclosure with splices, taps, or terminals. Seals must be located within 18” of the entry point into the enclosure.

2.1.1.2.3 Seals are also required within 10’-0” of the exit point when a conduit leaves a Class I, Division 1 Group D area.

2.1.1.2.4 Where a length of conduit originates and ends outside of a classified area but passes through the hazardous location with no breaks in continuity (no unions, couplings, etc.), a seal shall not be required.

2.1.2 Cables and Wiring

2.1.2.1 Materials and Components

2.1.2.1.1 Where areas of the plant are accessible only to authorized maintenance personnel, type MC cable may be used if listed for Class I, Division 1 Group D.

2.1.2.1.2 Where cables risk contacting condensed vapors or liquids, the insulation shall be approved for that condition or be protected by a sheath of lead (or other approved means).

2.1.2.2 Cable Seals

2.1.2.2.1 Cable seals are to be provided for each termination with a listed fitting for Class I, Division 1 Group D use. All cables shall be sealed when entering an explosion proof or purged and pressurized enclosure.

2.1.2.2.2 Multi-conductor cable in conduit which is not listed as “gas block” type shall be sealed by removing the outer jacket and applying sealing compound to prevent the cable from transmitting gases or vapor through the core.

2.1.2.2.3 Shielded twisted pair cables shall be considered a single conductor cable and are exempt from this requirement.

2.1.2.2.4 Multi-conductor cables which are sealed within 18” of the enclosure and sealed within the enclosure (when opened to permit individual wiring) shall be considered single conductor cables and are exempt from this requirement.

2.1.2.2.5 Flexible cords shall be sealed when entering an explosion proof enclosure.

2.1.2.3 Multi-wire Circuits

2.1.2.3.1 Multi-wire branch circuits are prohibited unless disconnect devices open all ungrounded conductors simultaneously.

2.1.3 Heaters and Heat Tracing

2.1.3.1 Electrical Heat Tracing

2.1.3.1.1 All heat tracing power junction boxes, end seals, thermostats and accessories shall be listed for use in Class I, Division 1 Group D locations.

2.1.4 Grounding and Protection

2.1.4.1 Grounding and Bonding Methods

2.1.4.1.1 Grounding conductors shall bond together and extend back to the service equipment or separately derived system grounding point.

2.2 Equipment

2.2.1 Raceway and Boxes

2.2.1.1 Materials and Components

2.2.1.1.1 All above ground raceway shall be rigid galvanized steel.

2.2.1.1.2 Conduit sections, fittings and bodies shall be threaded at the ends.

2.2.1.1.3 Underground conduit located at least 2’-0” beneath the surface of a Class I, Division 1 Group D area may be concrete encased rigid Schedule 40 PVC conduit.

2.2.1.2 Conduit Seals

2.2.1.2.1 Sealing compound must be able to withstand temperatures of up to 200°F and local environmental extremities.

2.2.2 Cables and Wiring

2.2.2.1 Materials and Components

2.2.2.1.1 All exposed cables shall be type MI with termination fittings listed for use In Class I, Division 1 Group D.

2.2.3 Meters, Instruments and Relays

2.2.3.1 Enclosures

2.2.3.1.1 All meters, instruments and relays shall be encased within either NEMA 8 enclosures rated for Class 1, Division 1 Group D or purged and pressurized enclosures meeting the requirements of NFPA 496.

2.2.4 Switches, Overcurrent Protection and Control / Communication Equipment

2.2.4.1 Enclosures

2.2.4.1.1 All switching mechanisms and current interrupting devices capable of igniting flammable concentrations of fluids shall be enclosed in explosion proof NEMA 8 housings rated for Class I, Division 1 Group D or purged and pressurized enclosures meeting the requirements of NFPA 496.

2.2.4.1.2 General purpose enclosures may be used if the contacts and current breaking mechanisms are located within a hermetically sealed enclosure,

immersed completely in oil, within a factory sealed enclosure listed for the location, or where a solid state device with a surface temperature not exceeding 80% of the ignition temperature (in degrees Celsius).

2.2.5 Motors and Generators

2.2.5.1 Rotating Machinery

2.2.5.1.1 All motors and generators shall be listed as explosion proof, enclosed in a purged and pressurized container, or enclosed in a pressurized sealed enclosure. Internal and external temperatures of such machinery shall not exceed 80% of the ignition temperature (in degrees Celsius).

2.2.6 Heaters and Heat Tracing

2.2.6.1 Electrical Space Heaters

2.2.6.1.1 Heaters shall be rated for use in Class I, Division 1 Group D areas and shall have surface temperatures not exceeding 80% of the ignition temperature (in degrees Celsius).

2.2.6.2 Electrical Heat Tracing

2.2.6.2.1 Heat tracing cable shall be solid core and fiber wrapped construction and listed for use in Class I, Division 1 Group D locations.

2.2.6.2.2 The maximum temperature of any heating cable shall not exceed 80% of the ignition temperature (in degrees Celsius).

2.3 Installation

2.3.1 Raceway and Boxes

2.3.1.1 Conduit Seals

2.3.1.1.1 All seal fittings must be listed for use in class I, Division 1 Group D areas and be readily accessible after installation is complete.

2.3.1.1.2 No splices or taps may be made within a seal.

2.3.2 Cables and Wiring

2.3.2.1 Materials and Components

2.3.2.1.1 Flexible cords are permitted only if listed for “extra hard” usage. The flexible cord must contain an equipment grounding conductor and be installed with no tension at the terminal connections.

2.3.3 Meters, Instruments and Relays

2.3.3.1 Intrinsically Safe Barrier

2.3.3.1.1 Instrumentation devices with sensor wiring located within Class I, Division 1 Group D areas shall be installed with intrinsically safe barriers.

2.3.4 Switches, Overcurrent Protection and Control / Communication Equipment

2.3.4.1 Enclosures

2.3.4.1.1 Switching, circuit breaking and control equipment must be approved as a complete assembly within the enclosure.

2.3.5 Grounding and Protection

2.3.5.1 Grounding and Bonding Methods

2.3.5.1.1 Proper bonding shall be insured by installing bonding jumpers as opposed to grounding bushings and locknut contacts for all raceways, fittings, boxes, enclosures, etc.

2.3.5.2 Surge Protection

2.3.5.2.1 Surge protection equipment must be installed within a NEMA 8 explosion proof enclosure listed for use in Class I, Division 1 Group D locations or within a purged and pressurized enclosure.

3.0 CLASS I, DIVISION 2 GROUP D LOCATIONS

3.1 Design

3.1.1 Raceway and Boxes

3.1.1.1 Materials and Components

3.1.1.1.1 Junction boxes may be general purpose type only if no arc or spark producing devices are contained within.

3.1.1.1.2 Where flexible connections are required (such as for motors, transformers, etc.), the flexible conduit must be rated for Class I, Division 2 Group D use.

3.1.1.2 Conduit Seals

3.1.1.2.1 Conduit seals are required where conduit enters a pressurized enclosure or an enclosure with devices that can produce arcs, sparks, or temperatures greater than 80% of the fluid ignition temperature (in degrees Celsius).

3.1.1.2.2 A seal is also required for conduit 2” and larger entering an enclosure with splices, taps, or terminals. Seals must be located within 18” of the entry point into the enclosure.

3.1.1.2.3 Seals are also required within 10’-0” of the exit point when a conduit leaves a Class I, Division 2 Group D area.

3.1.1.2.4 Where a length of conduit originates and ends outside of a classified area but passes through the hazardous location with no breaks in continuity (no unions, couplings, etc.) a seal shall not be required.

3.1.2 Cables and Wiring

3.1.2.1 Materials and Components

3.1.2.1.1 Flexible cords are permitted only if listed for “extra hard” usage.

3.1.2.1.2 Where cables risk contacting condensed vapors or liquids, the insulation shall be approved for that condition or be protected by a sheath of lead (or other approved means).

3.1.2.2 Cable Seals

3.1.2.2.1 Cable seals are to be provided for each termination with a listed fitting for Class I, Division 2 Group D use. All cables shall be sealed when entering an explosion proof or purged and pressurized enclosure.

3.1.2.2.2 Multi-conductor cable in conduit which is not listed as “gas block” type shall be sealed by removing the outer jacket and applying sealing compound to prevent the cable from transmitting gases or vapor through the core.

3.1.2.2.3 Shielded twisted pair cables shall be considered a single conductor cable and are exempt from this requirement.

3.1.2.2.4 Multi-conductor cables which are sealed within 18” of the enclosure and sealed within the enclosure (when opened to permit individual wiring) shall be considered single cables and are exempt from this requirement.

3.1.2.2.5 Flexible cords shall be sealed when entering an explosion proof enclosure.

3.1.3 Meters, Instruments and Relays

3.1.3.1 Enclosures

3.1.3.1.1 If arc and spark producing devices are immersed in oil, enclosed in a hermetically sealed chamber, or have been tested to not ignite the atmosphere during operation, a general purpose enclosure may be used.

3.1.3.1.2 Coils which do not incorporate “make-or-break” arc producing contacts may be placed within general purpose enclosures.

3.1.4 Switches, Overcurrent Protection and Control/Communication Equipment

3.1.4.1 Enclosures

3.1.4.1.1 All switching mechanisms and current interrupting devices capable of igniting flammable concentrations of fluids shall be enclosed in explosion proof NEMA 8 housings rated for Class I, Division 2 Group D or purged and pressurized enclosures meeting the requirements of NFPA 496.

3.1.4.1.2 General purpose enclosures may be used if the contacts and current breaking mechanisms are located within a hermetically sealed enclosure, immersed completely in oil, within a factory sealed enclosure listed for the location, or where a solid state device with a surface temperature not exceeding 80% of the ignition temperature (in degrees Celsius).

3.1.4.1.3 Switches (non-fused) that are not used to interrupt live current when operated may be housed in general purpose enclosures.

3.1.5 Motors and Generators

3.1.5.1 Rotating Machinery

3.1.5.1.1 Motors or generators not listed for Class I, Division 2 Group D which use no brushes, switching devices or arc producing components may be used.

3.1.6 Heaters and Heat Tracing:

3.1.6.1 Electrical Heat Tracing

3.1.6.1.1 All heat tracing power junction boxes, end seals, thermostats and accessories shall be listed for use in Class I, Division 2 Group D locations.

3.1.7 Grounding and Protection

3.1.7.1 Grounding and Bonding Methods

3.1.7.1.1 Grounding conductors shall bond together and extend back to the service equipment or separately derived system grounding point.

3.2 Equipment

3.2.1 Raceway and Boxes

3.2.1.1 Materials and Components

3.2.1.1.1 All above ground conduit shall be rigid galvanized steel.

3.2.1.1.2 Conduit sections, fittings and bodies shall be threaded at the ends.

3.2.1.1.3 Underground conduit located at least 2'-0" beneath the surface of a Class I, Division 2 Group D area may be concrete encased rigid Schedule 40 PVC conduit.

3.2.1.1.4 Rigid galvanized steel risers shall be used where an underground conduit enters a Class I, Division 2 Group D above ground location.

3.2.1.2 Conduit Seals

3.2.1.2.1 Sealing compound must be able to withstand temperatures of up to 200°F and local environmental extremities.

3.2.2 Cables and Wiring

3.2.2.1 Materials and Components

3.2.2.1.1 Exposed cable may be type MI, MC, ITC, PLCT, TC, or MV with termination fittings listed for use in Class I, Division 2.

3.2.3 Meters, Instruments and Relays

3.2.3.1 Enclosures

3.2.3.1.1 All meters, instruments and relays shall be encased within either NEMA 8 enclosures rated for Class 1, Division 2 Group D or purged and pressurized enclosures meeting the requirements of NFPA 496.

3.2.4 Motors and Generators

3.2.4.1 Rotating Machinery

3.2.4.1.1 All motors and generators shall be listed as explosion proof and suitable for use in Class I, Division 2 Group D locations, enclosed in a purged and pressurized container, or enclosed in a pressurized sealed enclosure. Internal and external temperatures of such machinery shall not exceed 80% of the ignition temperature (in degrees Celsius).

3.2.5 Heaters and Heat Tracing

3.2.5.1 Electrical Space Heaters

3.2.5.1.1 Heaters shall be rated for use in Class 1, Division 2 Group D areas and shall have surface temperatures not exceeding 80% of the ignition temperature (in degrees Celsius).

3.2.5.2 Electrical Heat Tracing

3.2.5.2.1 Heat tracing cable shall be solid core and fiber wrapped construction and listed for use in Class I, Division 2 Group D locations.

3.2.5.2.2 The maximum temperature of any heating cable shall not exceed 80% of the ignition temperature (in degrees Celsius).

3.3 Installation

3.3.1 Raceway and Boxes

3.3.1.1 Materials and Components

3.3.1.1.1 Cable tray may be installed as long as cables contained within the tray system are not subject to tensile stresses at the termination points.

3.3.1.2 Conduit Seals

3.3.1.2.1 All seal fittings must be listed for use in Class I, Division 2 Group D areas and be readily accessible after installation is complete.

3.3.1.2.2 No splices or taps may be made within a seal.

3.3.2 Cables and Wiring

3.3.2.1 Materials and Components

3.3.2.1.1 The flexible cord must contain an equipment grounding conductor and be

3.3.3 Meters, Instruments and Relays

3.3.3.1 Intrinsically Safe Barrier

3.3.3.1.1 Instrumentation devices with sensor wiring located within Class I, Division 2 Group D areas shall be installed with intrinsically safe barriers.

3.3.4 Switches, Overcurrent Protection and Control/ Communication Equipment

3.3.4.1 Enclosures

3.3.4.1.1 Switching circuit breakers and control equipment must be approved as a complete assembly within the enclosure.

3.3.5 Grounding and Protection

3.3.5.1 Grounding and Bonding Methods

3.3.5.1.1 Proper bonding shall be insured by installing bonding jumpers as opposed to grounding bushings and locknut contacts for all raceways, fittings, boxes, enclosures, etc.

3.3.5.2 Surge Protection

3.3.5.2.1 Surge protection equipment must be installed within a NEMA 8 explosion proof enclosure listed for use in Class I, Division 2 Group D locations or within a purged and pressurized enclosure.

SECTION 16060
LOW VOLTAGE MOTORS – DESIGN, EQUIPMENT & INSTALLATION

DESIGN

1.0 INTRODUCTION

1.1 Scope

1.1.1 The work covered by this Specification includes the Specification and engineering application/design of Ameren Missouri Generation Low Voltage Motors.

1.1.2 This Specification applies to AC polyphase induction motors rated less than 250 HP and greater than ½ HP at voltages of 460 volts. Motors rated 250 HP and greater must use the Medium Voltage Motor Specifications. Motors rated 200 HP and above shall also meet the requirements of ANSI C50.41.

1.1.3 The Seller shall consider this Specification in detail for instructions pertaining to his work and shall be responsible for, and be governed by, all of the applicable requirements.

1.2 Reference Sections

1.2.1 Section 16092 – Low Voltage Variable Frequency Drives

1.2.2 Section 16100 – MCCs

1.2.3 Section 16110 – Low Voltage Switchgear

1.3 Codes and Standards

1.3.1 All motors shall be manufactured in accordance with applicable sections of the latest editions of the following codes and standards:

1.3.1.1 NFPA 70 – National Electric Code

1.3.1.2 National Electrical Manufacturers Association (NEMA)

1.3.1.3 American National Standards Institute (ANSI)

1.3.1.4 American Bearing Manufacturers Association (ABMA)

1.3.1.5 Institute of Electrical and Electronics Engineers (IEEE)

1.3.2 In cases of conflicts, the following order of precedence shall apply – this Specification, ANSI C50.41 for motors rated 200 HP and above, IEEE 841, NEMA MG 1.

2.0 LOW VOLTAGE MOTOR REQUIREMENTS

2.1 Design

2.1.1 Motor power distribution system shall be 480V, 3-phase, 3-wire, solidly grounded neutral.

2.1.2 Motor horsepower shall be sized to match the mechanical load as efficiently as possible with margin for future expansion as directed by Owner.

2.1.2.1 Motors shall be applied and specified to meet general load, operating and performance needs of project with the following parameters carefully reviewed as part of detail design:

2.1.2.1.1 Mechanical HP and torque requirements

2.1.2.1.2 Energy efficiency

2.1.2.1.3 Starting methods (direct/across the line, VFD, etc.)

2.1.2.1.4 Control and drive methods

2.1.2.1.5 Physical arrangements and limitations

2.1.2.1.6 Motor instrumentation and limitations

2.1.3 Motors to be supplied from variable frequency drives (VFDs) shall be specified and designed as inverter duty.

2.1.4 Heaters

2.1.4.1 Include motor monitoring instrumentation as specified by Owner. Provide design engineering for instrumentation including schematics, wiring and I/O to the designated control system.

2.1.4.2 Space heaters shall be provided for motors in the following conditions:

2.1.4.2.1 All motors operating in indoor and dry locations.

2.1.4.2.2 Environment conditions stated above are generic and should be evaluated on an application basis for every system and can be made more conservative if deemed necessary.

2.1.4.2.3 All intermittent motors should be provided with space heaters. For example, dampers, hoists, and crane motor.

2.1.4.2.4 Motors located in areas classified as hazardous shall be furnished with enclosures certified for use in the classified area.

2.1.4.2.5 The horsepower rating shall exceed the driven load maximum brake horsepower by a minimum of 10 percent. The service factor rating shall not be utilized for normal continuous operation.

END OF 16060 DESIGN SECTION

EQUIPMENT

1.0 INTRODUCTION

1.1 Scope

1.1.1 The work covered by this Specification includes materials and equipment used for Ameren Missouri Generation Low Voltage Motors for the Supplier/Manufacturer of motors.

1.1.2 This Specification applies to AC polyphase induction motors rated less than 250 HP and greater than ½ HP at voltages of 460 volts. Motors rated 250 HP and greater must use the Medium Voltage Motor Specifications. Motors rated 200 HP and above shall also meet the requirements of ANSI C50.41.

1.1.3 Supplier shall consider this Specification in detail for instructions pertaining to his work and shall be responsible for, and be governed by, all of the applicable requirements.

1.2 Reference Sections

1.2.1 Low Voltage Motor Data Sheet

1.2.2 Electric Motor Data Sheet

1.3 Codes and Standards

1.3.1 All motors shall be manufactured in accordance with applicable sections of the latest editions of the following codes and standards:

1.3.1.1 NFPA 70 – National Electric Code

1.3.1.2 National Electrical Manufacturers Association (NEMA)

1.3.1.3 American National Standards Institute (ANSI)

1.3.1.4 American Bearing Manufacturers Association (ABMA)

1.3.1.5 Institute of Electrical and Electronics Engineers (IEEE)

1.3.2 In cases of conflicts, the following order of precedence shall apply – this Specification, ANSI C50.41 for motors rated 200 HP and above, IEEE 841, NEMA MG 1.

2.0 LOW VOLTAGE MOTOR REQUIREMENTS

2.1 Equipment

2.1.1 General Motor Requirements

2.1.1.1 Only the following manufacturers or an Owner-approved equal shall be considered acceptable for Ameren Missouri low voltage motors:

APPROVED MANUFACTURERS	
Component	**Manufacturer**
Low voltage motors	General Electric, Baldor-Reliance Motors, Siemens, Allen-Bradley, ABB, U.S. Motors-Emerson, TECO Westinghouse, Hyundai-Ideal Electric

2.1.1.2 All three-phase motors shall be squirrel-cage induction type unless otherwise specified.

2.1.1.3 Motors shall be designed for direct-on-line (full voltage) starting.

2.1.1.4 Motors shall be rated on a continuous duty basis without exceeding the NEMA standard temperature rise for the specified ambient, elevation and enclosure, and Class B insulation.

2.1.1.5 The horsepower rating shall exceed the driven load maximum brake horsepower by a minimum of 10 percent. The service factor rating shall not be utilized for normal continuous operation.

2.1.1.6 Insulation shall be Class F minimum unless otherwise specified.

2.1.1.7 Service factor shall be 1.15

2.1.1.8 All motors shall have a minimum locked-rotor withstand time of 12 seconds.

2.1.1.9 Maximum temperature shall not exceed temperature code T3B (165° C) for all conditions including locked rotor, overload and single phasing.

2.1.1.10 Shielded, re-greaseable, vacuum degassed ball bearings shall be provided. Bearings shall be re-greseable with the motor in operation, with leakage into the stator winding. They shall have a temperature rise not exceeding 40° C at rated load measured on the housing. Bearings shall have an L-10 rated life of 50,000 hours per ABMA STD 9.

2.1.1.11 Maximum A-weighted motor sound power level shall not exceed 90 dBA (reference1012 W) when determined in accordance with NEMA MG 1, Part 9. Motor sound pressure level shall not exceed 85 dBA at 1 meter.

2.1.1.12 All motors shall be UL listed and labeled with temperature code T3B.

2.1.1.13 Motors shall not be subjected to vibration exceeding 0.5 G force.

2.1.1.14 Low voltage motors shall be severe duty type with a cast iron frame. Aluminum frames are not acceptable.

2.1.1.15 For application, in Class 2, Division 1, Group F areas, all motors shall be TEFC Explosion Proof construction, suitable for hazardous location duty.

2.1.1.16 Motor cooling fans shall be metallic. Plastic fans are not allowed.

2.1.1.17 Each motor shall have provisions for grounding the motor frame. NEMA frame sizes 254 through 445 shall each be equipped with a 3/8-inch, 16-tpi bronze grounding bolt located near the output shaft end of the motor and on the same side as the main lead conduit box.

2.1.1.18 Drain holes shall be provided with combination water drain-breather plugs.

2.1.1.19 External cooling fans for fan cooled motors shall be fabricated of brass, bronze, or aluminum alloy containing not more than 0.2 percent copper, malleable iron, or plastic.

2.1.1.20 Totally enclosed motors shall have all exposed metal surfaces protected with a corrosion-resistant polyester or epoxy paint or coating and shall have enclosure interior surfaces and the stator and rotor air gap surfaces protected with a corrosion-resistant alkyd enamel or with polyester or epoxy paint or coating.

2.1.1.21 Bolts, nuts, screws and other hardware items shall be corrosion-resistant or zinc dichromate treated metal.

2.1.1.22 All shafts shall be solid. Each shaft shall be furnished with a corrosion-resistant treatment or shall be made of a corrosion-resistant material.

2.1.1.23 Totally enclosed motors shall be furnished with drain holes and rotating shaft seals and bearing housing seals (Inproseal or equal approved by Owner).

2.1.1.24 All stator winding materials shall have a Class F, 311° F or higher thermal classification.

2.1.1.25 The temperature rises at rated output shall not exceed those for a Class B thermal insulation classification.

2.1.2 Enclosures

2.1.2.1 All other areas enclosure shall be TEFC and have a degree of protection of IP54, suitable for installation in the application specified.

2.1.2.2 Unless otherwise specified, all three-phase motors shall be NEMA Design B, with normal starting torque and low starting current for "across the line" full voltage starting.

2.1.2.3 Locked rotor kVA/HP shall not exceed NEMA Code G (6.29 kVA/HP).

2.1.2.4 Enclosure parts for all motors (e.g., frames, bearing brackets, terminal housings, external fan covers) shall be made of cast iron, cast steel, sheet steel, or steel plates. Aluminum enclosure parts are not acceptable.

2.1.2.5 Terminal Boxes and Leads

2.1.2.6 Terminal boxes shall be rotatable in 90° increments.

2.1.2.7 All terminal housings shall be externally mounted on the motor frame enclosure. Terminal housings for all motors shall be cast iron or sheet steel.

2.1.2.8 Cable motor leads shall use stranded copper conductors insulated with silicone rubber covered with a glass braid or acceptable equal. Bus bar if used inside motor terminal boxes shall be insulated. All leads shall be waterproof with the use of heat shrink, cold shrink or equivalent.

2.1.2.9 The cover of the terminal box containing the space heater connection shall be furnished with a permanent type plate cautioning that the heater circuits are energized when the motor is not running. It also should note that the disconnecting means is located in the motor controller.

2.1.2.10 Minimum protection requirements shall be equivalent to NEMA 4. All motors shall be furnished with an oversized terminal housing. Location and dimensions of terminal housings shall be acceptable to Owner.

2.1.3 Heaters

2.1.3.1 All motors shall be provided with space heaters sized to raise the average internal temperature of the motor at least 5° C above ambient temperature.

2.1.3.2 Motor terminal boxes shall be of diagonally split cover type and shall be located in accordance with NEMA Standard MG-1. Terminal boxes for 460-volt motors shall be one size larger than NEMA standard.

2.1.3.3 When located in an area that is designated as hazardous, space heater sheath temperature shall be limited as required for operation in a Class II, Group F, Division 1 area, with T3B temperature code.

2.1.3.4 Heaters shall be designed to operate at one half of heater rated voltage, for example 240 volt rated heaters shall be designed to operate at 120 volts.

2.1.4 Nameplates

2.1.4.1 Motor nameplates shall be in accordance with NEMA MG-1, Section 10.40 for integral horsepower motors.

2.1.5 Factory Testing

2.1.5.1 Testing to be performed in accordance with IEEE Std. 112.

2.1.5.2 This testing is to be considered part of the defined scope of work and all associated costs are the responsibility of Supplier. Supplier is responsible for all costs associated with correcting deficiencies and retesting in the event of a test failure.

2.1.6 Shipment

2.1.6.1 All motors which are shipped to the jobsite separate from the driven equipment shall be provided with aluminum (or equal) identification tags wired to the motor. The tags shall

bear the purchase order number of the driven equipment package and the equipment item number.

2.1.7 Field Support

2.1.7.1 Integral horsepower motors NEMA Fram 180 and above shall have suitable lifting devices for installing or removing the motor. Location of lifting points shall be shown on Supplier's drawings.

2.1.7.1.1 Supplier shall utilize lifting points and present rigging plans for NEMA Frame 180 and above motor frames.

2.1.7.2 Any work performed at the jobsite on the equipment in connection with repairs to or replacement of defective material or components shall be done under the supervision of Supplier’s representative by a party or parties mutually acceptable to Buyer and Supplier. This work shall be paid for by Supplier.

ELECTRIC MOTOR DATA SHEET

Vendor to supply with quote.

PROPOSAL DATA				
EQUIPMENT DESIGNATION (EQUIP. #)				
NUMBER OF MOTORS				
MOTOR TYPE (SQ. CAGE, SPLIT PHASE)				
MOTOR MANUFACTURER				
MFGR. TYPE DESIGNATION				
HORSEPOWER RATING				
RPM, NOMINAL				
RPM, FULL LOAD				
FRAME DESIGNATION				
ENCLOSURE (AREA DESIGNATION)				
VERTICAL OR HORIZONTAL				
ROTATION				
WEIGHT				
BEARINGS (BALL, SLEEVE)				
PHASE/FREQUENCY/VOLTAGE				
NEMA DESIGN LETTER				
INSULATION CLASS				
RANDOM/FORM WOUND				
SERVICE FACTOR				
TIME RATING/TEMP. RISE				
FULL LOAD CURRENT				
LOCKED-ROTOR CURRENT				
LOCKED-ROTOR WITHSTAND TIME				
ACCELERATION TIME				
LOCKED-ROTOR TORQUE (% FULL LOAD)				
PERMISSIBLE STARTS PER HOUR				
EFFICIENCY /POWER FACTOR (MINIMUM)				
100% LOAD				
75% LOAD				
50% LOAD				
THERMAL PROTECTION PROVIDED				
SPACE HEATERS, WATTS/VOLT				
INVERTER DUTY				
MULTI-SPEED				
NUMBER OF WINDINGS				
SPEEDS				
TORQUE (VARIABLE, CONSTANT)				
TEMPERATURE CODE				
SHOP DRAWING DATA				
MOTOR SERIAL #				

PROPOSAL DATA				
LUBRICATION BRAND				
LUBRICATION GRADE				
BEARINGS, BRAND NAME				
BEARINGS, CAT. #				

END OF 16060 EQUIPMENT SECTION

SECTION 16061
MEDIUM VOLTAGE MOTORS

DESIGN

1.0 INTRODUCTION

1.1 Scope

1.1.1 The work covered by this Specification includes the Specification and engineering application/design of Ameren Missouri Medium Voltage Motors.

1.1.2 This Specification covers the requirements for design of systems utilizing three-phase, induction motors greater than 250 HP and rated at standard NEMA voltages of 2.3, 4.0, 6.6, and 13.2 kV, 60 Hz.

1.1.3 The Engineer and Supplier shall consider this Specification in detail for instructions pertaining to his work and shall be responsible for, and be governed by, all of the applicable requirements.

1.2 Reference Sections

1.2.1 Section 16010 – Basic Electrical Requirements

1.2.2 Section 16101 – Medium Voltage Switchgear

1.2.3 Section 16195 – Electrical Identification

1.2.4 Section 16390 – Grounding

1.3 Codes and Standards

1.3.1 All motors shall be manufactured in accordance with applicable sections of the latest editions of the following codes and standards:

1.3.1.1 NFPA 70 – National Electric Code

1.3.1.2 National Electrical Manufacturers Association (NEMA)

1.3.1.3 American National Standards Institute (ANSI)

1.3.1.4 American Bearing Manufacturers Association (ABMA)

1.3.1.5 Institute of Electrical and Electronics Engineers (IEEE)

1.3.1.6 Ameren Standard 16G and Supplemental 16G

1.3.2 The motors shall specifically meet the requirements of the latest edition of ANSI C50.41, Polyphase Induction Motors for Power Generating Stations.

1.3.3 In cases of conflicts, the following order of precedence shall apply – this Specification, ANSI C50.41, all other referenced codes and standards.

1.3.4 Some motors may be located in hazardous coal dust locations as specified on the motor data sheet. The area classification of this motor location is Class II, Division 1, Group F with a temperature rating T3B per the National Electrical Code Article 500 and in particular section 502-8(a). Listed motors are preferred per Underwriters Laboratories UL 674 – Electrical Motors and Generators For Use In Hazardous (Classified) Locations. However, the motors, due to their size, may be impractical or unavailable as a UL listed motors. Therefore, the motor manufacturer shall specify on the nameplate the classification of the motor as necessary.

2.0 MEDIUM VOLTAGE MOTOR REQUIREMENTS

2.1 Design

2.1.1 Motor horsepower shall be sized to match the mechanical load as efficiently as possible with margin for future expansion as directed by Owner.

2.1.1.1 Motors shall be applied and specified to meet general load, operating and performance needs of project with the following parameters carefully reviewed as part of detail design:

2.1.1.1.1 Mechanical HP and torque requirements

2.1.1.1.2 Energy efficiency

2.1.1.1.3 Starting methods (direct/across the line, VFD, etc.)

2.1.1.1.4 Control and drive methods

2.1.1.1.5 Physical arrangements and limitations

2.1.1.1.6 Motor instrumentation and monitoring

2.1.2 Motors to be supplied from variable frequency drives (VFDs) shall be specified and designed as inverter duty.

2.1.3 All MV motors shall be equipped with space heaters.

2.1.3.1 Include motor monitoring instrumentation as specified by Owner. Provide design engineer-ing for instrumentation including schematics, wiring and I/O to designated control system.

2.1.4 Motors located in areas classified as hazardous shall be furnished with enclosures certified for use in the classified area.

2.1.5 The horsepower rating shall exceed the driven load maximum brake horsepower by a minimum of 10 percent. The service factor rating shall not be utilized for normal continuous operation.

END OF 16061 DESIGN SECTION

EQUIPMENT

1.0 INTRODUCTION

1.1 Scope

1.1.1 This Specification, together with attached data sheets, covers requirements for 3-phase, horizontal, induction motors greater than 250 HP and rated at standard NEMA voltages of 2.3, 4.0, 6.6, and 13.2 kV, 60 Hz. These voltage levels are also the nominal expected voltage at the motor terminals.

1.1.2 Motors shall be constructed and equipped in accordance with the manufacturer's standard practices where they do not conflict with this Specification.

1.1.3 The work covered by this Specification includes materials and equipment used for Ameren Missouri Generation Medium Voltage Motors.

1.1.4 Any deviations from this standard shall be documented by the submittal of an alternate proposal. Alternate proposal shall list exception by Specification section in numerical order on the first page of the alternate proposal.

1.1.5 The work covered by this Specification includes the designing and furnishing of Ameren Missouri Generation Medium Voltage Motors.

1.2 Reference Sections

1.2.1 Medium Voltage Induction Motors Typical Data Sheet

1.2.2 Motor Proposal Data Sheet

1.2.3 Motor Purchase Data Sheet

1.2.4 Section 16010 – Basic Electrical Requirements

1.2.5 Section 16390 – Grounding

1.3 Codes and Standards

1.3.1 All motors shall be manufactured in accordance with applicable sections of the latest editions of the following codes and standards:

1.3.1.1 NFPA 70 – National Electric Code

1.3.1.2 National Electrical Manufacturers Association (NEMA)

1.3.1.3 American National Standards Institute (ANSI)

1.3.1.4 American Bearing Manufacturers Association (ABMA)

1.3.1.5 Institute of Electrical and Electronics Engineers (IEEE)

1.3.2 The motors shall specifically meet the requirements of the latest edition of ANSI C50.41, Polyphase Induction Motors for Power Generating Stations.

1.3.3 In cases of conflicts, the following order of precedence shall apply – this Specification, ANSI C50.41, all other referenced codes and standards.

1.3.4 Some motors may be located in hazardous coal dust locations as specified on the motor data sheet. Listed motors are preferred per Underwriters Laboratories UL 674 – Electrical Motors and Generators For Use In Hazardous (Classified) Locations. However, the motors, due to their size, may be impractical or unavailable as a UL listed motors. Therefore, the motor manufacturer shall specify on the nameplate the classification of the motor as necessary.

2.0 MEDIUM VOLTAGE MOTOR REQUIREMENTS

2.1 Equipment

2.1.1 Only the following manufacturers or an Owner-approved equal shall be considered acceptable for Ameren Missouri medium voltage motors:

APPROVED MANUFACTURERS	
Component	**Manufacturer**
Medium voltage motors	General Electric, ABB (formerly Baldor-Reliance Motors), Siemens, Allen-Bradley, NIDEC (formerly US Motors-Emerson), WEG, TECO Westinghouse, Hyundai-Ideal Electric, Toshiba

2.1.2 The voltage, horsepower and speed ratings for the motors shall be as specified on the motor data sheet provided at the end of this section.

2.1.3 Motors shall be furnished with a sealed, vacuum-pressure impregnated Class F insulation with a Class B temperature rise.

2.1.4 Motors shall be rated for severe duty.

2.1.5 Motors shall meet the limiting temperature rise shown in Table 1 when measured by embedded stator RTDs. Temperature rises shown in Table 1 are based on a maximum ambient temperature of 40° C. If a higher ambient temperature is shown on the data sheet, the temperature rise shown in the following table shall be reduced by the number of degrees that the ambient temperature exceeds 40° C. For example, if the ambient temperature is 50° C, then for a 1000 HP motor with 1.15 SF the temperature rise shall be 90° C.

		Temperature Rise ° C	
HP Rating	Voltage Range	1.0 Service Factor	1.15 Service Factor
1500 and less	All	90	100
Over 1500	7000 and less	85	95
Over 1500	Over 7000	80	90

2.1.6 The motor starting current during a full voltage across the line start shall not exceed 600 percent of rated current.

2.1.7 The motor shall be supplied with NEMA standard load inertia (WK2) accelerating capability unless otherwise specified on the data sheet.

2.1.8 Successive starts allowable shall be in accordance with NEMA MG-1 unless otherwise specified on the data sheet.

2.1.9 Lifting and picking eyes on the motor shall be certified and shall be stamped for the rating.

2.1.10 Differential relaying is to be added for motors greater than 2500 HP or on a motor when the fault current and locked rotor current are of the same order of magnitude and when the motor application justifies the added cost of such importance to the plant. Contractor shall optionally price differential CTs for a flux summation method differential CT protection. This is three CTs wrapped around the incoming and outgoing phases in the motor lead box.

2.1.11 Contractor shall provide an analysis for the motors per IEEE Std. C62.21 “IEEE Guide for the Application of Surge Voltage Protection Equipment on AC Rotating Machinery 1000V or Greater” to determine if and to what degree surge protection is necessary for these motors. The surge protection provided shall be acceptable to Owner.

2.1.12 The motor noise level shall not exceed 85 dBa measured at 1 meter, when measured in accordance with the latest issue of IEEE Standard 85. If the 85 dBa requirement cannot be met, Vendor shall place hearing protection required signs on the motor stating the sound level at 1 meter. Signs shall be placed on 3 sides of the motor (not required on drive end).

2.1.13 The motor shall be designed to accelerate the connected load to full speed in less than 40 seconds at rated voltage and less than 55 seconds at 80% voltage.

2.1.14 The safe locked rotor time shall be a minimum of 5 seconds greater than the calculated acceleration time based on the driven load speed-torque curve, WK2, and at the minimum specified motor starting voltage.

2.1.15 Motor torque shall be calculated / designed at a constant rotor bar temperature not to exceed 75° C.

2.1.16 Motor time-current and thermal limit curves shall be provided based on IEEE Standard 620. Thermal limit curve shall be for hot conditions, i.e., for restarting the motor immediately after coasting to rest from operation at rated load and maximum ambient temperature. Maximum allowable temperature limits for thermal limit curves shall not exceed the following:

Rotor bars	340° C
Rotor end rings	140° C
Stator winding	170° C

2.1.17 Motors shall be designed for direct-on-line (full voltage) starting and shall be capable of at least two (2) consecutive successful starts (one start and acceleration to full speed - when initially at stabilized ambient temperature condition (“cold”), followed immediately by a trip and second start accelerating up to full rated speed again), with both starts at 100 percent rated voltage or at minimum starting voltage as specified herein, whichever case is more stringent.

2.1.18 Also, the motor shall be capable of one start with the motor initially at a temperature not exceeding its rated-load operation temperature. All motors shall be capable of continuous running duty in the specified ambient temperature.

2.1.19 The motor safe stall time, for all motors, shall be 4 seconds greater than the motor acceleration time at the minimum starting voltage.

2.1.20 If a service factor of 1.15 is specified, the motor must meet load requirements at 1.0 service factor. No part of the service factor shall be used in normal operation.

2.1.21 Motors shall be designed for a minimum of 1,000 full load starts per year.

2.1.22 It is the intention of this Specification that the motor manufacturer shall optimize power factor and efficiency, in order to obtain a motor with minimum full load current. For the efficiency evaluation the stated motor efficiency shall include an assumed value of stray load losses using Table 2 of IEEE Standard 112-2004.

2.1.23 Manufacturer shall supply the thermal design of the motor for customer review to meet the successive starting including coast down times of motors. Manufacturer shall use degree C for thermal analysis. See example below:

WORST CASE TEMPERATURE AFTER TWO CONSECUTIVE COLD STARTS AT 80% VOLTAGE			
	WORST CASE DEG C	TYPICAL CASE DEG C	
Ambient	40	30	Max rated / typical
Rise during 1st start	55	50	Total heat storage / 10% dissipation
Temp after 1st start	95	80	
Cooling during coast down	-20	-20	Removes heat by convection and conduction
Temp after coast down	75	60	
Rise during 2nd start	55	50	Total heat storage / 10% dissipation
Temp after 2nd start	**130**	**110**	

WORST CASE TEMPERATURE AFTER ONE HOT START AT 80% VOLTAGE			
	WORST CASE	TYPICAL CASE	
	DEG C	DEG C	
Ambient	40	30	Max rated / typical
Temp rise of motor	70	70	Expected rise on dynamometer test
Operating temp	110	100	
Cooling during coast down	-10	-10	Removes heat by convection
Temp after coast down	100	90	
Rise during start	55	50	Total heat storage / 10% dissipation
Temp after start	**155**	**140**	

2.1.24 Contractor shall have a design review meeting with Owner for MV motors.

2.1.25 Insulation System

2.1.25.1 Stator core laminations shall be non-aging, high grade silicon steel. Each lamination shall be coated on both sides with an insulating inorganic coating of at least C5 quality per ASTM A345.

2.1.25.2 Stator insulation shall be a Class F or above, chemical and moisture resistant material. It shall be capable of passing the sealed winding conformance test per NEMA MG1 20.18. The slot portion of stator coils rated greater than 4.5 kV shall be treated with a semi-conducting tape or paint for corona protection. Coils rated greater than 6.0 kV shall also employ a voltage gradient means to reduce corona in the transition area from the slot to the coil end turns.

2.1.25.3 Stator slot wedges shall be segmented and shall cover the entire length of each slot.

2.1.25.4 Motor lead insulation shall be a Class F or above material. It shall be extruded to form a solid, void free, integrally-sealed, non-hygroscopic system.

2.1.25.5 The stator windings with the leads attached shall be vacuum pressure impregnated in Class F or above epoxy insulating resin (and baked) not less than two times. When the stator assembly is too large for vacuum impregnation, coils shall be individually vacuum impregnated and baked prior to assembly in the stator. Inter-coil and coil to lead connection shall be impregnated with resin and baked.

2.1.25.6 The stator core shall be capable of withstanding insulation burnout at a temperature of 750° F without damage.

2.1.25.7 Stator winding end turns shall be braced to withstand repeated full line voltage starting and cycling load conditions. Manufacturer shall provide standard design with proposal.

2.1.25.8 Stator winding turn insulation shall be designed to have an impulse voltage withstand capability per the alternative withstand envelope Figure 2 of IEEE Standard 522-2004. Manufacturer may offer an alternative insulation system that has a surge voltage withstand capability as shown in Figure 1 of IEEE Standard 522-2004.

2.1.26 Vibration Requirements

2.1.26.1 Bearing housing vibration velocity shall not exceed the unfiltered values indicated below when measured in three mutually perpendicular directions on the bearing housing and on the motor shaft extension in the vertical and horizontal direction.

# of Poles	Synch. Speed	Vender Use Vibration (in/s)	Ameren Use Only Vibration (mils) peak
2	3600	0.12	0.4

# of Poles	Synch. Speed	Vender Use Vibration (in/s)	Ameren Use Only Vibration (mils) peak
4	1800	0.12	0.8
6	1200	0.12	1.2
8	900	0.096	1.2
10	720	0.072	1.4
12 or more	600 or less	0.064	1.5

2.1.27 Rotors

2.1.27.1 The rotor shall be of a squirrel-cage laminated construction. Copper is the preferred rotor winding material. However, aluminum rotors may be offered as an option with an associated deduct price from the base copper bid. If an aluminum rotor is offered as an option, an end user list must accompany the proposal. Bidder may not submit an aluminum rotor as the sole bid.

2.1.27.2 All motor rotating components shall be dynamically balanced after mounting on the shaft. Motor vibration shall not exceed half of the peak-to-peak amplitude values as defined in NEMA MG-1 (for motors <500 HP) and ANSI/API 541 (for motors ≥500 HP).

2.1.27.3 The minimum clearance space required for removal of the rotor shall be indicated on the dimensional outline drawing.

2.1.27.4 The entire rotor assembly shall be coated with a suitable corrosion resistant finish after fabrication.

2.1.27.5 Manufacturer shall supply an example of their standard end ring design with the proposal. End ring design is very critical for high inertia applications. For applications with load inertia greater than 1.5 times NEMA inertia, manufacturer shall supply example drawings of the end ring design with the proposal. The end ring design shall have been successfully used on similar motors with high load inertia and have at least 10 years operating experience.

2.1.28 Motor Enclosure

2.1.28.1 All motors shall be provided with space heaters sized to raise the average internal temperature of the motor at least 5° C above ambient temperature. Heaters shall be designed to operate at one half of heater rated voltage, for example 240 volt rated heaters shall be designed to operate at 120 volts. The cover of the terminal box containing the space heater connection shall be furnished with a permanent type plate cautioning that the heater circuits are energized when the motor is not running. It also should note that the disconnecting means is located in the motor controller.

2.1.28.2 Motor enclosures shall comply with NEMA standards.

2.1.29 Space Heaters

2.1.29.1 All motors shall have space heaters.

2.1.29.2 Space heaters shall be sized as required to raise the average internal temperature of the motor at least 5° C above ambient temperature and to maintain the motor internal temperature above the dew point when the motor is idle. Space heaters shall be powered with 120V AC when the space heaters are 1,200 watts or less. Space heaters greater than 1,200 watts shall be configured as 3 phase heaters and shall be powered with 480V AC. Heaters shall be designed to operate at one half of heater rated voltage; for example 240 volt rated heaters shall be designed to operate at 120 volts. Heaters shall be located and insulated so that they do not damage motor components or finish.

2.1.29.3 Terminal housings for all motors shall be cast iron or sheet steel. Minimum protection requirements shall be equivalent to NEMA 4.

2.1.29.4 All motor leads located in the housings shall be permanently marked for ease of identification.

2.1.29.5 A separate accessory terminal housing shall be provided for space heater leads, CT secondary leads, temperature detector leads, differential pressure switches and other similar accessory equipment leads. It shall be complete with screw type terminal blocks for termination of such leads. Each terminal in the blocks shall be identified and marked for its respective leads. Accessory terminal housings shall be accessible from outside the motor.

2.1.29.6 Current transformers for motor differential protection shall be mounted in the power lead terminal housing and terminated in an accessory terminal housing on shorting type terminal blocks.

2.1.29.7 MV motors shall be provided with busbar connections for feeder cable. Busbar shall accommodate two (2) hole compression lugs.

2.1.29.8 A grounding terminal with a connector suitable for No. 2 to No. 4/0 AWG stranded copper wire shall be installed in the stator lead terminal housing.

2.1.29.9 All conductors or busbar inside the motor terminal housing shall be insulated with material appropriate for the operating voltage class.

2.1.29.10 A terminal housing for power leads and a separate accessory terminal housing for accessory leads shall be furnished on all motors.

2.1.29.11 Motor power lead terminal housings shall be large enough to provide working space for the field fabrication of stress relief kits for shielded cable within the housing and to contain the stress relief kits after fabrication. In those cases, the minimum distance from the motor leads to the cable entrance plate of the motor terminal box shall be as follows:

- Motors with cable leads - 24 inches
- Motors with bus bar leads - 36 inches

2.1.30 Leads

2.1.30.1 When current transformers for motor differential protection are supplied for single-speed motors, the motor phase leads shall be wired to the motor power lead terminal housing for connection for self-balancing current type differential protection. Each current transformer shall encircle all power leads to the associated winding. The motor winding wye or delta connections shall be completed at the factory, leaving only three leads, T1, T2, T3 (U, V, W), for field connection in the power lead terminal housing. The wye or delta connection shall be completed in a manner that will allow easy access to the end of each phase for field testing.

2.1.30.2 All leads, including motor power leads, current transformer leads, space heater leads, temperature detector leads and alarm device leads, shall be wired into their respective terminal housings. Each lead marking shall be visible after taping of the terminals.

2.1.30.3 Non-motor power leads shall be wired to terminal blocks in the terminal boxes mounted on the motor (physically separated from the motor power leads).

2.1.30.4 Motors should rotate in the same direction for like applications.

2.1.30.5 Cable motor leads shall use stranded copper conductors insulated with silicone rubber covered with a glass braid or acceptable equal. Busbar, if used inside motor terminal boxes, shall be insulated. All leads shall be waterproof with the use of heat shrink, cold shrink or equivalent.

2.1.30.6 Contractor shall have a procedure that states the motor leads to stator winding tape length and requires worker sign-off of proper installation in the quality check.

2.1.31 Bearings

2.1.31.1 The motor bearing opposite the coupling end shall be insulated from the motor frame. A high grade hygroscopic insulating material shall be used.

2.1.31.2 Bearings shall be lead free to meet OSHA requirements to avoid hazardous work on future repairs.

2.1.31.3 The bearing oil reservoir shall have an optionally priced oil sampling line, if not standard.

2.1.31.4 Manufacturer shall supply recommended oil to be used in the motor.

2.1.31.5 Thrust bearings for vertical motors shall have Kingsbury or Michell bearings.

2.1.31.6 The motor shall be supplied with the manufacturer's standard sleeve bearing system unless otherwise specified on the data sheet. Manufacturer shall supply standard bearing design with proposal.

2.1.31.7 Sleeve type bearing housings shall be split type design to facilitate inspection and replacement without disassembly of the motor. Motor shall have:

1) Bearing housing oil reservoirs of sufficient depth to act as settling basins

2) Bearing housing oil reservoir drain valves with plugs

3) Oil rings

4) Bearing housing sight gauges. These gauges shall be externally mounted marked with proper oil levels.

5) RTDs and thermocouples shall be as specified on the data sheets.

2.1.31.8 The bearing embedded detectors shall be insulated such that the thermal couple itself shall not bypass the bearing insulation system.

2.1.31.9 The bearing surface temperature shall not exceed 90° C total temperature when measured by embedded temperature detectors. This temperature limit is for all operating conditions from no load through full load of the motor.

2.1.31.10 The bearing housing shall make provisions for temporary or permanently mounted vibration equipment per the customer’s plant specific requirements.

2.1.32 Oil Lubrication Systems

2.1.32.1 For oil reservoirs over 1 gallon; sample taps shall be provided to take samples in the live zone of the reservoir. If one reservoir services multiple bearings, a sample port shall be installed in each return line for troubleshooting purposes.

2.1.32.2 For non-pressurized locations Checkfluid Inc. LT series Minimess ports shall be used. For lines 750 to 6000 psi Checkfluid KST probes shall be used. Any reservoir with breathers shall have a desiccant breather appropriate for the location. Outside or high humidity locations shall use a breather with an expansion chamber such as the Des Case Hybrid. Less severe locations shall use a standard breather such as Des Case Standard Desiccant Breathers.

2.1.32.3 If an external lubricant recirculating system is provided, Contractor shall furnish pipe taps for oil inlet and outlet connections in addition to the internal lubricant recirculating system previously specified. Pipe taps for vertical motors shall be arranged to recirculate oil from the motor thrust bearing oil reservoir for cooling.

2.1.32.4 Where water cooling of bearing oil is required, Contractor shall furnish pipe taps for the water inlet and outlet connections. Contractor's lubrication system shall maintain proper cooling of the oil and bearings under the cooling water conditions specified.

2.1.32.5 Sufficient oil cooling (external or internal) shall be provided to maintain oil sump temperature at or below 160° F at specified ambient condition. The probability of reverse rotation or emergency shutdown shall be considered in the bearing design details.

2.1.32.6 Contractor's lubrication system shall maintain proper lubrication and cooling of the bearings over the complete performance range of the external lubricant recirculating

system. The internal lubricant recirculating system shall provide proper lubrication and cooling of the bearings during startup and coast-down with no oil flow from the external lubricant recirculating system.

2.1.33 Shafts and Couplings

2.1.33.1 The manufacturer shall mount a half coupling if so specified on the data sheet.

2.1.33.2 All shafts shall be solid. Each shaft shall be furnished with a corrosion-resistant treatment or shall be made of a corrosion-resistant material.

2.1.33.3 The output shafts of motors furnished with sleeve bearings shall be circumscribed with permanent marks indicating the motor magnetic center and end float limits when level and running at rated speed. A permanent, identified reference point shall be indicated or attached to the bearing housing or shaft seal. The markings shall be easily identifiable for use during motor installation.

2.1.33.4 For horizontal sleeve bearing motors, the rotor end float and coupling end play shall be in accordance with NEMA requirements.

2.1.33.5 The distance from the magnetic center line mark to each end float limit mark shall be not less than 37.5 percent of the total rotor end float.

2.1.33.6 For motors purchased separately from the driven equipment, coupling drawings or templates for shaft machining shall be provided. Half couplings shall be supplied to Contractor by the driven equipment supplier. Contractor shall mount and secure the half couplings to the motor shafts.

2.1.33.7 Shafts four (4) inches in diameter and larger shall have generous radii at all transitions in shaft diameter to alleviate stress concentrations. Shaft radii shall be reviewed with the customer at the design review meeting.

2.1.33.8 The shaft end play of sleeve bearing motors shall conform to the requirements of NEMA MG-1. The magnetic center position of the shaft shall be scribed on a permanent nameplate. Total end play and end play limits shall be shown on motor outline drawing.

2.1.33.9 The manufacturer shall supply shaft design for approval by customer.

2.1.34 Ground Connectors

2.1.34.1 The grounding connector may be a lug or terminal or other acceptable grounding connector. Ground cable size will be 4/0 AWG.

2.1.34.2 Each motor shall be furnished with a grounding connector attached to the motor frame inside the power lead terminal housing.

2.1.35 Torque Characteristics

2.1.35.1 The torque provided shall be sufficient to accelerate the connected load with the lesser of 80 percent of nominal voltage on the motor terminals or the voltage available as determined from the system information provided on the data sheet.

2.1.35.2 At the minimum starting voltage specified, motor torque shall exceed the load torque by at least 15 percent of full load torque at any point on the motor speed torque curve up to the breakdown torque point.

2.1.35.3 Load-torque characteristics will be furnished by the driven equipment supplier; however, the responsibility for successful starting under the given conditions shall rest with the motor manufacturer.

2.1.35.4 The motor shall be supplied with NEMA standard load inertia (WK2) accelerating capability unless otherwise specified on the data sheet.

2.1.36 Soleplates

2.1.36.1 Soleplate anchor bolt cross-sectional area shall not be less than the cross-sectional area of the motor mounting bolts.

2.1.36.2 Anchor bolt holes shall be shop drilled and shall be oversized 1/4 inch in diameter. The anchor bolts shall be located under the motor, and all projections, including washers and nuts, shall clear the motor and its appurtenances completely.

2.1.36.3 Grout holes shall be provided in the central portion of each soleplate. Motor mounting holes shall be drilled and tapped.

2.1.36.4 Motors shall be designed to permit convenient access for drilling vertically through the motor feet for installation of tapered dowel pins after the motors are mounted with driven equipment.

2.1.36.5 Where motor design requires angle drilling of dowel pin holes through the motor feet, Contractor shall start the dowel pin holes at the required angle, and shall drill each hole to a depth not less than one-half the thickness of the motor feet.

2.1.36.6 The tapered dowel pins shall be furnished by Contractor.

2.1.36.7 Soleplate drawings shall be furnished indicating the size and location of the anchor bolts holding each soleplate to the concrete foundation and all mounting, alignment and connection details and procedures.

2.1.36.8 Motor mounting bolts shall be furnished with each soleplate. All foundation anchor bolts, washers, and nuts shall be furnished by Contractor.

2.1.36.9 Soleplates shall be furnished for each motor.

2.1.37 Temperature Detectors

2.1.37.1 Type E thermocouple temperature detectors shall be dual-element ungrounded. All temperature detectors shall be ungrounded with detector leads wired to terminal blocks furnished in the accessory terminal housings.

2.1.37.2 A grounding terminal for each temperature detector shall be included with the detector lead terminals. The grounding terminals shall be provided with internal wiring to a common ground connection.

2.1.37.3 The internal wiring shall be removable.

2.1.38 Bearing Temperature Detectors

2.1.38.1 Dual element Type E thermocouple bearing temperature detectors shall be provided. Each detector shall be complete with a detector head and holder assembly; the detector temperature-sensitive tip shall be hermetically sealed.

2.1.38.2 Where sleeve type bearings are furnished, each detector tip shall be held in intimate contact with the outside diameter of the bearing babbitt not more than 1/8 inch from the shaft surface of the bearing.

2.1.39 Wiring Temperature Detectors

2.1.39.1 Winding temperature detectors shall be 100 ohm platinum RTDs as specified herein. Temperature detector and detector lead insulation class shall be the same as the stator coil insulation class.

2.1.39.2 Resistance temperature detectors (RTDs) shall be of the 3 wire type. All leads of a given RTD shall be electrically isolated from the leads of the next RTD. The motor supplier shall clearly indicate on the motor wiring diagrams which winding (phase) of the motor is monitored by each winding temperature detector.

2.1.39.3 MV motors shall have a minimum of two RTDs per phase.

2.1.40 Current Transformers

2.1.40.1 Unless otherwise indicated on the Equipment Data Sheets, motors above 2500 hp shall be provided with differential current protection by providing either of the following:

2.1.40.1.1 Six CT Method, when specified on the Equipment Data Sheets.

2.1.40.1.2 Current transformers shall be mounted in a terminal box or inside the motor enclosure.

2.1.40.1.3 Each current transformer shall have a ratio of 50/5A and a Relaying Accuracy Class of C50.

2.1.41 Vibration Transducer Mounting

2.1.41.1 As determined during detailed design, vibration transducer mounting for field installation of vibration transducers shall be provided on the drive shaft bearing housing of the motor.

2.1.42 Critical Speeds

2.1.42.1 Motors shall be designed to keep torsional and rotational natural frequencies of vibration at least 25 percent (or at least 15% for well damped resonant frequencies (having amplification factors less than 5.0) subject to approval by Owner) above or below, preferably above, the motor rated speed ranges to avoid resonant vibration over the operating speed range of the equipment-motor unit.

2.1.43 Terminal Boxes

2.1.43.1 Each box shall have a bolted and gasketed removable cover identified by a permanent nameplate.

2.1.43.2 A grounding terminal with a connector suitable for No. 2 to No. 4/0 AWG stranded copper wire shall be installed in the stator lead terminal box.

2.1.43.3 Terminal Boxes shall be watertight and meet the requirements of the area classification shown on the data sheet. The boxes shall be suitable for entry through the bottom.

2.1.43.4 Separate terminal boxes shall be provided for:

2.1.43.4.1 Stator leads (including surge protection package and current transformers if specified)

2.1.43.4.2 Current transformer secondary leads

2.1.43.4.3 Space heater leads

2.1.43.4.4 Temperature sensor and vibration sensing unit leads

Items 2.1.52.4.1, 2.1.52.4.2, 2.1.52.4.3 and 2.1.52.4.4 may be provided in a single terminal box if so specified on the data sheet.

2.1.43.5 The stator lead terminal box shall be of ample size to terminate the incoming cables (cable information on data sheet), stress cone kits, and any surge equipment or current transformers listed on the data sheet. Cable size may change dependent on FLA changes by manufacturer per design process. Stator lead terminal box size changes due to design process will not be at customer's expense.

2.1.43.6 Terminal boxes shall be orientated on the motor as specified on the motor data sheet.

2.1.44 Protection

2.1.44.1 Surge protection suitable for the system voltage shall be supplied, if specified on the motor data sheet. It shall be located in the stator lead terminal box.

2.1.44.2 Stator winding and bearing temperature detectors shall be furnished when specified on the motor data sheet.

2.1.44.3 Differential Relaying is to be added on a motor when fault current and locked rotor current are of the same order of magnitude and when the motor application justifies the added cost of such importance to the plant. Manufacturer shall optionally price differential CTs for a flux summation method differential CT protection. This is 3 CTs wrapped around the incoming and outgoing phases in the motor lead box.

2.1.45 Nameplate

2.1.45.1 The motor nampleate shall contain information as required by NEMA. Manufacturer shall supply standard nameplate picture with proposal.

2.1.46 Painting (Manufacturer to supply painting standard with proposal)

2.1.46.1 The motor frame assembly including covers, bearings, stator-rotor air gaps, etc., shall be cleaned to bare metal and sealed with a moisture-resistant, long life protective coating.

2.1.46.2 The enclosure exterior and interior (when applicable) including all air flow passages, shall be cleaned to bare metal, primed with an inorganic zinc coating and finished with a chemically resistant paint compatible with the inorganic primer.

2.1.47 Testing

2.1.47.1 Each motor shall be given routine factory tests.

2.1.47.2 Additional testing on the first motor of each design shall be performed as required.

2.1.48 Variations from Rated Voltage and Rated Frequency:

2.1.48.1 Induction motors shall operate successfully under running conditions at rated load with a variation in the voltage or the frequency as follows:

2.1.48.1.1 Plus 10 or minus 20 percent of rated voltage with rated frequency.

2.1.48.1.2 Plus or minus 5 percent of rated frequency with rated voltage.

2.1.48.1.3 A combined variation in voltage and frequency of 10 percent (sum of absolute values) of the rated values provided the frequency variation does not exceed ± 5 percent of rated frequency.

2.1.49 Warranty

2.1.49.1 Motors shall be guaranteed by the manufacturer against defective material, poor workmanship, design deficiencies and failure from normal usage for a minimum of 1 year after being placed in the specified service or 18 months after the date of shipment. The Manufacturer shall repair, as required, any equipment damage or failures resulting from poor workmanship or faulty design found within this time frame without expense to the purchaser. Any work performed at the jobsite on the equipment in connection with repairs to or replacement of defective material or components shall be done under the supervision of Seller's representative, by a party or parties mutually acceptable to Buyer and Seller.

2.1.50 Drawings and Submittals

2.1.50.1 Manufacturer shall certify each drawing as correct, positively identify each drawing as to the motor to which it applies, and list all changes on each drawing maintaining a date and revision change for each change.

2.1.50.2 All manufacturer drawings shall be in an AutoCAD or Microstation format. No PDFs are acceptable.

2.1.50.3 All manufacturer test data sheets and other publications shall be in a PDF format. Other publications include installation, receiving, storage and maintenance instructions.

2.1.50.4 All drawings and PDF submittals shall contain a document number, revision number and date for archiving and reference for design and future discussions on the motor.

2.1.50.5 Manufacturer shall send design review drawings no later than 25 business days after receipt of a PO. Manufacturer shall send four (4) sets of design review drawings and PDFs to customer for approval.

2.1.50.6 Manufacturer shall send eight (8) sets of after test finalized drawings and PDFs in a binder book. Each book shall come with a CD of all the test sheets, drawings, other publications. Spine and cover of book shall include plant name, motor designation and unit number and motor character (example: Labadie Induced Draft Fan Unit 1A). Spine and cover shall also reference customer work order number, customer purchase order number and manufacturer's shop order number.

MOTOR PROPOSAL DATA SHEET (Contractor to supply with bid)

MOTOR RATING

Manufacturer	
Horsepower	
Voltage	
Full load RPM	
Temperature rise at SF rating	
Service Factor	

PERFORMANCE DATA

	100% Load	75% Load	50% load	No Load
Current – Amps				
Efficiency - %				-----
Power Factor - %				

STARTING DATA

Locked rotor current – Amps	
Locked rotor current - % of FL	
Locked rotor PF - %	
Locked rotor torque – lb.-ft.	
Locked rotor torque - % of FL	
Pull-up torque - % of FL	
Breakdown torque - % of FL	
Motor rotor inertia (WK^2) lb.-$ft.^2$	
Maximum load inertia (WK^2) lb.-$ft.^2$	
Number of consecutive starts – cold/hot	
Cooling time after max. starts – running/standing	

ACCELERATION TIME (SECONDS)

at 100% Voltage	
at 90% Voltage	
at 80% Voltage	
at Minimum Specified Starting Voltage	

HOT SAFE STALL TIME (SECONDS)

at 100% Voltage	
at 90% Voltage	
at 80% Voltage	
at Minimum Specified Starting Voltage	

Standard Outline drawing #

Motor Speed-Torque curve #

ADDITIONAL DATA

Maximum vibration tolerance that motor can handle from driven load	in/s mils

MOTOR PURCHASE DATA SHEET (Contractor to supply with bid), Page 1 of 3

MOTOR RATING

Manufacturer	
Serial Number	
Horsepower	
Voltage	
Full load RPM	
Temperature rise at SF rating	
Service Factor	

PERFORMANCE DATA

% Load	115	100	75	50	25	0
Current – Amps						
Efficiency - %						
Power Factor - %						
RPM						

STARTING DATA

Locked rotor current – Amps	
Locked rotor current - % of FL	
Locked rotor PF - %	
Full load torque – lb.-ft.	
Locked rotor torque - % of FL	
Pull-up torque - % of FL	
Breakdown torque - % of FL	
Motor rotor inertia (WK^2) lb.-ft.^{2}	
Temperature rise after one start	
Stator winding	
Rotor bars	
End rings	

ACCELERATION AND SAFE STALL TIMES (SECONDS)

Starting Voltage	100%	90%	80%	Minimum specified
Acceleration time				
Safe Stall time (hot)				
Safe Stall time (cold)				
Number of consecutive starts hot / cold				
Cooling Time Constants Running / Stopped				

After maximum number of consecutive starts, further starts may be made at _____ minute intervals, provided that stator temperature measured by the hottest RTD is less than ____° C prior to each start.

RECLOSURE

Maximum residual voltage before re-closure	
Time delay in open circuit time constants required for residual voltage to decay to above level	
Open circuit time constant (seconds with and without power factor correction capacitors)	

(CONTINUED ON NEXT PAGE)

MOTOR PURCHASE DATA SHEET (Contractor to supply with bid), Page 2 of 3

ADDITIONAL DATA

Space heater power requirements – Watts/Voltage		
Bearing oil requirements (for pressure lubrication)	PSI	GPM
Maximum vibration tolerance that motor can handle from the driven load	in/s	mils

INDUCTION MOTOR PARAMETERS - PER UNIT VALUES

R1	X1	Xm	R2	X2	X"d	X/R	Base Impedance-ohms

CALCULATED TEMPERATURE DURING STARTING (USE WORST CASE ROTOR OR STATOR)

Worst Case Temperature After Two Consecutive Cold Starts At 80% Voltage			
	Worst Case	**Typical Case**	
	Deg C	**Deg C**	
Ambient			Max rated / typical
Rise during 1st start			Total heat storage / 10% dissipation
Temp after 1st start			
Cooling during coast down			Removes heat by convection and conduction
Temp after coast down			
Rise during 2nd start			Total heat storage / 10% dissipation
Temp after 2nd start			
Worst Case Temperature After One Hot Start At 80% Voltage			
	Worst Case	**Typical Case**	
	Deg C	**Deg C**	
Ambient			Max rated / typical
Temp rise of motor			Expected Rise on dynamometer test
Operating temp			
Cooling during coast down			Removes heat by convection
Temp after coast down			
Rise during start			Total heat storage / 10% dissipation
Temp after start			

MOTOR REWIND AND REPAIR DATA

STATOR

Number of stator slots	
Stator slot size (width x depth)	
Stator slot depth under slot wedge	
Stator copper strand size	
Strand insulation thickness and description	
Number of strands per turn	
Turn insulation description	

(CONTINUED ON NEXT PAGE)

Number of turns per coil	

Finished coil dimensions in slot (width x height x length of straight section)	
Stator coil extension from core (DE / ODE)	
Coil Throw 1	
Winding connection (wye or delta)	
Number of winding parallel circuits	
Slot filler description and thickness (top/middle/bottom)	
Stator core outside diameter	
Stator core inside diameter	
Stator gross core length	
Number and size of stator core radial vents	
Stator core lamination insulation type	
Stator core lamination grade (loss/lb. at 1.5T esla)	

ROTOR

Number of rotor bars	
Rotor bar alloy	
Bar conductivity - % IACS	
Bar length between end rings	
Bar dimensions (width x height) (If other than rectangular provide sketch)	
Rotor slot dimensions (width x height) (If other than rectangular provide sketch)	
Rotor slot lip (state whether open or closed)	
Rotor slot lip dimensions (width of opening x depth from rotor OD to rotor bar)	
Rotor outside diameter	
Rotor inside diameter	
End ring finished dimensions (OD x ID x thickness)	
End ring alloy	
Retaining ring material	
Retaining ring (magnetic or non-magnetic)	

DRAWINGS AND CURVES

Outline Drawing # ___.

Nameplate Drawing # ___.

Speed-torque-current curve # ___.

Time current and thermal limit curve # ___.

Performance curves # ____.

END OF 16061 EQUIPMENT SECTION

END OF SECTION 16061

SECTION 16111
GENERAL RACEWAY, CONDUIT AND WIREWAY

1.0 INTRODUCTION

1.1 Scope

1.1.1 This Specification includes general requirements which apply to all raceway installations along with specific requirements for conduit and wireway. For sections containing specific requirements for cable tray, duct bank, and trench refer to 1.2 Reference Sections.

1.1.2 These conduit and wireway standards include all design requirements, accepted equipment materials and manufacturers, and installation procedures that have been deemed as the established standards for Ameren Missouri Generation conduit and wireway systems and components.

1.2 Reference Sections

1.3 Codes and Standards

1.3.1 NFPA 70 – National Electric Code (NEC)

1.3.2 National Electrical Manufacturers Association (NEMA)

1.3.3 Underwriters' Laboratories, Inc. (UL)

1.3.4 American National Standards Institute (ANSI)

1.3.5 Occupational Safety and Health Administration (OSHA)

2.0 GENERAL RACEWAY REQUIREMENTS

2.1 Design

2.1.1 Raceway routes shall be approved by Owner project engineer, Construction Project Lead, or authorized Owner's representative.

2.1.2 The location and material used for the raceway shall be designed for the identified hazards for that specific location.

2.1.3 Elevations of the raceway shall be increased appropriately in areas where equipment removal, disassembly, or maintenance requires it.

2.1.4 Where openings through grating are required, the openings shall be made at divisions or ends of grating sections to the greatest extent possible.

2.2 Equipment

2.2.1 All raceway and raceway components must comply with NFPA 70.

2.2.2 All raceway and raceway components shall be as manufactured as detailed below.

2.3 Installation

2.3.1 The hanging requirements for raceway include:

2.3.1.1 Bracket supports shall be used where specifically indicated and may be substituted for other types of hangers where acceptable to the Owner.

2.3.1.2 Raceway supports attached to concrete floors shall be installed such that they are elevated and grouted above the finished floor a minimum of 1 inch to prevent corrosion caused by exposure to standing water.

2.3.1.3 Raceway and all supports for raceway connected to equipment, piping, conduits, etc., that have been electrically insulated from contact with other structures shall be properly installed to prevent shunting of the insulation.

2.3.1.4 Particular attention shall be given to bearings on large motors and insulated piping flanges.

2.3.1.5 Beam clamps for attachment of hanger rods to structural steel beams shall be electro-galvanized steel and shall be provided with safety beam anchor straps.

2.3.2 All sealing materials and installation methods shall be acceptable to Owner prior to installation.

2.3.2.1 Sealing installation shall be finished to provide a smooth, neat appearance.

2.3.2.2 Openings shall not be sealed until all the cables passing through the opening have been installed and tested.

2.3.3 All galvanized surfaces on which the galvanizing is removed or damaged by cutting, drilling, or any other operation shall be re-galvanized in accordance with ASTM A780.

Contractor's as-built drawing set shall be available to Owner.

Contractor's as-built record set shall be turned over to Owner after installation of all raceway is completed.

3.0 GENERAL CONDUIT REQUIREMENTS

3.1 Design

3.1.1 Conduit types and installation locations are listed in the table below:

TYPE OF CONDUIT	INSTALLATION LOCATION
Rigid Metallic Conduit	All above ground conduit interconnections between devices, panels, boxes and fittings.
PVC Coated Rigid Metallic Conduit	Under roadways and other similar high load areas that are underground. Corrosive areas and conduit riser penetrations.
Plastic Conduit	Underground routes and site lighting.
Liquid-Tight Flexible Metallic Conduit	By both building steel and by structures subject to vibration or thermal expansion in all process areas or where water contact may be an issue.
Flexible Metallic Conduit	By both building steel and by structures subject to vibration or thermal expansion where water contact is not an issue.
Electro-metallic Tubing (EMT)	Administration/office area lighting, receptacles, HVAC/ misc. appliances, and communications (non-process) only, as approved by Owner.

3.1.2 Arrange conduit to maintain headroom and present a neat appearance.

3.1.3 Conduit outlet bodies shall be provided where required for pulling ease and changing conduit direction.

3.1.4 Use conduit hubs for fastening conduit to cast boxes, and for fastening conduit to sheet metal boxes in damp or wet locations.

3.1.5 Two-piece conduit clamps shall be designed for use with the 1-5/8 inch series formed channel.

3.2 Installation

3.2.1 Conduit fittings

3.2.1.1 Expansion fittings shall be provided in threaded conduit runs to allow for the expansion and contraction of conduit supported across expansion joints.

3.2.1.2 Conduit fittings for metal conduit shall be installed wrench-tight.

3.2.1.3 Seal-off fittings shall be provided to isolate conduit runs and prevent the passage of flammable gases, vapors and dusts from hazardous areas.

3.2.1.4 Completed conduit seal-off fitting installations shall not restrain equipment removal or access beyond that which would be encountered if there were no sealing fitting installed on the conduit run.

3.2.2 The use of a pipe tee or vise for bending metal conduit shall not be permitted.

3.2.3 Conduit shall be securely fastened to all boxes and cabinets.

3.2.4 Conduit may be routed through building steel only when the routing is reviewed for structural integrity and approved by Owner. Contractor shall minimize routing conduit through structural members to the greatest extent possible.

3.2.5 If the conduit connected to the equipment exceeds the number or size of threaded hubs supplied with the equipment, additional material shall be furnished and installed as required to connect the conduit to the equipment.

3.2.6 One interior locknut, one exterior locknut, and one bushing shall be provided at the termination of each rigid metal conduit not terminated in a hub or coupling.

3.2.7 Locknuts shall be designed to securely bond the conduit to the box when tightened while also preventing loosening by vibration.

3.2.8 Conduit unions shall be provided for the connection of two threaded conduit ends when the conduit cannot be turned.

3.2.9 Reducers shall be provided to connect two different conduit sizes together.

3.2.10 Hazardous area conduit seal-off fittings shall be installed at locations required by the NEC for the classified area.

3.2.11 Plugs shall be either threaded plastic or threaded metal inserts.

3.2.12 Except as otherwise specified, all conduit shall be installed in exposed runs parallel or perpendicular to dominant surfaces with right angle turns made of symmetrical bends or fittings.

3.2.13 Expansion joints shall be provided as recommended by the manufacturer.

3.2.14 Conduit bodies and fittings used in hazardous areas shall conform to NEC requirements for the area classification.

3.2.15 Do not fasten conduit with wire or perforated pipe straps. Remove all wire used for temporary conduit support during construction, before conductors are pulled.

3.2.16 Conduits in single runs or groups of two shall be supported by one-hole cast metal clamps with clamp backs, or with conduit clamps attached to beams.

3.2.17 Electrical metallic tubing shall be joined together by unthreaded compression couplings.

3.2.18 A run of conduit shall not contain more than the equivalent of four 90 degree bends, including those immediately at outlet bodies and fittings.

3.2.19 The center line radius of field bends shall not be less than six times the nominal trade size diameter of the conduit.

3.2.20 The plane of all conduit ends shall be square and perpendicular with the center line.

3.2.21 The ends of all conduit and tubing shall be reamed to remove all rough edges and burrs.

3.2.22 Conduit riser extensions shall be straight and plumb, plugged prior to pouring of concrete, and remain plugged until conduit is extended later or readied for cable pulling operations.

3.2.23 Conduits shall be installed so that water will not drain into any equipment containing electrical devices or connections.

3.2.24 Conduit outlet bodies shall not be installed in conduit runs containing 5 kV and higher voltage conductors, unless the type and location have been reviewed for excessive cable bending radius constraints as defined by the cable manufacturer.

3.2.25 Covers shall be installed on outlet bodies at the time of installation to prevent the entrance of moisture or contaminants into the conduit system prior to cable pulling operations.

3.2.26 All conduit shall be clearly identified with its raceway number and voltage level as indicated on the detailed design drawings.

4.0 RIGID METALLIC CONDUIT

4.1 Design

4.1.1 All above ground conduit interconnections between devices, panels, boxes, and fittings shall be heavy wall rigid metal conduit which conforms to NEMA C80.1 and UL 6, minimum size of 3/4 inch diameter.

4.1.2 Rigid galvanized steel conduit shall not be directly buried in the earth.

4.2 Equipment

4.2.1 Steel conduit, couplings and elbows

4.2.1.1 Shall be threaded hot-dipped galvanized rigid mild steel manufactured in accordance with ANSI/NEMA C80.1 and UL 6.

4.2.1.2 The conduit interior and exterior surfaces shall have a continuous hot-dipped galvanized coating with a transparent overcoat of enamel, lacquer, or zinc chromate.

4.2.1.3 The thread protector shall have sufficient mechanical strength to protect the threads during normal handling and storage.

4.2.1.4 Rigid galvanized steel conduit shall be similar to Type GRC.

4.3 Installation

4.3.1 All steel conduit ends, after cutting or threading, shall be re-galvanized using a cold galvanizing zinc rich coating.

4.3.2 Rigid metal conduit bodies and fitting shall:

4.3.2.1 Conform to the requirements of ANSI/NEMA FB-1, UL 514B and UL 886 where these standards apply.

4.3.2.2 Be appropriate for the area and equipment with which they are associated.

4.3.3 Rigid metal conduit shall be joined by threaded conduit couplings with the conduit ends butted.

4.3.4 Where rigid metal conduit cannot be turned and joined together by standard threaded couplings. Conduit unions or split couplings may be used.

4.3.5 Rigid metal conduit and plastic conduit shall be supported within a certain distance of a junction box, pull box, cabinet, conduit body, or other conduit termination as specified by NEC.

4.3.6 Vertical rigid metal conduit shall be supported in maximum intervals as specified by NEC.

4.3.7 Single runs of below grade rigid galvanized steel conduit shall be encased with a minimum of 3 inches of red concrete between the conduit outer walls and earth.

4.3.8 Multiple runs of below grade rigid galvanized steel conduit shall maintain a minimum 2 inch separation between adjacent conduits to allow for concrete placement.

4.3.9 Multiple runs of rigid galvanized steel conduit shall be provided with 3 inches of concrete encasement between the conduit outer walls and earth.

5.0 PLASTIC (PVC) CONDUIT

5.1 Design

5.1.1 Below grade rigid plastic conduit shall be concrete encased unless used exclusively for site lighting or other non-process circuits.

5.2 Equipment

5.2.1 Plastic conduit and elbows shall be unthreaded Schedule 40 or Schedule 80 polyvinyl chloride manufactured in accordance with NEMA TC-2 and UL 651.

5.3 Installation

5.3.1 Spacers for underground rigid plastic conduit shall be plastic interlocking base and intermediate type spacers.

5.3.2 Plastic conduit bodies and fittings shall be of the same schedule or type composition as the plastic conduit attaching to.

5.3.3 Plastic conduit shall be joined together in accordance with manufacturer recommendations using unthreaded couplings and a medium bodied solvent cement.

5.3.3.1 Joining surfaces shall be wiped clean of dirt, moisture, or other contaminants prior to application of the solvent cement.

5.3.3.2 Joining surfaces shall be thoroughly dried before applying solvent cement.

5.3.4 Where field bending of plastic conduit is required, the conduit length shall be heated to approximately 275° F.

5.3.4.1 Conduit heating may be by radiant heat, hot air, or hot liquid immersion.

5.3.4.2 Open flame heating will not be permitted.

5.3.4.3 Conduit discolored by prolonged heating will not be acceptable.

6.0 LIQUID-TIGHT FLEXIBLE METALLIC CONDUIT

6.1 Design

6.1.1 Liquid-tight flexible conduit inserts shall be installed at the locations indicated below.

6.1.1.1 In all rigid metal conduit runs which are supported by both building steel and by structures subject to vibration or thermal expansion.

6.1.1.2 In rigid metal conduit runs which cross expansion joints or which connect to building supported independent structures, such as heat exchangers, storage tanks or ash hoppers.

6.1.2 Liquid-tight flexible conduit lengths shall not be greater than 24 inches in length for 2-inch and under nominal conduit diameter and 48 inches in length for nominal conduit diameter greater than 2 inches.

6.2 Equipment

6.2.1 Liquid-tight flexible metallic conduit shall be:

6.2.1.1 A plastic jacketed, heavy-duty, continuous interlocked, flexible, rust resistant, metal core manufactured in accordance with ANSI/UL 360.

6.2.1.2 The plastic jacket shall be UV, oil, and acid resistant and shall be suitable for a temperature rating of 60° C.

6.2.1.3 The metal core shall be a locking galvanized steel core for use with galvanized conduit systems.

6.2.1.4 Conduit of this type used in high temperature areas shall have a thermoplastic PVC jacket suitable for a temperature rating of 105° C.

6.2.2 Liquid-tight flexible metallic fittings shall:

6.2.2.1 Have insulated throats and bear the UL label.

6.2.2.2 Be similar to Type STB and Type STN.

6.3 Installation

6.3.1 Liquid-tight flexible metallic fittings shall be provided to connect liquid-tight flexible metallic conduit to rigid metal conduit and devices.

6.3.2 Threads on metallic conduit not terminated in threaded hubs shall project through the wall of the box or cabinet to allow the bushing to butt against the end of the conduit.

6.3.3 Flexible metallic couplings shall be used in Class I, Div. 1 locations where a liquid-tight flexible conduit connection is required.

7.0 FLEXIBLE METALLIC CONDUIT

7.1 Design

7.1.1 Flexible conduit inserts shall be installed at the locations indicated below.

7.1.1.1 In all rigid metal conduit runs which are supported by both building steel and by structures subject to vibration or thermal expansion where water contact is not an issue.

7.1.1.2 In rigid metal conduit runs which cross expansion joints or which connect to building supported independent structures, such as heat exchangers, storage tanks, or ash hoppers.

7.1.1.3 Conduits in finished areas connecting recessed light fixtures and their adjacent junction boxes shall be flexible metallic conduit 1/2-inch minimum size.

7.2 Equipment

7.2.1 Flexible metallic conduit shall be:

7.2.1.1 A heavy-duty, locking galvanized steel core manufactured in accordance with ANSI/UL 1.

7.2.1.2 Similar to Type HWS.

7.2.2 Flexible metallic couplings shall be:

7.2.2.1 Prefabricated lengths of flexible conduit comprised of a bronze braided brass core and insulating wire duct manufactured in accordance with UL 886.

7.2.2.2 Similar to Type ECGJH.

7.2.3 Flexible metallic fittings shall:

7.2.3.1 Have insulated throats and bear the UL label.

7.2.3.2 Have a friction type connector on one end for fastening to flexible metallic conduit, and a compression type connector on the other end for fastening to electrical metallic tubing.

7.2.3.3 Be similar to Types C, 24 Series, and CB.

7.3 Installation

7.3.1 Flexible metallic fittings shall be provided to connect flexible metallic conduit to light fixtures and wiring devices in finished areas.

7.3.2 Threads on metallic conduit not terminated in threaded hubs shall project through the wall of the box or cabinet to allow the bushing to butt against the end of the conduit.

7.3.3 Flexible metallic conduit inserts not greater than 6 feet in length shall be installed for light fixture tap conductors above finished ceilings.

END OF SECTION 16111

SECTION 16130
ELECTRICAL BOXES AND ENCLOSURES

1.0 INTRODUCTION

1.1 Scope

1.1.1 This Specification includes all design and furnishing, equipment and materials, and installation requirements for Ameren Missouri Generation general purpose electrical boxes and enclosures including outlet, pull and junction boxes as well as electrical cabinets.

1.1.2 This Specification does not apply to electrical control panels, relay panels, power panels, or other electrical equipment enclosures which are already covered by other Specification sections.

1.2 Reference Sections

1.2.1 16010 – Basic Electrical Requirements

1.2.2 16141 – Wiring Devices

1.2.3 16195 – Electrical Identification

1.2.4 16390 – Grounding

1.3 Codes and Standards

1.3.1 NFPA 70 – National Electric Code (NEC)

1.3.2 National Electrical Manufacturers Association (NEMA)

1.3.3 Underwriters' Laboratories (UL)

1.3.4 American National Standards Institute (ANSI)

1.3.5 Institute of Electrical and Electronics Engineers (IEEE)

2.0 GENERAL

2.1 Design

2.1.1 General

2.1.1.1 Electrical boxes and cabinets shall be provided as required to provide sufficient means for cable management, terminations and pulling.

2.1.1.2 Boxes with process wiring shall be accessible in locations where maintenance can readily take place. This includes mounting boxes at heights accessible from grade or finished floor (without kneeling or use of ladders) and designing necessary clearances from surrounding structures and equipment.

2.1.1.3 Size boxes and cabinets according to NEC with proper capacity for future/spare capacity as necessary.

2.1.1.4 Junction boxes shall be provided for limited connection points between field cabling and integral/internal instrument or device wiring. Junction boxes shall also be installed for lighting and wiring devices as necessary. Junction boxes may be field located unless used for process equipment, in which they shall be identified and shown on layout and wiring drawings.

2.1.1.5 Splicing in junction boxes is not acceptable except for low voltage lighting and receptacle circuits.

2.1.1.6 Terminal boxes shall be provided for large scale field interface between cabling as required for field device interface, equipment shipping splits, or marshalling. Terminal boxes shall always be shown on layout and wiring drawings. All wiring shall in terminal boxes shall land on appropriately sized terminal strips – no splicing is allowed.

2.1.1.7 A terminal box may double as a pull box for additional cables to pass through. The boxes shall be sized appropriately to allow for cables to pass through without interference with the terminal blocks and wiring.

2.1.1.8 Pull boxes shall be provided for cable throughput and to provide access for pulling long distances or through significant step changes in elevation or direction. Pull boxes may be field located and shown on raceway drawings where applicable.

2.1.1.9 General purpose hinged-door electrical cabinets shall be provided for larger terminal or pull boxes (typically larger than 24”W x 36”H) which contain multiple field terminals, power terminal blocks, instrumentation, small scale devices or components, or as otherwise required by the design.

2.1.1.10 Terminal and junction boxes shall be supplied with appropriate OATT ring-tongue terminal strips for all wiring, with a minimum of 25% spare terminals.

2.1.1.11 Outlet and field boxes shall be field located.

2.1.1.12 All boxes shall be labeled according to Owner’s site nomenclature and identification requirements.

2.1.1.13 Unless otherwise indicated, enclosure types shall be as follows:

ELECTRICAL BOXES			
Location	**Enclosure Type**		
	Junction & Terminal Boxes	**Pull Boxes**	**Cabinets**
Indoor (nonhazardous)			
Conditioned rooms	NEMA 1	NEMA 1	NEMA 1
Process areas (dry)	NEMA 12	NEMA 12	NEMA 12
Process areas (wet)	NEMA 4	NEMA 4	NEMA 4
Corrosive areas	NEMA 4X	NEMA 4X	NEMA 4X
Outdoor (nonhazardous)			
Noncorrosive areas	NEMA 4	NEMA 4	NEMA 4
Corrosive areas	NEMA 4X	NEMA 4X	NEMA 4X
Hazardous areas			
Class I, Division 1	NEMA 7*****	NEMA 7*****	NEMA 7*****
Class I, Division 2	NEMA 7*****	NEMA 12 (indoor) NEMA 3 (outdoor)	NEMA 7*****
Class II, Division 1	NEMA 9*****	NEMA 12 (indoor) NEMA 3 (outdoor)	NEMA 9*****
Class II, Division 2	NEMA 12 (indoor) NEMA 3 (outdoor)	NEMA 12 (indoor) NEMA 3 (outdoor)	NEMA 12 (indoor) NEMA 3 (outdoor)
Class III	NEMA 12 (indoor) NEMA 4 (outdoor)	NEMA 12 (indoor) NEMA 3 (outdoor)	NEMA 12 (indoor) NEMA 3 (outdoor)
Note: * Indicates an alpha character identified by the group designation associated with the known suspended air hazard as identified in the National Electrical Code.			

2.2 Equipment

2.2.1 Electrical boxes shall be manufactured by one of the following or an Owner-approved equal:

APPROVED MANUFACTURERS	
Component	**Manufacturer**
Electrical Boxes & Enclosures	Carlon, Cooper Crouse-Hinds, Hubbel, Hoffmann, Eaton Cutler Hammer, Square D, Leviton, Gexpro

2.2.2 General

2.2.2.1 Junction boxes and terminal boxes 4 inch trade size or smaller in any dimension shall be galvanized malleable iron or acceptable equal cast ferrous metal.

2.2.2.2 Junction boxes and terminal boxes larger than 4 inch trade size, and having a depth of not over 24 inches, shall be constructed from manufacturer's standard gauge phosphatized sheet steel. The surfaces of the steel shall be finish coated inside and out after fabrication, in accordance with manufacturer's standard.

2.2.2.3 Electrical boxes shall be constructed in accordance with UL 50 and NEMA for their intended service. Boxes shall not have pre-punched knockouts.

2.2.2.4 Shop assembled enclosures and cabinets housing terminal blocks or electrical components in accordance with ANSI/NEMA ICS 6.

2.2.2.5 Provide conduit hubs on all cabinets and enclosures.

2.2.2.6 Provide a protective pocket inside front cover with schematic diagram, connection diagram, and layout drawing of control wiring and components within enclosure.

2.2.2.7 Hinged cover enclosures shall be steel and finished in the Manufacturer’s standard enamel.

2.2.2.8 Hinged cover enclosures shall be per NEMA rating table above.

2.2.2.9 The panel for mounting terminal blocks or electrical components shall be 14 gage steel, white enamel finish.

2.2.2.10 Heated enclosures, when specified, shall include wet pipe automatic sprinkler system with coverage density of 0.25 GPM per square foot over the entire area of the enclosure and shall be equipped with a 20-lb. dry chemical fire extinguisher by a door.

2.2.2.11 Indoor enclosures shall be dust-tight and impervious to dripping or falling water.

2.2.2.12 Electrical cabinets shall utilize hinged covers that have a continuous hinge, held closed by a flush latch. Keyed locks shall be provided when specified by the Owner.

2.2.3 Outlet and Switch Boxes

2.2.3.1 Outlet boxes shall be constructed of galvanized steel.

2.2.3.2 All surface mounted outlet boxes, switch boxes, and associated fittings shall be galvanized malleable iron or Owner-accepted equal cast ferrous metal.

2.2.3.3 All outlet boxes, switch boxes, and associated fittings shall be constructed in accordance with UL 514.

2.2.3.4 Provide cast outlet boxes in exterior locations exposed to weather and wet locations.

2.2.4 Pull and Junction Boxes

2.2.4.1 Pull and junction boxes shall be constructed of galvanized steel and be hinged.

2.2.4.2 Junction boxes having a depth greater than 24 inches shall be constructed from steel plate reinforced as required to provide true surfaces and adequate strength to support a concentrated load of 200 pounds on the top after erection. The junction box surface shall be finish coated inside and out after fabrication, in accordance with the manufacturer's standard.

2.2.5 Terminal Boxes

2.2.5.1 Terminal boxes shall be furnished complete with terminal blocks and an engraved nameplate with the terminal box identification indicated on the design drawings.

2.2.6 Cabinets

2.2.6.1 Cabinet boxes shall be galvanized steel with removable endwalls. The size shall be as indicated on the design drawings.

2.2.6.2 Cabinet fronts shall be steel, surface type with concealed trim clamps, concealed hinge and flush lock keyed to match branch circuit panelboard.

2.2.6.3 The cabinet front shall be finished in gray baked enamel.

2.3 Installation

2.3.1 General

2.3.1.1 If exposed terminals are present in boxes or cabinets, Contractor shall provide appropriate signage on the door/cover indicating that live voltage may be present and designate the exposed voltage level(s).

2.3.1.2 Do not install boxes back-to-back in walls. Provide minimum 6-inch separation, except provide minimum 24-inch separation in acoustic-rated wall.

2.3.1.3 Locate boxes in masonry walls to required cutting of masonry unit corner only. Coordinate masonry cutting to achieve neat openings for boxes.

2.3.1.4 Provide knockout closures for unused openings.

2.3.1.5 Use multiple-gang boxes where more than one device is mounted together; do not use sectional boxes. Provide barriers to separate wiring of different voltage systems.

2.3.1.6 Install cabinets and boxes in walls without damaging wall insulation.

2.3.1.7 In inaccessible ceiling areas, position outlets and junction boxes within 6 inches of recessed luminaries, to be accessible through luminary ceiling opening.

2.3.1.8 Cabinets and boxes shall be rigidly mounted. Mounting on concrete shall be by post-installed mechanical anchors. Mounting on steel shall be by drilled and tapped screw holes, or by special support channels welded to the steel, or by both.

2.3.1.9 Cabinets and boxes shall be leveled and fastened to the mounting surface with not less than 1/4 inch air space between the enclosure and mounting surface. All mounting holes in the enclosure shall be used.

2.3.1.10 Except as prevented by the location of other work, all terminal boxes, junction boxes, pull boxes, and outlet boxes shall be centered on structures.

2.3.1.11 Each enclosure shall be identified with an engraved nameplate at the top of the front cover. Each nameplate shall be engraved with the electrical box identification as determined by Contractor.

2.3.1.12 The identification number indicated on the drawings for each junction box and terminal box having a depth greater than 24 inches shall be engraved on a Phenolic tag and attached to the box.

2.3.1.13 The identification number of each junction box and terminal box having a depth of 24 inches and smaller shall be engraved on a phenolic nameplate and attached to the box.

2.3.1.14 Install cabinets and enclosures plumb; anchor securely to wall and structural supports at each corner, minimum.

2.3.1.15 Provide accessory feet for free-standing equipment enclosures.

2.3.1.16 Install trim plumb and level with the enclosure.

2.3.1.17 All covers or enclosures which have been removed for shipment or removed during installation shall be securely bolted in place.

2.3.1.18 Each enclosure shall be installed so that it is level and all doors freely swing full travel.

2.3.2 Outlet and Switch Boxes

2.3.2.1 Coordinate mounting heights and locations of outlets mounted above counters, benches and backsplashes.

2.3.2.2 Position outlets to locate luminaries as shown on reflected ceiling plans.

2.3.2.3 Provide recessed outlet boxes in finished areas; secure boxes to interior wall and partition studs, accurately positioning to allow for surface finish thickness. Use stamped steel stud bridges for flush outlets in hollow stud wall, and use adjustable steel channel fasteners for flush ceiling outlet boxes.

2.3.2.4 Align wall-mounted outlet boxes for switches, thermostats and similar devices.

2.3.3 Pull and Junction Boxes

2.3.3.1 Lighting and receptacle pull boxes and junction boxes may be located above accessible ceilings or in unfinished areas.

2.3.3.2 Support pull and junction boxes independent of conduit.

2.3.3.3 Pull boxes shall be labeled per Owner's site nomenclature. Cables inside pull boxes shall be labeled with cable number, circuit, and from/to locations.

END OF SECTION 16130

SECTION 16161
CONTROL PANELS AND MARSHALLING PANELS

1.0 INTRODUCTION

1.1 SCOPE

1.1.1 This Specification includes requirements for Ameren Missouri Generation control panels and marshalling panels.

1.1.2 The scope of work shall include the design and furnishing, material and equipment and installation as defined herein and on the Panels Specification Sheet.

1.2 REFERENCE SECTIONS

1.2.1 16111 – General Raceway, Conduit and Wireway

1.2.2 16130 – Electrical Boxes & Enclosures

1.2.3 16195 – Electrical Identification

1.2.4 16201 – Protective Relaying Devices

1.2.5 16390 – Grounding

1.3 CODES AND STANDARDS

1.3.1 Work performed under this Specification shall be in accordance with the following codes and standards:

CODES AND STANDARDS	
Work	**In Accordance With**
Control panels and marshalling panels	ANSI C37.90.1, Surge Withstand Capability (SWC) Tests for Protective Relays and Relay Systems EIA 232-D, Interface Between Data Terminal Equipment and Data Circuit-Terminating Equipment Employing Serial Binary Data Interchange EIA RS-310-D, Racks, Panels and Associated Equipment EIA RS-422-A, Electrical Characteristics of Balanced Voltage Digital Interface Circuits EIA RS-485, Standard for Electrical Characteristics of Generators and Receivers for Use in Balanced Digital Multipoint Systems NEMA 250, Enclosures for Electrical Equipment NEMA ICS6, Enclosures for Industrial Controls and Systems NFPA 70, National Electrical Code UL 50, Cabinets and Boxes UL 508, Industrial Control Equipment NFPA 79, Electrical Standard for Industrial Machinery

2.0 GENERAL REQUIREMENTS

2.1 DESIGN

2.1.1 Panel Structure

2.1.1.1 A rigid, self-supporting, free-standing cabinet shall be designed and supplied for incorporation within a suite of bolted cabinets, unless directed otherwise in project scope.

2.1.1.2 Freestanding control panels/cabinets shall be a minimum of 60” high by 10” deep and a maximum of 90” high (18” maximum depth). The enclosures shall be designed for bolting to the floor. Alternative dimensions for special circumstances where physical space is an issued may be submitted to Owner for approval.

2.1.1.3 Where rear access doors are used on freestanding control panels, the width of a single door shall not exceed 24 inches, unless approved by Owner.

2.1.1.4 The layout of the panels shall be subject to approval.

2.1.1.5 The control panels shall be of suitable design to allow entry of the cabling into both the top and bottom of the enclosure. The panel drawings, when submitted for approval, shall show the areas available for cable entrance, located and identified by the appropriate dimensions.

2.1.1.6 A detailed bill of material, enclosure outline, equipment arrangement, I/O module layout drawing and wiring diagrams shall be submitted for review and approval prior to cabinet fabrication.

2.1.1.7 The control panel shall provide adequate support for all equipment mounted on it, and exterior surfaces shall be free from waves, bellies, and other imperfections.

2.1.1.8 The panel shall be designed for entry of all connecting piping, tubing, and wiring as defined in the technical attachments.

2.1.1.9 Cutouts with gasketed removable closure plates shall be provided in the panel top or bottom for Contractor's incoming raceway system, as defined in the technical attachments.

2.1.1.10 The cutout locations and sizes shall be subject to approval of Owner when panel fabrication drawings are submitted.

2.1.1.11 Bulkhead connections to the panel shall be watertight.

2.1.1.12 Neoprene door gaskets shall be furnished and attached with oil-resistant adhesive.

2.1.1.13 Where a larger door is required, double door with unobstructed openings shall be provided.

2.1.1.14 Hinges shall be located so as not to interfere with access to wiring termination or devices.

2.1.1.15 Arrangement and spacing of devices on the panel front shall be as approved by Owner.

2.1.1.16 Side panels may be removed between adjacent panels which are installed in an environmentally isolated and climate controlled electrical room.

2.1.1.17 Access to the equipment mounted within the panel shall be from vertically hinged doors. Hinges shall be designed to allow the easy removal of the entire door.

2.1.1.18 Finger room between devices, terminal blocks, and wire trough shall be a 4” minimum.

2.1.2 Panel Accessories

2.1.2.1 Where purging is specified to reduce the area classification, the panel shall be furnished with an alarm relay for remote indication of pressurization system malfunction.

2.1.2.1.1 The blower shall be sized to develop a differential pressure of 1/2 inch water gauge across its inlet and outlet at maximum atmospheric pressure and shall be designed for continuous operation.

2.1.2.2 Lighting, heaters, blowers and other non-control equipment shall have independent power feeds/supplies separate from the UPS and control power sources.

2.1.2.3 Heat load and internal temperature rise shall be calculated for all equipment including spares, to determine cooling requirements.

2.1.2.4 All cabinets shall be provided with ventilation filters to prevent entry of dust. Filters are to be designed to be removed and serviced without the use of tools from the cabinet exterior.

2.1.3 Panel Equipment Mounting

2.1.3.1 Indicating instruments, switches, visual display units (VDUs), and other instrumentation and control devices that should be readily accessible to operating personnel during normal operation shall be mounted on the front face of the panel, unless otherwise specified.

2.1.3.2 Auxiliary devices, such as input/output (I/O) racks, relays, signal conditioners and terminal blocks shall be mounted inside the panel on the rear face.

2.1.3.3 Devices shall not be located on the side faces. Terminal blocks may be mounted inside the panel on the side face if space on the rear face is not available.

2.1.3.4 Piping, tubing and wiring connections to panel front mounted devices shall be located inside the panel.

2.1.3.5 Piping, tubing, fittings and wiring shall be arranged so that instruments or devices may be removed and/or serviced without disturbing piping, tubing or wiring.

2.1.3.6 Mounting brackets shall be designed to provide adequate support for their associated equipment.

2.1.3.7 All equipment shall be accessible without stepping into the cabinet. All equipment shall be mounted and accessible with 15 inches of open face of the cabinet.

2.1.4 Electrical Raceway

2.1.4.1 A system of wiring raceways shall be provided inside the panel for all factory wiring and external cables entering the panel. The raceway system shall be shown on Contractor's drawings and shall be acceptable to Owner.

2.1.4.2 For adjacently located panels, wireways shall be provided on the bottom and each side between panels for cable entry and routing.

2.1.4.3 Wire trough used shall be 2”x2” minimum.

2.1.5 Wiring

2.1.5.1 Arrangement of circuits on terminal blocks shall be such that all connections for one circuit, plus any spare conductors, shall be on adjacent terminals.

2.1.5.2 Leads for external circuit wiring shall be connected to grouped terminal blocks located for convenient connection of the external circuits.

2.1.5.3 Shield wiring shall land on grounding terminals which are integral to the field wiring blocks.

2.1.5.4 Each panel shall be supplied with an internal isolated instrument ground bus for attachment to the station grounding system by Contractor.

2.1.5.5 Cable used to attach the instrument ground bus to the ground grid shall be insulated.

2.1.6 Tubing and Piping

2.1.6.1 Tubing shall not be routed in front of electrical wireways.

2.1.6.2 The air supplied to the pneumatic devices shall be individually valved and pressure regulated.

2.1.7 Semi-Graphic Display

2.1.7.1 If required on the Panels Specification Sheet, a semi-graphic display of the process system and equipment shall be designed with the local control panel.

2.1.7.2 Contractor shall submit a preliminary arrangement of his display, based on his process flow arrangement, for review by Owner.

2.1.8 Electric Power Supplies

2.1.8.1 Local control panels shall be designed to accept Contractor's power supply feeds for motor power, control power, panel interior lighting and pressurizing blowers as defined on the Panels Specification Sheets.

2.1.8.2 The AC power supply used for single-phase motors shall be distributed as required from a control drive panel.

2.1.8.3 Power supply feeds shall be distributed through fused branch circuits to individual devices and equipment.

2.1.8.4 Control power circuits shall be arranged and connected to devices and equipment so that in the event of a power failure, either momentary or prolonged, all necessary intelligence is reestablished when power is restored to indicate the status of operation at the time of power failure and enable any process that was in operation to continue from the point where interruption occurred.

2.1.8.5 A minimum of two UPS control power feeds from separate sources and panels shall be provided for the control logic equipment and miscellaneous control and instrumentation.

2.1.8.6 Two control power feeds shall be switched to provide uninterrupted power to the control logic equipment.

2.1.8.7 Miscellaneous control and instrumentation devices that, when interrupted, do not cause a process shutdown shall be connected to the control power supply ahead of the transfer switch.

2.1.8.8 An auxiliary relay shall be connected to the control logic power circuit to monitor control power. The relay shall have a minimum of two normally open and two normally closed contacts wired out to terminal blocks for use in the plant control system.

2.1.8.9 The power supply circuit shall be a parallel bus with fuses or circuit breakers at each recorder, monitor, or device requiring power supply so that any device can be removed without dropping power to any other device.

2.2 EQUIPMENT

2.2.1 For the following components, only the listed manufacturers (or an Owner-approved equal) are recognized as maintaining the level of quality of workmanship required by these Specifications:

APPROVED MANUFACTURERS	
Component	**Manufacturer**
Control panels	Honeywell, Johnson Controls, Siebe, CSI, Hoffman Engineering Company, Allison Controls, Midwest Automation, and Barry-Wehmiller

2.2.2 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. In the event of a test failure, Contractor shall be responsible for all costs associated with correcting deficiencies and retesting. Where Owner witness testing is specified, Contractor shall notify Owner at least 10 working days prior to the scheduled test.

TEST REQUIREMENTS		
Tests	**In Accordance With**	**Conducted By**
Point-to-point wiring check	Contractor's Quality Assurance Procedures and Owner Commissioning Procedures	Contractor
Functional check	Contractor's Quality Assurance Procedures and Owner Commissioning Procedures	Contractor
Pressurized leak tests	ASME B31.1 Code for Pressure Piping	Contractor

2.2.3 Panel Structure

2.2.3.1 Enclosed panels and cabinets shall be NEMA Type 12 for indoor service and NEMA Type 4X for outdoor service unless otherwise specified. Any panels in coal handling areas shall be NEMA 9 minimum.

2.2.3.2 The control panel surfaces shall be fabricated from steel plates, if located in air-conditioned areas or stainless steel or fiberglass reinforced polyester (FRP) in damp areas, outdoors, corrosive areas, or areas subject to hose-down.

2.2.3.3 The FRP, stainless steel or steel plates, leveled steel sheets, and formed steel members shall be welded together as required to form a rigid, self-supporting structure. Joints shall be welded and ground smooth.

2.2.3.4 Panel access doors shall have turned back edges and bracing as required to assure rigidity, shall be mounted with hinges, and shall have three-point type door latches.

2.2.3.5 Front access doors on free-standing control cabinets shall not exceed 30 inches in width.

2.2.3.6 Hinges shall be located so as not to interfere with access to wiring termination or devices.

2.2.3.7 Panel dimensions shall be sufficient to permit installation of all instruments and controls in an uncluttered manner that is acceptable to Owner. Panel depth shall allow sufficient access for service personnel.

2.2.3.8 No equipment shall be located within 30 inches of the bottom or within 6 inches of the top or side of the panel front.

2.2.3.9 The center line of instruments and visual display units (VDUs) shall be at eye level, approximately 62 inches from the floor, which may require compensation of the concrete pad thickness.

2.2.3.10 The panel shall be built with shipping skids constructed to furnish attachment points for lifting slings at or beneath the panel structure. The panel shall be crated to prevent shipping or handling damage.

2.2.3.11 Cabinets shall be completely fabricated, assembled, wired, and tested before leaving the factory. Wring shall be in accordance with Code.

2.2.3.12 After project completion, control panels shall be cleaned, primed, and finish painted in accordance with standard practice. Color shall be ANSI 61, light gray outside and white inside unless otherwise specified. Touch-up paint shall be furnished and shipped with equipment.

2.2.4 Panel Accessories

2.2.4.1 If required on the Panels Specification Sheet, the panel shall be provided with suitable filter blower equipment, including an internally mounted switch to pressurize the control panel to prevent entrance of environmental contaminants or to reduce the area classification inside the panel.

2.2.4.2 Alarm contacts shall be "Form C."

2.2.4.3 The panel shall be provided with anti-condensation space heaters designed to maintain the panel internal temperature above dew-point, unless the panel is installed in an environmentally controlled room. The heaters shall be designed for continuous operation.

2.2.4.4 Panel illumination shall be controlled by switches mounted on the panel ends, inside, near the doors. Switches may be door activated which turn on when doors are open and turn off when doors are closed.

2.2.4.5 A 120 VAC convenience receptacle shall be externally located within 25 feet of the control panel.

2.2.4.6 Terminal blocks shall have “slide-link” type terminal blocks except for current transformer circuits, and other circuits as specified. This facilitates quick easy segmenting of feed circuits and grounds. Also these terminals will be wired such that when the slide link is opened it is on the load side of the block (facilitates safe troubleshooting).

2.2.5 Nameplates

2.2.5.1 Nameplates shall be provided on the panel front for all instruments and devices mounted on the panel front, except where the instruments or devices are themselves provided with a service engraving.

2.2.5.2 Nameplates shall be provided with legends acceptable to Owner.

2.2.6 Panel Equipment Mounting

2.2.6.1 Mounting brackets shall be arranged inside the panel for mounting and wiring auxiliary devices and terminal blocks as required.

2.2.7 Electrical Raceway

2.2.7.1 The raceway system shall be constructed to provide separation of shielded and coaxial cables from all other internal wiring. Raceways shall be sized so that the fill does not exceed 40 percent in any raceway.

2.2.7.2 Raceways shall be plastic wiring duct with covers. Raceways shall meet the requirements of Inflammability Class V0 in accordance with UL 94.

2.2.7.3 Wireways shall be a minimum of 6 inches wide and shall be sized to handle the anticipated field cables and panel wiring, plus margin for spare or future additions.

2.2.8 Wiring

2.2.8.1 All internal cabinet wiring shall be stranded copper #16 AWG minimum Type SIS and rated for 600 volts unless specified. All wiring shall be sized for appropriate ampacity with negligible voltage drop, per NEC requirements.

2.2.8.2 All controls network copper Ethernet cables shall be CAT6.

2.2.8.3 High impedance circuits and low signal level circuits shall be connected using shielded or coaxial cable suitable for the service.

2.2.8.4 Earth connection shall be accomplished via the DIN rail for the grounding terminals.

2.2.8.5 All fiber shall be multi-mode, 62.5/125 µm with minimum of 25% spare fiber pairs (corning glass). Proper strain relief and ST patch panels provided for all spare fibers.

2.2.9 Tubing and Piping

2.2.9.1 Use of adhesive mounting brackets for tubing is unacceptable.

2.2.9.2 A dual function filter regulator shall be supplied in each local control panel to serve the control air supply header.

2.2.9.3 Tests shall be made with the piping system isolated from the respective instruments.

2.2.9.4 Isolation shall be achieved by closing the instrument manifold valves or individual instrument shutoff valves at the instruments.

2.2.10 Semi-graphic Display

2.2.10.1 If required on the Panels Specification Sheet, a semi-graphic display of the process system and equipment shall be furnished, mounted, and wired on the local control panel.

2.2.10.2 The semi-graphic display shall consist of an insert panel containing a colored laminated process diagram.

2.2.10.3 The semi-graphic display shall be a complete representation of all tanks, pumps, exchangers, automatic valves, major piping and other major equipment.

2.2.10.4 All automatic valves, pumps and other dynamic equipment shall be provided with status indicating lights.

2.2.10.5 Final arrangement, color selections and construction shall be acceptable to Owner.

2.2.10.6 All equipment and valves shall be identified on the display and legends shall be acceptable to Owner.

2.2.10.7 Electrical devices mounted on the insert panel shall be wired to terminal blocks mounted on the rear of the insert panel.

2.2.11 Electric Power Supplies

2.2.11.1 Contractor shall provide power supply terminal blocks adequately sized to terminate Contractor's power supply copper conductors.

2.2.11.2 Contractor shall provide all necessary internal panel power supply distribution wiring and branch circuit protection.

2.2.11.3 All power supply equipment required to rectify, transform, isolate, regulate, eliminate transients, or otherwise condition Contractor's power sources for use by the equipment in the control panel shall be furnished by Contractor.

2.2.11.4 If required on the Panels Specification Sheet, ferro-resonant signal conditioning type transformers of the appropriate size and rating shall be furnished and installed on the primary and backup circuits for the control logic equipment.

2.2.11.5 The signal conditioning type transformers, if required, shall be installed in such a way that they provide conditioned power to the control logic only and not to any other loads in the control panel.

2.3 INSTALLATION

2.3.1 Contractor shall install all control and marshalling panels per the design documents, including any items shipped loose and designated for field installation.

2.3.2 Panel Structure

2.3.2.1 The panel shall be installed on a concrete pad unless the area is not subjected to wash-down (electrical rooms only).

2.3.3 Painting

2.3.3.1 Painted surfaces shall be free from waves, bellies, or other imperfections. Paint films that show sags, checks, blisters, teardrops, or fat edges are not acceptable and shall be corrected.

2.3.4 Panel Equipment Mounting

2.3.4.1 If mounted on the side face, terminal blocks shall be installed on 45 degree angled standoffs.

2.3.4.2 All control devices shall be installed in the local panels unless the functional requirements for a device make such installation impractical.

2.3.4.3 All devices installed in the local panels, and which require either electrical, pneumatic, or process external connections, shall be tubed or wired to suitable panel terminal blocks or bulkhead connectors.

2.3.4.4 Instruments installed on the fronts of panels or cabinets shall be semi-flush mounted.

2.3.5 Wiring

2.3.5.1 Wiring to each sub-panel and to each rotary control switch shall be individually bundled and shall be installed with a "drop loop" of sufficient length to allow the item to be removed from the panel for maintenance without disconnecting the wiring.

2.3.5.2 No more than 2 wires shall be terminated on any one terminal.

2.3.5.3 Wires shall be bundled neatly together and run through spiral split tubing.

2.3.5.4 All cabinet signal and power wiring shall be securely fastened with mechanical fasteners; no adhesives shall be permitted.

2.3.5.5 Field wiring shall be pulled into the same panel where terminations take place (do not use adjacent panels as pull boxes to route field wiring through).

2.3.5.6 All field cable designated spare conductors shall be cut at sufficient length to reach the furthest field terminal block within the respective panel.

2.3.5.7 Label all field wiring with cable and wire numbers per the design documents.

PANELS SPECIFICATION SHEET

Local Control Panel Structure			
Installed location			Dry indoor, Wet, Outdoor, Wet chemical corrosive
NEMA enclosure classification			Type 1 - indoor, environmentally controlled room, Type 12 - indoor, dry, air conditioned areas, Type 4 - outdoor, indoor wet areas, Type 4X - wet, corrosive areas
Material			Sheet steel - indoors, dry air conditioned areas. Fiberglass reinforced polyester (FRP) or stainless steel - wet, outdoor, or wet corrosive areas.
Panel type			Free-standing
Personnel access			Front
Cable access			Bottom or Side
Tubing access			Bottom or Side
Panel will be mounted on			As required by application and approved by Owner
Pad dimensions, (L by W by H), in.			As required by application
Maximum dimensions, (L by W by H), in.			As required by application
Local Control Panel Accessories			
Space heater(s)			
Space heater rated voltage			120 VAC
Voltage			80 - 120 VAC
Control transformer(s)			
Primary voltage			120 VAC, 60 Hz
Secondary voltage			As required
Minimum kVA			As required for internal panel devices plus 20 percent
Interior illumination required			Yes
Convenience receptacles required			No
Semigraphic Display			
Semigraphic display required			No
Annunciator			
Annunciator required			No
Electric Power Supplies			
Function	**Quantity**	**Power Supply Code**	**Voltage**
Control	One		120 VAC
Motor	One		As required by application & approved by Owner
Signal Conditioning Transformer(s)			
Signal conditioning transformer(s) required			No

END OF SECTION 16161

SECTION 16195
ELECTRICAL IDENTIFICATION

1.0 INTRODUCTION

1.1 Scope

1.1.1 This Specification shall include all design, material and equipment and installation requirements regarding the identification of all Ameren Missouri electrical equipment.

1.2 Reference Sections

1.2.1 16010 – Basic Electrical Requirements

1.3 Codes and Standards

1.3.1 NFPA 70 – National Electric Code (NEC)

1.3.2 National Electrical Manufacturers Association (NEMA)

1.3.3 Underwriters' Laboratories

1.3.4 American National Standards Institute (ANSI)

1.3.5 The Institute of Electrical and Electronics Engineers (IEEE)

2.0 GENERAL

2.1 Design

2.1.1 All electrical equipment such as panels, transformers, buses, motor control centers, lights, wiring devices, motors and other miscellaneous components shall be identified with nomenclature as noted on the drawings or Specifications. Equipment identification labels for all electrical equipment shall include switchgear, switchboards, panels, transfer switches, disconnect switches, transformers, capacitors, fixed equipment, motor starters, motor control centers (MCCs), motors, etc.

2.1.2 Wire markers shall be provided on each conductor in control panels, cabinets, switchgear/MCCs, panelboards, gutters, pull boxes, outlet and junction boxes, transformers, and at load connection.

2.1.3 A branch circuit or feeder number shall be provided to identify power and lighting circuits. A control wire number shall also be used as indicated on the drawings or as provided by Owner.

2.1.4 Cable markers shall be provided on each cable at 15 feet to 20 feet from the termination point inside switchgear, motor control centers, panelboards, pull boxes, outlet and junction boxes before removal of this equipment and during new installation of equipment.

2.1.5 A cable number shall be used to identify each cable as indicated on drawings or as provided by Owner.

2.1.6 All control-wire terminations shall be identified by tubular sleeve heat shrink-type markers to agree with wire marking identification on manufacturer's equipment drawings.

2.1.7 Buses, feeders, branch circuit conductors and all medium-voltage cables shall be properly phased and identified throughout.

2.1.8 Cable tray shall be identified with the designated number. Labels shall be readable from grade level. Labels shall be applied upon exiting/ entering an area, at junction, or every 20 feet minimum.

2.1.9 Conduit and other raceway shall be identified per Energy Center specific requirements.

2.1.10 Nameplate material and etching requirement details shall be provided as part of detail design.

2.1.11 Any special signage or labeling beyond this Specification shall be called out on the design, as directed by Owner.

2.1.12 When required by detail design, provide arc flash labels per Owner standards.

2.2 Equipment

2.2.1 Brady self-laminating vinyl labels with 1/4-inch text shall be used for wire and cable markers.

2.2.2 Nameplates shall be engraved three-layer laminated plastic, black letter on a white background.

2.2.3 Wire and cable markers shall be cloth markers, split sleeve or tubing type.

2.2.4 Panelboards, switchboards and motor control centers shall have 1/4-inch letter heights to identify equipment designations.

2.2.5 Panelboards, switchboards and motor control centers shall have 1/8-inch letter heights to identify voltage rating and source.

2.2.6 Individual circuit breakers, switches, motor starters and motor control centers shall have 1/8-inch letter heights to identify circuit and load served, including location.

2.2.7 Transformers shall have 1/4-inch letter heights to identify equipment designated.

2.2.8 Transformers shall have 1/8-inch letter heights to identify primary and secondary voltages, primary source and secondary load and location.

2.2.9 Other equipment enclosures shall have 1/8 inch letter heights to identify enclosed equipment and source.

2.2.10 Indicate panel and circuit identification for all receptacles.

2.2.11 Cable tray and conduit label individual numbers shall be a minimum of 2 inches high by 3/4 inches wide.

2.2.12 Raceway shall be labeled using labels with a yellow background and black lettering/numbering.

2.2.13 All labels shall be electronically printed.

2.3 Installation

2.3.1 All surfaces shall be degreased and cleaned prior to receiving nameplates and tape labels.

2.3.2 Nameplates and tape labels shall be installed parallel to equipment lines.

2.3.3 Nameplates shall be secured to equipment fronts using screws or rivets.

2.3.4 Nameplates shall be secured inside the face of recessed panelboard door in finished locations.

2.3.5 Embossed tape shall not be permitted for any application.

2.3.6 Cable tray identification labels shall be applied at all tray junctions and at intervals not to exceed 20 feet.

END OF SECTION 16195

SECTION 16201
PROTECTIVE RELAYING PANELS

1.0 INTRODUCTION

1.1 Scope

1.1.1 Scope of supply shall include furnishing the protective relaying panels as specified herein and on the Protective Relaying Panels Specification Sheet included at the end of this section.

1.1.2 The Specification includes all design, material and equipment and installation guidelines by which all Ameren Generation protective relaying panels shall be provided.

1.2 Reference Sections

1.2.1 Protective Relaying Panels Specification Sheet

1.2.2 16111 – General Raceway, Conduit and Wireway

1.2.3 16161 – Control Panels and Marshaling Panels

1.2.4 16195 – Electrical Identification

1.2.5 Ameren Standard 16G – Protective Relaying

1.3 Codes and Standards

1.3.1 Work performed under these Specifications shall be done in accordance with the following codes and standards:

CODES AND STANDARDS	
Work	**In Accordance With**
Protective relaying panels	The applicable ANSI, NEMA and UL standards

2.0 GENERAL

2.1 Design

2.1.1 Protective Relaying Design

2.1.1.1 Protective relaying design shall be per Ameren Standard 16G.

2.1.1.2 Vertical protective relaying panels shall be supplied to accommodate the protective relaying systems as required by project scope.

2.1.2 Diagrams

2.1.2.1 Contractor's wiring diagram shall be in accordance with the requirements specified herein. One-line, three-line panel schematic, complete connection and interconnection wiring diagrams shall be furnished by Contractor.

2.1.2.2 Drawings shall be created and laid out per typical Owner drawing standards. Examples may be provided by Owner.

2.1.2.3 The complete interconnection and connection wiring diagrams of each panel shall be on an individual sheet.

2.1.2.4 Information on each connection diagram sheet shall include point-to-point wiring of the entire unit as it would appear to a person wiring the panel.

2.1.2.5 Elementary diagrams of control and instrument circuits, contact arrangement of switches and internal wiring of relays and instruments for each panel shall be on additional sheets

as required. Interconnection diagrams shall be on separate sheets. All sheets shall be the same size.

2.1.3 Terminal Blocks

2.1.3.1 Furnish and install 20 percent spare control terminal blocks in each panel.

2.1.3.2 In addition, one lot of terminal blocks (with 20 percent spares) shall be provided for the current transformers, potential transformers and analog wiring interface circuits as shown on the one-line diagrams included with these Specifications.

2.1.3.3 Wire all internal component terminals (whether used or not) to terminal blocks for future field wiring connection.

2.1.3.4 In addition, for terminal blocks interfacing with Owner's field cabling, one side of the terminal block shall be used by the equipment manufacturer for factory wiring and the other side of the terminal block shall be reserved for Owner's field cabling terminations.

2.1.4 Buses

2.1.4.1 Control, potential and alarm buses of 10 AWG or larger panel wire shall be furnished and installed as required.

2.1.5 Power Supply Disconnects

2.1.5.1 Power supplies for special devices shall be wired to a separate supply circuit for connection to Owner's preferred ac power supply.

2.1.5.2 Each panel mounted device requiring AC or DC supply shall have in its supply circuit a panel mounted fuse to allow isolation of the device from the power supply.

2.1.6 Relays, Meters, Controls and Instruments

2.1.6.1 Unless otherwise noted, instruments and meters including transducers shall be suitable for operation from instrument transformers with nominal 5 ampere and 120 volt secondary.

2.1.6.2 Scale ranges and dial constants shall be provided to match the primary current and voltage ratings.

2.1.7 Potential Transformer Circuit Fuses

2.1.7.1 Each potential transformer (PT) circuit entering the panel shall be provided with incoming fuses. Typically PTs are fused at 30A but shall be sized appropriately according to the design requirements.

2.1.7.2 Each device connected to the PT circuit shall be fused separately. Typically each device is fused at 3A but shall be sized appropriately according to the design requirements.

2.1.8 Raceway

2.1.8.1 An adequate raceway system shall be provided for all wiring on each side of each panel and between panels.

2.1.8.2 The raceways for factory wiring shall be sized so that fill does not exceed 30 percent.

2.1.8.3 Vertical raceways for field wiring shall be twice as large as those provided for factory wiring or shall have a minimum cross-sectional area of 20 in^2, whichever is larger.

2.1.8.4 Vertical raceways for field wiring shall be so constructed as to be accessible to conductors entering from the bottom or the top of the panel.

2.1.9 Space Heater

2.1.9.1 The space heater shall be capable of maintaining the enclosure interior at a temperature above the dew point, based on ambient conditions.

2.1.9.2 Space heaters shall be controlled by an adjustable thermostat or fixed humidistat.

2.1.10 Receptacles

2.1.10.1 Receptacles shall be furnished, mounted and wired in a convenient location at each end of the panel.

2.1.10.2 The receptacles for portable tools and droplights shall be supplied from a single-phase AC source. The receptacles' 120 VAC source shall be circuited completely separately from other control panel components, with the exception of cabinet lighting.

2.2 Equipment

2.2.1 Protective relaying panels shall be manufactured by one of the following or an Owner-approved equal:

MATERIALS	
Component	**Manufacturer**
Protective Relaying Panels	Carter & Crawley Control Center LLC Electrical Power Products Harlo Power Industries, Inc. Schweitzer Engineering Labs Midwest Automation GE Fabrication AZZ

2.2.2 Panel Components

2.2.2.1 Panel components shall meet the requirements of Ameren Standard 16G.

2.2.3 Vertical Panel Structures

2.2.3.1 Panels shall be fabricated from not less than 11 USS gauge leveled steel sheets and reinforced as required to form a rigid structure.

2.2.3.2 Finished panel surfaces shall be free of waves, bellies and other imperfections.

2.2.3.3 Exterior panel surfaces shall be sandblasted, ground smooth, filled, primed and enamel finished.

2.2.3.4 Instruments, meters, lockout relays and protective relays shall be mounted on the front of the panels.

2.2.3.5 Where required, brackets shall be hinged and located access to the back of the equipment mounted on the front of the panels.

2.2.3.6 Blank panels shall be provided with standard wiring gutters for future wiring.

2.2.3.7 The interior of each panel shall be illuminated with a light, mounted inside the top of the panels and controlled from a switch mounted inside the door.

2.2.3.7.1 Lighting shall be incandescent. Fluorescent lighting shall not be acceptable.

2.2.3.8 Wiring for lights and receptacles shall be run to one common 15 ampere fuse or circuit breaker for the voltage as specified.

2.2.3.9 The vertical panel structure shall be an assembly of standard fixed vertical panels.

2.2.3.10 An open vertical panel will be supported by wall braces.

2.2.3.11 An enclosed vertical switchboard shall have an overall sheet metal enclosure (not grille) covering the back, top, and ends of the entire assembly.

2.2.3.12 Access to the interior of the enclosure shall be provided by doors or by removable covers.

2.2.3.13 Each panel shall be formed with edges bent back and joints welded and ground smooth and shall be designed to be readily removable from the structure without disturbing the remaining panel assembly or existing control or cross panel wiring.

2.2.3.14 Panel cutouts, mounting studs and support brackets shall be accurately located as indicated on the drawings.

2.2.3.15 Mounting brackets, as required, shall be arranged for mounting and wiring auxiliary equipment and devices and terminal blocks.

2.2.3.16 Panel space not used by equipment shall remain clear for the addition of possible future equipment.

2.2.4 Nameplates

2.2.4.1 Inscriptions on these tags shall coincide with those used on the drawings and shall be approved by Owner.

2.2.4.2 Nameplates shall be furnished on the front of the panel and on the inside of the panel next to each relay or component.

2.2.4.3 Nameplates shall be located such that they are easily readable after the wiring installation is complete and shall be acceptable to Owner.

2.2.5 Terminal Blocks

2.2.5.1 Supply 600 V, 20 A, ring-tongue type terminal blocks.

2.2.5.2 Sufficient space shall be left on Contractor’s side of outgoing terminal blocks for adding cable color does and circuit numbers.

2.2.6 Buses

2.2.6.1 A continuous 1/4 inch x 1 inch cross-section bare copper ground bus, with copper/bronze compression or clamp type connectors at each end, shall be provided in the panel.

2.2.6.2 All panel equipment requiring grounding shall be connected to this ground bus with copper/bronze compression or clamp type connectors.

2.2.7 Power Supply Disconnects

2.2.7.1 Isolation fuses shall be furnished for each power supply, with at least one box of spares for each size specified.

2.2.8 Indicating Lights

2.2.8.1 Indicating lights shall be light-emitting diode (LED) type sized for the supply voltage.

2.2.8.2 Lamps and lenses shall be replaceable from the front of the panel. Shields shall be provided to prevent short circuits.

2.2.8.3 Indicating lights in outdoor panels shall be weatherproof.

2.2.8.4 Resistor type lights shall be used when lights are in trip circuits (for breakers, contactors, lockout relays, etc.).

2.2.9 Raceway

2.2.9.1 Wiring raceways shall be plastic wiring duct with covers.

2.2.9.2 A complete system of separate vertical wiring raceways shall be provided for all factory and field wiring. This shall include vertical raceways along both sides of each panel.

2.2.9.3 The Manufacturer's standard raceway may be considered, provided the Proposal includes sufficient information to evaluate the raceway system offered.

2.2.10 Space Heaters

2.2.10.1 A thermostatically controlled space heater shall be furnished and installed in the panel.

2.2.11 Receptacles

2.2.11.1 Receptacles shall be duplex 120 VAC, 20A minimum.

2.2.12 Factory Tests

2.2.12.1 After the panel has been fabricated and all parts assembled, the complete gear, including instruments and devices, shall be factory tested. Factory tests shall include the following:

2.2.12.1.1 Tests that verify correct assembly and operation

2.2.12.1.2 Applicable standard tests

2.2.12.2 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.

2.2.12.3 The panel Manufacturer is responsible for all costs associated with correcting deficiencies and retesting in the event of a test failure:

TEST REQUIREMENTS		
Tests	**In Accordance With**	**Conducted By**
Production test	NEMA, IEEE, UL	Panel Manufacturer
Type test/Functional test	Panel Manufacturer standard	Panel Manufacturer
Point-to-point wiring checking	Panel Manufacturer standard	Panel Manufacturer
Protective relay functional checks	Relay manufacturer instructions	Panel Manufacturer
Component functional checks	Component manufacturer instructions	Panel Manufacturer

2.2.13 Type Tests and Certification

2.2.13.1 Type test certificates from identified components are acceptable in lieu of the individual type test.

2.2.13.2 Type test certificates shall be made available to Owner at no extra charge upon request.

2.2.14 Special Shipping Requirements

2.2.14.1 Panels shall be shipped upright and fully assembled. Doors and covers may be removed and packaged separately for installation in the field if necessary.

2.3 Installation

2.3.1 Panel Installation

2.3.1.1 Contractor shall install protective relaying panels according to design documents.

2.3.1.2 Contractor shall assemble panel covers and doors per panel manufacturer's instructions.

2.3.2 Panel Wiring

2.3.2.1 All wiring used within the panel may be installed and tested at the factory. Contractor shall supply additional internal panel wiring and field wiring as specified on the design documents.

2.3.2.2 All wiring shall be neatly and carefully installed in wiring gutters or raceway.

2.3.2.3 Contractor shall ensure continuity of field wiring and check terminations against drawings prior to turnover. Mis-wired elements shall be corrected by Contractor at no additional cost to Owner.

2.3.3 Relays, Meter, Controls and Instruments

2.3.3.1 Meters, relays, instruments and controls shall be installed and wired on the front panels with the exception of auxiliary relays, transducers and instrument transformers that may be mounted inside of the panel or on sub-panels. Contractor shall mount devices as specified on the design documentation.

PROTECTIVE RELAYING PANELS SPECIFICATION SHEET

General Requirements	
Standards for manufacturing and testing	ANSI / NEMA
Item	
Description	
Location	Indoor
Panel type	Enclosed vertical
Enclosure type	Indoor electrical rooms – NEMA 12, Outdoor or plant process areas – NEMA 4X, Indoor non-electrical rooms – NEMA 4
Power supply	
Circuit Description	**Voltage**
Two 2 wire circuit for DC power to relays One single-phase 1 wire/ground circuit for receptacles and space heaters.	120 VAC or 125 VDC
Space heater	Yes
Receptacles	Yes - 1 per panel minimum
Wiring Method	
Wiring methods shall be in accordance with this Specification.	
Additional requirements	
Accessories	
The panels shall be furnished with the following maintenance and operating equipment:	

Quantity	**Unit**	**Item**
1	Lot	100 percent replacement of fuses (box of fuses for each type/size)
1	Each	Lockout relay coil spare

END OF SECTION 16201

SECTION 16390
GROUNDING

1.0 INTRODUCTION

1.1 Scope

1.1.1 This section covers all design requirements, accepted equipment materials and manufacturers, and installation procedures that have been deemed as the established standards for Ameren Missouri Generation grounding systems and all components.

1.1.2 Any materials not specified as being furnished by others, but which are required for a complete grounding installation, shall be furnished.

1.2 Reference Sections

1.2.1 16010 – Basic Electrical Requirements

1.2.2 All Division 16 sections shall be reviewed for equipment specific grounding requirements.

1.3 Codes and Standards

1.3.1 Grounding systems and components furnished with these Specifications shall be manufactured in accordance with the applicable standards of:

1.3.1.1 NFPA 70 – National Electric Code (NEC)

1.3.1.2 National Electrical Manufacturers Association (NEMA)

1.3.1.3 Underwriters' Laboratories, Inc. (UL)

1.3.1.4 American Society for Testing and Materials (ASTM)

1.3.1.5 Institute of Electrical and Electronics Engineers, Inc. (IEEE)

1.3.1.6 Occupational Safety and Health Administration (OSHA)

2.0 GENERAL GROUNDING REQUIREMENTS

2.1 Design

2.1.1 Ground conductors shall be sized to accommodate available fault current and fault clearing times along with NEC requirements. Minimum conductor sizes shall depend on the following table:

Application	Minimum Ground Conductor Size
Cable Trench	4/0 AWG
Underground Grounding Conductor	4/0 AWG
Ground Grid Conductor	4/0 AWG
Stub-ups and Cable Tray	2/0 AWG
MV/LV Switchgear and MCC's	2/0 AWG
LV Power and Control Panels	8 AWG
Misc. Equipment Grounding Conductor	12 AWG
Unless Otherwise Noted (Cable)	6 AWG

2.1.2 The system shall be designed to ensure personnel safety and ensure proper overcurrent protective device operation to minimize equipment damage resulting from fault current.

2.1.3 Ground calculations are required per IEEE 80 and IEEE 142 for any new and/or stand-alone grounding systems.

2.1.3.1 Exceptions to calculations may be granted for direct tie-in to the existing facility ground grid, if agreed upon by Owner. Contractor is still responsible for ensuring requirements in Item 2.1.2.

2.1.3.2 Ground resistance shall not exceed 5 OHMS.

2.1.4 Grounding shall be provided for all electrical equipment, raceways, structural systems, utility racks, tanks and systems to a buried ground grid of stranded copper conductors and copper-clad ground rods.

2.1.5 Grounding electrode systems include: existing metal underground water pipe, existing metal frame of the building, concrete encased electrode and rod electrode.

2.1.6 Comply with NFPA 70, Article 250 for types, sizes and quantities of equipment grounding conductors, unless specific types, larger sizes, or more conductors that required by NFPA 70 are indicated.

2.1.7 Ground conductors shall be routed as to not create a tripping hazard.

2.1.8 Insulated ground conductor shall have green insulation and shall meet all insulation requirements.

2.1.9 Isolated ground conductor shall be insulated with green-colored insulation with yellow stripe.

2.1.10 All connections shall be made by the exothermal welding process.

2.1.11 Ground plates embedded in concrete shall be carefully located and firmly secured to the concrete forms.

2.1.12 Use exothermically welded joints where ground network connects to ground plates or building structural steel and for all buried or otherwise inaccessible connections.

2.1.13 Bonding between raceways and enclosures shall provide electrical continuity with capacity to safely conduct any possible fault current imposed on system.

2.1.14 Framework of motors, panelboards and other metallic enclosures of electrical devices shall be electrically bonded to grounding network.

2.1.15 Provide bonding of concrete reinforcing, rebar, welded wire fabric, steel columns, water lines, gas lines, sprinkler piping and electrical system neutral bonds.

2.1.16 Motors located within the confines of the unit steel base shall be grounded in the motor terminal housing.

2.1.17 Use only copper conductors for both insulated and bare grounding conductors in direct contact with earth, concrete, masonry, crushed stone and similar materials.

2.1.18 Conduit Grounding

2.1.18.1 All grounding bushings on conduit runs which are terminated at tray shall be connected to the tray grounding cable or tray side rail with bare copper conductor as indicated on the drawings.

2.1.18.2 Where a conduit run is terminated at tray and the conduit carries a separate insulated grounding conductor, this grounding conductor shall be terminated on the tray grounding cable.

2.1.18.3 Metallic conduits shall be effectively bonded to any metallic enclosures to which they are attached or entered into by metal-to-metal contact.

2.1.18.4 Conduits that terminate at cable trays shall be attached to trays using cable tray conduit clamps.

2.1.19 Tray Grounding

2.1.19.1 Tray grounding conductor shall be attached to trays using bolted ground clamps and shall be connected to the ground grid at locations as required by Contractor's design.

2.1.19.2 Splices for the tray grounding conductor shall be made using compression connectors.

2.1.19.3 Grounding jumpers shall be required across all expansion splice plates, dropouts and adjustable splice plates where a continuous ground conductor is not installed along the tray level.

2.1.20 Electrical Equipment Grounding

2.1.20.1 The term "electrical equipment" as used in this article, shall include all enclosures containing electrical connections or bare conductors except that individual devices such as solenoids, pressure switches and limit switches shall be exempt from this requirement unless the device requires grounding for proper operation.

2.1.20.2 An embedded copper grounding plate connector shall be used for from underground to above ground transitions for equipment grounding connections.

2.1.20.3 Grounding plates are Owner's required method for making underground to above ground transitions. Stinger conductors directly connecting ground grid to equipment shall only be allowed where it is not physically possible to install a grounding plate, and with approval of Owner.

2.1.20.3.1 Electrical equipment that requires a ground grid extension stinger shall be connected to the ground grid with copper grounding conductor.

2.1.20.4 Large electrical power distribution equipment such as medium or low voltage switchgear or MCCs will be furnished with a ground bus which Contractor shall connect to the ground grid at each end of the ground bus.

2.1.20.5 Transformers, large motor bases, skids, etc. shall be connected to the ground grid twice at opposite corners of the equipment.

2.1.20.6 Where a ground conductor is included with the phase conductors of power circuits, the ground conductor shall be connected to the equipment grounding facilities and to the source ground bus.

2.1.20.7 Where a ground conductor is not included with the phase conductors, the equipment shall be grounded by connecting a separate ground cable to the equipment grounding facilities and to the tray ground cable or source ground bus.

2.1.20.8 All equipment ground conductors which are not an integral part of a cable assembly shall be sized in accordance with the requirements of NEC.

2.1.20.9 Power circuits shall include an insulated ground conductor to all 6,900 volt, 4,160 volt, 480 volt, and 208 volt loads. This ground conductor is either a separate cable, Type GI, or is contained within the multi-conductor power cable.

2.1.20.10 Power circuits from 120/208 volt power panels contain one additional conductor which is used for grounding smaller devices which require 120 volt power.

2.1.21 Duct bank, Trench and Electrical Manhole Grounding

2.1.21.1 Duct bank ground conductors shall be located at the top of the duct bank and physically separated on each side.

2.1.21.2 Duct bank ground conductors shall be connected to the plant ground grid and outlying grids at locations where the duct bank meets the perimeter of the grids.

2.1.21.3 Two 4/0 bare copper ground conductors shall be routed with each duct bank routed outside the plant grid or outlying grids as indicated on the drawings.

2.1.21.4 Two 4/0 bare copper ground conductors shall also be run in each cable trench, one on each side of the trench, and connected to the ground grid.

2.1.22 Overhead-Line Grounding

2.1.22.1 Comply with IEEE C2 requirements. Use 2 or more parallel ground rods if a single ground rod electrode resistance to ground exceeds 25 ohms.

2.1.22.2 Drive ground rods to a depth of 12 inches below finished grade in undisturbed earth.

2.1.22.3 Separate arrester grounds from other grounding conductors.

2.1.22.4 Secondary neutral and tank of transformer shall interconnect and connect to grounding conductor.

2.1.22.5 Protect grounding conductors running on surface of wood poles with molding extended from grade level up to and through communication service and transformer spaces.

2.1.23 Ground Bus

2.1.23.1 An uninsulated solid tin-plated copper ground bus shall be furnished with each electrical equipment assembly. Where multiple ground buses are required within the same enclosure, they shall be bonded together to ensure a uniform grounding plane. A continuous bare copper ground bus, with a compression or clamp type connector at one end, shall be provided in each cabinet.

2.1.23.2 All components within the same electrical equipment requiring grounding shall be connected to this grounding bus.

2.1.24 Bonding

2.1.24.1 All metal bodies within 6 feet of a lightning protection conductor, or as required by the referenced codes and standards, shall be bonded to the system with approved fittings and conductor.

2.1.24.2 Metal bodies of inductance located within 6 feet of a conductor or object with secondary bonds, or as required by the referenced codes and standards, shall be bonded with secondary cable and fittings.

2.2 Equipment

2.2.1 Grounding and bonding components shall be manufactured by a company listed herein, or an Owner-approved equal.

2.2.2 Ground grid components shall be manufactured by: Cadweld, T&B – Fuseweld, Thermoweld, ERICO, Harger, FCI Burndy, Panduit, or an Owner-approved equal.

2.2.3 Grounding component materials shall be furnished new and undamaged.

2.2.4 Cable shall be copper, #6 AWG minimum, stranded, soft drawn, ASTM designated B-3-45. Class A or B stranding shall be used unless otherwise noted on drawings.

2.2.4.1 No equipment grounding conductor shall be smaller in size than 12 AWG unless it is a part of an acceptable cable.

2.2.5 Clamps, connectors, bolts, washers, nuts and other hardware used with the grounding system shall be of copper, copper alloy, or stainless steel.

2.2.6 Connector products shall comply with IEEE 837 and UL 47; listed for use for specific types, sizes and combinations of conductors and connected items.

2.2.7 Underground grounding conductors shall use copper conductor, No. 4/0 AWG minimum buried at 24 inches below.

2.2.8 Some of the acceptable instruments for measuring ground resistance are as follows:

2.2.8.1 Advanced Geosciences, Inc., Sting R1, Mini Sting, Super Sting R1, or Super Sting R8

2.2.8.2 Iris Instruments, SYSCAL R1 Plus, SYSCAL R2, or SYSCAL Pro.

2.2.9 Ground Rods

2.2.9.1 Rod electrodes shall be manufactured by: American Electric, Amp, Inc., or an Owner-approved equal.

2.2.9.2 Ground rods shall be copper clad, cold drawn carbon steel manufactured in accordance with UL 467. Ground rods shall be manufactured by Copperweld Co. or copper-plated rods as manufactured by ITE Blackburn Co.

2.2.9.3 Ground rods shall have a conical taper on one end to facilitate soil penetration.

2.2.9.4 Individual ground rods shall be a minimum of 3/4 inch diameter and 10 feet long.

2.2.9.5 The copper cladding shall be electrolytically bonded to the steel rod or bonded by a molten welding process.

2.2.9.6 Cold rolled copper cladding will not be acceptable.

2.2.10 Conductors

2.2.10.1 Bare ground conductor shall be soft drawn, stranded copper conforming to the requirements of ASTM B-8.

2.2.10.2 Minimum ground conductor size shall be #4/0 for ground grid and #2/0 for stub-ups and cable tray.

2.2.10.3 Insulated ground conductor shall be soft drawn, stranded copper conforming to the requirements of UL 83.

2.2.11 Exothermally Welded Connections

2.2.11.1 Exothermic connections shall be manufactured by: Burndy, Cadweld, or an Owner-approved equal.

2.2.11.2 Exothermal connections shall be a standard duty copper molten weld conforming to the requirements of IEEE 837, IEEE 80 Section 11, and UL 467.

2.2.11.3 Welded Joints – Molds and powder charges for "self-welding" process as manufactured by Cadweld or approved equal. Standard duty molds below 350 MCM - heavy duty molds for 350 MCM and above.

2.2.11.4 Molds and powder cartridges used for making exothermal connections shall be furnished by the same manufacturer.

2.2.12 Bolted and Screwed Connections

2.2.12.1 Mechanical connectors shall be manufactured by: American Electric, Burndy, or an Owner-approved equal.

2.2.12.2 Make bolted connections to equipment using suitable bar, cable with compression type terminals, or copper strap.

2.2.12.3 Where copper terminals or bars are connected to aluminum surfaces, tin the copper surface, clean aluminum surface, and coat with NO-OX-ID or similar corrosion inhibitor.

2.2.12.4 Bolted connectors shall be copper alloy connectors with copper alloy bolts and nuts. Galvanized steel shall not be acceptable.

2.2.12.5 Bolted connectors shall be Wrench-Lok connectors for grounding, as manufactured by AMP Inc., only when specified on drawings.

2.2.13 Ground Lugs

2.2.13.1 Ground lugs shall be single hole or two hole, heavy-duty, copper bars conforming to the requirements of IEEE 837 and UL 467.

2.2.13.2 Two hole ground lugs shall have NEMA center line hole spacings.

2.2.14 Ground Plates

2.2.14.1 Ground plates shall be high strength, four hole copper bodies conforming to the requirements of IEEE 837 and UL 467.

2.2.14.2 Ground plates shall have NEMA center line hole spacings and shall be provided with hole plugs on the mating side of the plate.

2.2.14.3 Manufactured by Panduit or Owner-approved equal.

2.2.15 Conduit Grounding

2.2.15.1 Grounding bushings shall be grounded with conductor sized in accordance with the NEC, but not smaller than 8 AWG.

2.2.15.2 Conduit bushing ground conductors shall be connected to the tray ground cable using split bolt connectors or an Owner-acceptable equal mechanical connector.

2.2.16 Ground Bus

2.2.16.1 Ground bus shall be bare, annealed copper bars of rectangular cross section, with insulators.

2.2.16.2 The minimum bus size shall be suitable for carrying the maximum ground fault current for the rated short-circuit duration but shall not be smaller than 0.25 inch by 2 inches.

2.2.16.3 Two ground connectors shall be furnished for the attachment of a Contractor-supplied 1/0 AWG to a 300 kcmil stranded copper cable at each end of the switchgear assembly protective ground bus.

2.2.16.4 Ground busbar shall be soft drawn, uncoated copper conforming to the requirements of ASTM B-187.

2.2.16.5 Busbar shall be a minimum 1/8 inch thick and 1 inch wide.

2.2.16.6 Where required, bus bar shall be provided with predrilled holes measuring 9/16 inch in diameter with NEMA center line hole spacings.

2.2.17 Bonding

2.2.17.1 Flat metal bonding plates shall be cast bronze or aluminum with a minimum surface contact area of 3 square inches.

2.2.17.2 Each bonding plate shall be furnished complete with bronze or aluminum screws for mounting.

2.2.17.3 Pipe bonding clamps shall be lead coated copper or aluminum and shall have provisions for connecting the conductors as specified herein.

2.2.17.4 Pipe bonding clamps shall be sized according to the piping that requires bonding.

2.2.17.5 Rebar bonding clamps shall be cast bronze universal conductor to rebar bonding clamps.

2.2.17.6 Rebar bonding clamps shall be sized to accommodate conductor sizes though 4/0 AWG.

2.2.17.7 Primary bonds for metal bodies of conductance shall be bonded with appropriate fittings and full size conductor.

2.3 Installation

2.3.1 Contractor shall design, furnish and install all equipment and all required grounding cables.

2.3.1.1 This shall include, but not be limited to, devices which have electrical connections but do not require a power circuit such as junction boxes and control equipment enclosures, any equipment to which the routed ground conductor is not of sufficient size to properly ground the equipment, and any other electrical equipment which is not grounded by means of a conductor.

2.3.2 Grounding system components shall be installed as indicated on the detailed drawings.

2.3.3 Inspect grounding and bonding system conductors and connections for tightness and proper installation.

2.3.4 Contractor shall ensure proper ground continuity and resistance. All ground resistance measurements shall be made with the Fall of Potential or slope methods as defined in IEEE 81.

2.3.4.1 Record measurements and submit to Owner upon request.

2.3.5 Install ground cables such that they are protected from mechanical injury and routed to avoid interference with access doors or covers.

2.3.6 All ground connection surfaces shall be cleaned immediately prior to connection.

2.3.7 Ground all electrical equipment, including cable tray and conduits as shown on drawings or as required by applicable codes, particularly NEC Article 250.

2.3.8 Ground each separately-derived system neutral to nearest effectively grounded building structural steel member or as shown on drawings.

2.3.9 After connection of ground rods to the ground system, Contractor shall obtain a ground resistance measurement from a selected location on the ground grid using methods approved by Owner. This data shall be obtained, identified and recorded.

2.3.10 Contractor shall furnish, install and connect additional ground rods as necessary.

2.3.11 Use hydraulic compression tools to provide correct circumferential pressure for compression connectors.

2.3.12 If insulated grounding conductors are connected to ground rods or grounding buses, insulate entire area of connection and seal against moisture penetration of insulation and cable.

2.3.13 Excursion

2.3.13.1 Bury ground wire directly in earth at depth specified on drawings. Backfill with earth material only. Rock or sand is not acceptable as backfill material.

2.3.13.2 Drive ground rod to full depth in direction as nearly perpendicular to top of yard as possible. Notify Company Supervisor if obstructions are encountered that prevent full-depth penetration.

2.3.13.3 Install welded joints in accordance with instructions of manufacturer of molds and welding charges. Do not cover welded joints with earth until they have been inspected by Company Construction Supervisor. Joints must be capable of standing repeated blows with a hammer without rupturing at weld.

2.3.14 Ground Rods

2.3.14.1 All ground rods shall be located as required by Contractor's design and installed to the depth indicated.

2.3.14.2 Drive ground rods until tops are 2 inches (50 mm) below finished floor or final grade, unless otherwise indicated.

2.3.14.3 Where the required ground rod length exceeds 10 feet, ground rod standard sections shall be welded together to provide an extended rod with one true centerline a minimum of joint resistance.

2.3.14.4 During welding, the ground rod sections being welded shall be supported by a guide to ensure proper alignment.

2.3.14.5 Install a minimum of two rod electrodes as indicated on Contract Documents.

2.3.14.6 Install additional rod electrodes as required to achieve specified resistance to ground.

2.3.14.7 Ground rods shall be interconnected 2' below grade with a #4/0 cable by means of extreme welding.

2.3.14.8 A minimum of 4 ground rods, one at each corner, shall be driven vertically into ground with top of each ground rods minimum 1'-0" below grade.

2.3.15 Conductors

2.3.15.1 Exposed conductors shall be installed inconspicuously in vertical or horizontal positions on supporting structures.

2.3.15.2 When located on irregular supporting surfaces or equipment, the conductors shall run parallel to or normal to dominant surfaces.

2.3.15.3 All below grade ground conductors shall be buried a minimum of 18 inches and a maximum of 30 inches below finished grade unless installed under a concrete foundation.

2.3.15.4 Ground grid conductors under foundations shall have 6 inches of earth cover between conductor and bottom of foundation.

2.3.15.5 Conductors routed over concrete, steel, or equipment surfaces shall be kept in close contact with those surfaces by using fasteners located at intervals not to exceed 3 feet.

2.3.15.6 Conductors routed around 90 degree corners shall be kept in close contact with the perpendicular surfaces and shall not be physically damaged due to an insufficient bending radius.

2.3.15.7 Damaged ground system conductors shall be repaired or replaced.

2.3.16 Exothermally Welded Connections

2.3.16.1 The manufacturer's instructions on the use of exothermal welding materials shall be followed in all details.

2.3.16.2 Do not cover welded joints until they have been inspected by the Owner Construction Project Lead or representative.

2.3.16.3 All surfaces to be joined by welds shall be thoroughly cleaned.

2.3.16.4 Powder cartridges and molds shall be kept dry and warm. Worn or damaged molds shall not be used.

2.3.16.5 All exothermally welded connections shall successfully resist moderate hammer blows without rupturing at weld.

2.3.16.6 All exothermal welds shall encompass 100 percent of the ends of the materials being welded.

2.3.17 Bolted and Screwed Connections

2.3.17.1 All bolted and screwed connections shall be securely tightened.

2.3.17.2 Dies used in the compression tools shall be of the same manufacturer as the compression fittings.

2.3.18 Ground Plates

2.3.18.1 The threaded holes in the mating surface of ground plates shall be plugged prior to pouring concrete.

2.3.18.2 Grounding conductor attached to the ground plates shall be inspected prior to the pouring of concrete to ensure a good solid connection in accordance with industry standards.

2.3.19 Column Grounding

2.3.19.1 Structural steel columns shall be grounded by use of servit post installed in a pre-drilled hole in the web of the column near the base as indicated on the drawings.

2.3.19.2 Contractor shall provide a hole in the web of structural steel columns not so equipped for grounding provisions.

2.3.19.3 Hole shall be 9/16 inch in diameter and located approximately 8 inches up from the base.

2.3.19.4 Prior to installation of the servit post, paint, scale and other nonconductive substances shall be removed from surfaces of ungalvanized structural steel members by grinding.

2.3.19.5 Galvanized steel surfaces shall be leaned with emery paper.

2.3.20 Conduit Grounding

2.3.20.1 All conduit grounding bushings within all enclosures, including equipment enclosures, shall be wired together and connected internally to the enclosure grounding lug grounding bus with a bare copper conductor.

2.3.20.2 If the conduit run is terminated with a grounding bushing and the separate ground conductor it carries is sized in accordance with the requirements for conduit bushing grounding, the ground conductor in the conduit run may be continued through the conduit bushing ground connection and terminated on the tray grounding cable making unnecessary the installation of a separate conduit bushing grounding cable.

2.3.20.3 All ground conductors installed in conduit shall be insulated.

2.3.21 Tray Grounding

2.3.21.1 A bare copper grounding conductor shall be installed on all power level cable trays (with 480V or greater) containing single or multi-conductor power cables.

2.3.21.2 The tray grounding conductor shall be installed on the outside of the tray side rails, along the entire length of the trays, attaching to each tray fitting and to each straight section of tray at 6 foot maximum intervals.

2.3.21.3 Cable trays containing only multi-conductor power cables (less than 480V), control, or instrument circuits shall not require a continuous ground conductor installed along the tray. Instead, these tray levels shall be grounded by means of a ground jumper extended from the tray side rail to the continuous ground conductor installed along a power level cable tray, to building steel, or to the ground grid.

2.3.21.4 Grounding intervals shall not exceed 100 feet.

2.3.22 Electrical Equipment Grounding

2.3.22.1 Location and configuration of equipment grounding plates shall be acceptable to Owner.

2.3.22.2 Where ground grid extension stingers are to be provided for connection to electrical equipment, Contractor shall connect the grounding conductor to the equipment ground bus, pad, or lug.

2.3.22.3 A ground conductor shall be provided from the tray ground cable to the incoming line end of the ground bus in each assembly of medium or low voltage switchgear and MCCs indicated on the drawings.

2.3.22.4 Suitable grounding facilities shall be furnished on electrical equipment not so equipped. Grounding facilities shall consist of compression type terminal connectors bolted to equipment frame or enclosure and providing a minimum of joint resistance.

2.3.22.5 Suitable grounding facilities for electrical equipment not so equipped, but requiring multiple grounding connections, shall include installation of a bare copper ground bus for the connection of several grounding conductors.

2.3.22.6 Equipment grounding conductors shall be run in conduit or raceway with phase wires. Nonmetallic conduits or raceways shall have ground conductors.

2.3.23 Duct Bank, Trench and Electrical Manhole Grounding

2.3.23.1 A ground conductor, equal in size to the ground grid conductors, shall be installed around the upper interior of each electrical manhole.

2.3.23.2 The manhole ground conductor shall also be connected to any manhole rebar ground plates, conduit ground bushings, cable racks and cable tray located in the electrical manhole.

2.3.24 Ground Bus

2.3.24.1 Ground bus shall be bolted to each vertical section and to each breaker ground contact.

2.3.24.2 Both ground bus and ground cable connections shall be easily accessible from the cable compartment.

2.3.24.3 An uninsulated protective ground bus shall be furnished through the entire length of the MCC. All MCC equipment requiring grounding shall be connected to this ground bus.

2.3.25 Bonding

2.3.25.1 Bonding of all metallic objects and systems at roof levels and elsewhere on the structure shall be complete.

END OF SECTION 16390

APPENDIX A
DEFINED TERMS

1.1. ARO means after receipt of order.

1.2. Asbestos Containing Material (ACM) means material that contains asbestos in concentration greater than 1% and must be handled according to Owner procedures and federal and state regulations.

1.3. Barricade means a physical obstruction such as barricade tape, chains, cones, concrete barriers, fencing, or "A" frame type wood and/or metal structures intended to warn and limit access to a work area. Barricade tape alone cannot be used to protect certain hazards such as unattended floor openings or fall hazards.

1.4. Change Order (CO) is defined in the Terms and Conditions.

1.5. Chemicals of Interest (COI) is defined in Appendix G, Paragraph 2.0

1.6. Clearance means the assurance to Holder that the system or equipment for which it is issued has been properly isolated from its normal energy sources (including any emergency back-up energy source(s) and will remain isolated as long as Clearance is in effect.

1.7. CMTR means Certified Material Test Report.

1.8. Competent Person means an individual engaged by Contractor who is trained and certified in applicable standards, is capable of identifying workplace hazards relating to specific operations, performs inspections of industrial and construction jobsite equipment, and has authority to take corrective actions when needed.

1.9. Computer Based Training (CBT) Computer Based Training is used for safety and job work rules orientation of new personnel before they are permitted unescorted access to Owner property.

1.10. Confined Space means an enclosed area that is not normally designed or intended for human occupancy, has a restricted entrance or exit by way of location or size, and can represent a risk for the health and safety of anyone who enters, due to atmospheric, engulfment, entrapment, mechanical, electrical, or any other recognized hazard. See OSHA 29CFR1910.146 and Power Operations Administrative Procedure AUE-ADM-2415.

1.11. Contract means collectively the Purchase Order to which this Specification is attached or incorporated, the Terms and Conditions, and the other Contract Documents (defined in the Contract).

1.12. Contractor means the entity identified in Company's Purchase Order, and its agents, employees and authorized representatives undertaking the performance of the Work as defined in this Specification. The terms "Vendor," "Supplier," "Manufacturer," or “Fabricator” if used in the Contract Documents, are considered synonymous and refer to Contractor.

1.13. Corporate Safety Department means Owner’s Corporate Safety Department which sets standards for safety and health issues and monitors compliance with Owner’s policies, as well as with federal, state and local regulations.

1.14. Critical Lifts is defined in Appendix B, Paragraph 7.3.

1.15. Critical Path is defined in Attachment D.1.2.

1.16. Custody Authority is defined in Appendix B, Attachment B.4.3.

1.17. Day is defined as a business day or working day.

1.18. Energy Center is defined in Division 1, Paragraph 1.1.

1.19. Equipment means the Materials apparatus, equipment, and machinery to be provided by Contractor as part of the Work and that become a permanent part of the Energy Center.

1.20. Extra Work shall be considered synonymous and refer to a Change Order.

1.21. Foreign Material Exclusion (FME) means the practice of preventing the contamination of components in energy center systems.

1.22. Functional Authority is defined in Appendix B Attachment B.4.3.

1.23. GASLC means Owner's Generation Approved Supplier List-Critical.

1.24. Hold Off Tag is defined in Appendix B, Attachment B.4.1, Paragraphs 2.2 and 2.3.

1.25. Holder means the individual signed on to a WPA tag.

1.26. Hot Work means work that will generate sparks, such as; cutting, grinding, welding, and brazing. A permit may be required for Hot Work that is hazardous due to location or other factors.

1.27. Incident/Accident means an incident is defined as a near miss, vehicle accident, or property damage to Owner-owned/leased equipment or facilities. Refer to OSHA 29CFR1904 for definitions of reportable incidents and injuries.

1.28. Job Working Rules means the rules of conduct for work performed at Owner facilities which are various types of prohibited behavior, off-limit areas, driving and parking instructions, and site safety information.

1.29. JR means Job Request.

1.30. Jurisdictional Authority is defined in Appendix B, Attachment B.4.3.

1.31. Key Personnel means the Contractor personnel identified in the organizational chart submitted with the Bid.

1.32. Law means or Laws means: (1) all applicable federal, state, and local laws, treaties, ordinances, codes, rules and regulations, judgments, decrees, injunctions, writs and orders of any court, arbitrator or governmental agency or authority; and (2) all applicable and generally recognized building and safety standards governing performance of the Work.

1.33. Level 2 Project Schedule is defined in Appendix D, Attachment D.1.1.

1.34. Level 3 Project Schedule is defined in Appendix D, Attachment D.1.1.

1.35. Local Control is defined in Appendix B, Attachment B.4.1, Paragraph 2.4.3.

1.36. Material means the supplies, goods, items, and materials to be provided by Contractor and consumed, used or incorporated in connection with or as a part of the Work.

1.37. Must Fix Guarantee is defined in Paragraph 1.4.1 of Section 1A, warranty items.

1.38. National Maintenance Agreement (NMA) is defined in Appendix C, Paragraph 2.1.

1.39. OSHA is defined as the Occupational Safety and Health Administration.

1.40. Operating Supervisor means the Owner's supervisor with control authority at the Site at the relevant time.

1.41. Owner means Union Electric Company, d/b/a Ameren Missouri.

1.42. Owner's Security is defined in Appendix C, Paragraph 1.0.

1.43. Out of Service means equipment under a Hold-Off Tag which is isolated from all normal sources and emergency back-up energy sources.

1.44. P&ID means piping and instrumentation diagram.

1.45. Privileged Users is defined in Appendix C, Paragraph 1.5.1.

1.46. Professional Engineer means the applicable professional engineer or structural engineer licensed in the State in which the Work is performed and qualified to seal and/or sign documents to the extent required by Law.

1.47. Project means the project identified on the cover page.

1.48. Project Execution Plan is defined in Appendix D, Attachment D.1.1.

1.49. Project Manager is the individual Contractor identifies to provide a full-time onsite management of the Work on behalf of the Contractor.

1.50. PPE means personal protective equipment.

1.51. Quality Management Plan or QMP – A document that applies Contractor's Quality Program to the Project. The QMP describes the quality standards, practices, resources, specifications, sequence of activities, and method of measurement particular to the Project.

1.52. Quality Program – means a coordinated, comprehensive, and systematic set of processes, procedures, instructions, and records designed to achieve work of the highest quality effectively and efficiently and to control, test and correct quality defects.

1.53. QMS means Owner's Quality Management System.

1.54. Project Schedule means the schedule mutually approved by Owner and Contractor which delineates the dates by which the Work will be performed, as further described in Appendix D, together with all amendments thereto approved in writing by the Owner, if applicable.

1.55. Restraint is issued on a Functional Authority's Hold Off, and means an assurance given by the Functional Authority to the person to whom it is issued that the equipment it covers has been properly isolated from its energy sources and that normal voltage will not be applied while the Restraint is in effect.

1.56. Rules to Live By (RTLB) is defined in Appendix B, Paragraph 3.0.

1.57. RWP (Recommended Welding Practices) is defined in Appendix F, Attachment F.1.3.

1.58. Safety Data Sheet (SDS) means the sheets referenced in Appendix G, Paragraph 2.0.

1.59. Safety Director means the individual identified by Contractor as its Project director of safety, as further described in Appendix B, Paragraph 2.0.

1.60. Single Point of Contact (SPOC) is the individual identified by Owner as such, who is Owner's representative for the Project to act on behalf of Owner and with whom Contractor may consult.

1.61. Site means the Owner site on which the Work shall be performed.

1.62. Site Specific Safety Plan (SSSP) is the safety plan to be completed by Contractor in the form attached hereto as Attachment B.1.1 in Appendix B.

1.63. Specification means these Construction Specifications for the Project.

1.64. Terms and Conditions means the contract terms and conditions (which may be Owner's General Conditions of Contract or other legal agreement) which form a part of the Contract Documents, and which incorporate these Specifications.

1.65. Work is defined as all the services, labor, Materials and Equipment to be provided by Contractor for the Project.

1.66. Worker's Hold Off Tag is defined in Appendix B, Attachment B.4.1.

1.67. Worker's Protection Assurance (WPA) or Hold Card Procedure means Owner's equipment lock-out procedure that ensures equipment and systems are in a safe state prior to service or testing. WPA is the process used by Owner to ensure the safety of those who work on generation, transmission and substation equipment, and the procedure to tag equipment or systems that have been de energized or put in a specified state to allow for service or testing. The energy in a system may be electrical, mechanical, pneumatic, hydraulic, chemical, kinetic, or nuclear.

END OF APPENDIX A

APPENDIX M
GENERAL REQUIREMENTS FOR HAULING HEAVY EQUIPMENT

1.0 INTRODUCTION

This specification outlines the requirements for moving heavy loads more commonly referred to as “Super Loads” by state transportation agencies. The specification will detail Ameren’s responsibility as well as those of the hauler and rigger. The terms “bidder,” “Hauling Contractor” and “Rigger Contractor” are used interchangeably.

Each bidder shall furnish with his bid the route he proposes to use, the estimated time required, and a complete description of the hauling equipment which he proposes to use for the move, including; age, number of axles and wheels, rated capacity of trailer, number, type and pulling capacity of power units, the overall height above grade of the equipment to be moved as it is carried upon the hauling rig, etc. All work required to be performed for the move must be identified prior to the awarding of the contract.

2.0 AMEREN’S RESPONSIBILITIES

Meet with the rigger/hauler contractor to review the move and address questions.

Provide detailed information for the equipment to be moved (applicable for existing Ameren equipment that will be moved at the job site). This will include:

- Complete physical information – height, width, depth, and weight of equipment to be moved. Generally, an equipment outline drawing with dimensions will be provided.
- Miscellaneous materials to be moved (fans, bushings, radiators, turrets, conservator or expansion tank, arresters, piping, hardware, etc.). A list of the miscellaneous material that shall be moved will be provided. Transformer oil will be moved by others (applicable to existing Ameren transformers).
- Physical drawings of the equipment and special lifting or loading manufacturer’s instructions.
- Any known conditions that could have an effect on moving the equipment.
- Location where the equipment can be picked up.
- Final destination for the equipment.

Provide impact recorder mounted on equipment.

Arrange for lifting of electric utility wires for the portion of the move that is within Ameren’s service territory.

Provide access to beginning and ending locations.

Provide outages to electrical facilities as required to facilitate the work.

Provide the date when the move can begin.

Provide the date the move must be completed.

In some instances, the rigger and the hauler will be the same firm, but in others the two will be different. This specification divides specific responsibilities between the rigging and moving. In those cases where the two are different, the rigger and mover will coordinate and work together.

3.0 HAULER / RIGGER RESPONSIBILITIES

3.1 General

Investigate the originating location and final destinations to determine any special situations that may exist. Make Ameren aware of special situations and note any modifications to Ameren facilities that will be required to successfully complete the move.

Contractor shall provide and be responsible for all necessary cargo insurance, services, labor, equipment, trucks, tools, fuel, power, light, heat, telephone, water sanitary facilities, supervision, permits, bonds, permission to cross private property, insurance, payment of taxes and license fees, right-of-way clearances, and other personnel, devices & incidentals necessary to load, transport, unload and set in place the designated transformer or equipment, including accessories.

Where required, provide temporary cribbing for equipment to rest on prior to being moved to the final destination.

Secure all required permits or approvals to complete the move from federal, state, and local authorities. Where specific permitting is not required from a local authority such as a city, county, or township road commission, Contractor shall still obtain written permission from the local authority prior to the move. A copy of all permitting including written permission from the local authority shall be provided to Ameren upon request.

Clean up as the work progresses from day to day. All litter, debris, packing materials, etc., shall be disposed of off-site at the hauler's expense.

Repair any and all damage to private, public, or Ameren property at no additional cost to Ameren.

CAUTION: Caution must be observed at all times when working in or around the existing substation/switchyard. The existing substation/switchyard is energized with exposed high voltage substation bus and equipment. Also, there are energized high voltage overhead conductors in close proximity around the substation & switchyard. Coordination with the Ameren Construction Supervisor to have appropriate lines and/or equipment de-energized may be necessary. All outages and releases shall be in accordance with Ameren's Workman's Protection Assurance (WPA) Procedure. Personnel shall be trained, wear hard hats, protective clothing, safety glasses with side shields, safety shoes and fall protection in accordance with OSHA requirements. The operating substation shall not be left open and unsupervised, due to the common access to energized and de-energized equipment.

3.2 Hauler Specific

Determine a route and request approval from the appropriate governmental agency or agencies to cover the complete move.

Complete a route survey and contact overhead utility companies as required by the permitting authority.

Investigate all weight limitations that may affect the move. This can include but is not limited to seasonal weight requirements imposed by governmental agencies.

Make all necessary arrangements to complete the move.

Taking super loads over railroad tracks can present unique challenges. The mover shall investigate any railroad crossing that can pose a problem and develop a plan that will not cause damage to the track or impede the operation of the railroad.

Coordinate any and all requirements with state and local law enforcement officials.

Submit OEM load charts for all equipment used.

Provide a detailed Transport Plan to Ameren for review and approval before proceeding with the move, including but not limited to:

- The proposed route
- The estimated time required for the move
- A complete description of the proposed hauling equipment
- The overall height above grade of the equipment to be moved as it is carried upon the hauling rig
- Axle loading
- Wheel loading

- Center of Gravity of load and trailer
- Calculation
- DOT permit, if applicable

Provide a detailed Safety Plan to Ameren for review and approval before proceeding with the move.

All loads that exceed 85% capacity of the hauling equipment shall be reviewed and stamped by a professional engineer.

The Hauling Contractor shall comply with all requirements prescribed by Manufacturer instruction leaflets & drawings related to moving and supporting of the transformer or equipment. No welding on or to the equipment shall be permitted without written approval by Ameren and the equipment manufacturer.

The Hauling Contractor shall also be responsible for replacing or making prompt repairs to the equipment used by the Hauling Contractor which is damaged for any reason, including, but not limited to, broken axles.

Any temporary rocking or temporary roadways that may be necessary for any portion of the move, including, but not limited to, the substation yard, shall be provided by the Hauling Contractor unless other arrangements have been made in advance and are clearly described in the contract.

Removal of temporary rocking or temporary roadways, at Ameren's discretion, will be the responsibility of the Hauling Contractor.

The Hauling Contractor shall be responsible for making arrangement for raising, removal or relocation of all telephone, TV cables and electric utility wires, traffic lights, and other similar obstructions in accordance with the following:

The Hauling Contractor shall make all arrangements directly with the involved utilities and authorities and the cost of such arrangements shall be included in the bid.

The Hauling Contractor shall, where necessary, allow a reasonable amount of time for raising these obstructions, while the move is in progress.

The Hauling Contractor shall be responsible for repairing or replacing any damaged roads or surfaces, equipment, structures, fences, and fields, and for the restoration of any other damage to public or private property, caused by the move, to the satisfaction of the Ameren Construction Supervisor, the private owner, and/or the local road district authority.

Any damage done to the transformer, accessories, oil, or other equipment being moved (including paint scratches which expose bare metal) by the Hauling Contractor, his employees, subcontractors, contact with trees or overhead obstructions, or any other cause during the progress of this work, shall be the responsibility of the Hauling Contractor and shall be repaired to the satisfaction of the Ameren Construction Supervisor.

The Hauling Contractor shall provide adequate cargo insurance to cover the complete replacement of the equipment being hauled.

3.3 Rigger Specific

Provide all necessary material, labor, and supervision to move the load to a place where the load can be placed on the mover's truck or rail car.

Load the item on the truck and assist the mover in securing the load to the truck or rail car.

Off load the item at the final destination and locate it as directed by Ameren personnel.

The Rigging Contractor shall comply with all requirements prescribed by Manufacturer instruction leaflets & drawings related to moving and supporting of the transformer or equipment. No welding on or to the equipment shall be permitted without written approval by Ameren and the equipment manufacturer.

The Rigging Contractor shall be responsible for having an ample supply of cables, jacks, planking and other miscellaneous equipment on hand and in good condition, so that the move can be made safely and without delay.

Unless specifically stated in this specification, no pulling anchors will be available. The equipment to be moved shall be handled and positioned solely by use of the equipment furnished by the Hauling Contractor. At no time shall the equipment to be moved, or the equipment furnished by the Hauling Contractor, make contact with or exert a force on (directly or indirectly) any building, structure, foundation, oil pit, other improvement, tree, natural formation, or vehicle (except those furnished by the Hauling Contractor).

4.0 SCOPE OF WORK

4.1 Ameren Company Representative

An Ameren Company representative will generally observe the move and shall have the authority to immediately stop the work because of hazardous conditions or for any other reason which he deems necessary. This shall in no way relieve the Hauling Contractor of his responsibilities for the proper performance and supervision of the move.

4.2 Inspection of Equipment to be Moved

Prior to the move, Ameren personnel will inspect the equipment. Ameren will furnish all labor and material for this inspection. The Hauling Contractor and Ameren shall coordinate their work so that no unnecessary interference or delays occur during this period.

4.3 Hauling Contractor

The Hauling Contractor shall provide and be responsible for all necessary cargo insurance, services, labor, equipment, trucks, tools, supervision, permits, bonds, permission to cross private property, insurance, payment of taxes and license fees, right-of-way clearances, and other personnel and devices necessary to load, transport, unload and set in place the designated transformer or equipment, including accessories.

END OF APPENDIX M

APPENDIX P
PRICING SHEET

1.0 **INTRODUCTION**

1.1 This Appendix contains information that shall be provided by the Supplier as part of his bid proposal for the work described in this Specification.

1.2 This Appendix shall be completed by the Supplier and returned as part of his bid proposal.

1.2.1 The information contained in this Appendix will be used to evaluate the proposals and to award the contract. Any additional information that the Supplier desires to be evaluated shall be attached to this document as part of his bid proposal.

1.3 All information requested shall be entered in the blanks provided in this Appendix.

1.3.1 All blanks shall be completed. Use the characters “N/A” to signify if the information requested is not applicable.

1.3.2 Several sections in this Appendix specifically request the Supplier to clarify his understanding and agreement with the various Sections of the Specification. This in no way relieves or reduces the Supplier's responsibility to completely comply with all other Sections of this Specification.

2.0 **BID FORM**

Project Name: Motor Driven Compressor Packages

Bid From: _____
_____
_____
_____
_____

2.1 The undersigned Supplier proposes and agrees, if this proposal is accepted, to do all work specified in Specification CB-SPEC-000004 for the Contract Price and within the contract time as specified in Specification CB-SPEC-000004.

2.2 In submitting this proposal, the Supplier represents that:

2.2.1 The Supplier has examined copies of all the contract documents, modifying letters, and addenda. The receipt of any of these is hereby acknowledged below:

Letter or Number of Addenda	Date

2.2.2 The Supplier has familiarized himself with the all local conditions at the site and all Federal, State, and local laws and ordinances, rules, and regulations that in any manner may affect the work as specified in Specification CB-SPEC-000004.

2.2.3 The Supplier attests that this proposal is genuine and not made in the interest or on behalf of any undisclosed person, firm, or corporation and is not submitted in conformity with any agreement or rules of any group, association, organization, or corporation. The Supplier has not directly or indirectly induced or solicited any other Supplier to submit a false proposal. The Supplier has not solicited or induced any person, firm, or corporation to refrain from bidding and the Supplier has not sought by collusion to obtain for himself any advantage over any other Supplier or over the Company.

2.3 The Supplier shall complete all the work described in Specification CB-SPEC-000004 for the following price:

Pricing Information	
Base Scope Items	**Pricing**
1. Gas Compressor Package – 1	(List price here.)
2. Gas Compressor Package – 2	(List price here.)
3. Gas Compressor Package – 3	(List price here.)
4. Gas Compressor Package – 4	
TOTAL	
Schedule Requirements *	
1. Scheduled Time for Engineering and Drawing Completion.	(Weeks)
2. Scheduled Time for Fabrication/Assembly of Compressor Packages.	(Weeks)
Optional Work	
1. Price per pound for fabrication of revised (larger) pulsation bottles.	(List price here.)
2.	(List price here.)
3.	(List price here.)
4.	(List price here.)

* The Schedule Requirements listed here are an overview of the Level 2 Project Schedule as required in Paragraph 3.1 in Section 1A – General Conditions.

3.0 **BID BASIS**

3.1 The Supplier agrees to meet the milestone dates as defined in Section 1A, Paragraph 1.3 of Specification CB-SPEC-000004.

3.2 All documentation as defined in Section 1A, Paragraph 3.1 of Specification CB-SPEC-000004 is attached to and made a condition of this proposal.

3.3 The Supplier shall include with his bid proposal all additional information that he believes to be relevant to the scope of work and the evaluation of his proposal.

4.0 **COMMUNICATIONS**

4.1 All technical questions regarding Specification CB-SPEC-000004 shall be submitted in writing to:

Mr. Mac Voss, PE
Consulting Project Engineer
Ameren Power Operations Services
11149 Lindbergh Business Court
St. Louis, MO 63123
314-957-3416
mvoss@ameren.com

All commercial matters shall be directed to the Ameren Sourcing Specialist designated on the Request for Proposal.

4.2 All questions regarding this bid proposal shall be addressed to the following address:

_____

_____

_____

_____

Phone Number: _____

E-mail Address: _____

5.0 **BID SUBMISSION**

This bid proposal is submitted on _____

Signature of Bidder:

By _____

Title _____

Address _____

_____

State of Incorporation _____

Attest _____

_____

Title _____

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APPENDIX S
SUBMITTALS

PART 1 – GENERAL

1.1. Drawings and Data

1.1.1. General Requirements

1.1.1.1. Only project specific drawings and data shall be submitted to the Owner as described herein.

1.1.1.2. All drawings, calculations, and data shall be in the English language.

1.1.1.3. All units on drawings and calculations shall be standard English units.

1.1.1.4. All structural drawings and documents that provide structural loading and anchorage information as an input to others shall be certified as final and complete.

1.2. Submittals

1.2.1. The project may utilize a collaborative Web site or SharePoint site for the transmittal/submitting of drawings and other project related data. The Owner will work with the Supplier to develop a mutually agreed upon system of documentation sharing.

1.2.2. Hardcopies of drawings, data, and other documents are not required unless specifically requested. All information (correspondence, data, drawings, documents, etc.) shall be submitted electronically utilizing the Web site or SharePoint site indicated in Paragraph 1.2.1 or via email transmittal with attachments. The size of emailed attachments is limited to 10 MB.

1.2.3. The Owner will post comments on the Supplier's transmittals via the Web site or SharePoint site or via an email transmittal.

1.2.4. The Supplier and the Owner will coordinate the specific details of the transmittal of project data during the project kickoff meeting.

1.2.5. Electronic copies of drawings, data, and other documents shall be in pdf format.

1.2.6. All Supplier transmittals shall include a transmittal sheet or cover page with a unique transmittal number and that clearly indicates the Owner's name, how they are being sent, and the reason for the submittal. The transmittal shall include a clear, concise description of all documents included. Documentation by drawing number, revision number, and date shall be indicated, if applicable. Separate transmittals are preferred for each discipline and/or type (General, Structural, Mechanical, calculations, weld procedures, etc.).

1.2.6.1. The Supplier shall clearly indicate on the transmittal letter the date by which comments are required to maintain the engineering, fabrication, and construction schedule.

1.2.7. Drawings shall not be “typical” but shall represent the equipment provided. Construction drawings shall be revised to reflect the “as-built” conditions.

1.2.7.1. Where alternatives are shown, the alternative being furnished shall be easily identified on that document.

1.2.8. Drawings and documents shall be clearly labeled with:

1.2.8.1. Owner's Name

1.2.8.2. Energy Center Name and Unit Number (if applicable)

1.2.8.3. Contract Number and/or Specification Number

1.2.8.4. Supplier's Order Number

1.2.8.5. Drawing Number and Title

1.2.8.6. Drawing Issue or Revision Number and Date

1.3. Master Document List

1.3.1. The Supplier shall provide the Owner with a complete list of all documents submitted or planned to be submitted as part of the work. The Master Document List shall be updated and resubmitted monthly for the duration of the work and/or until all documentation has been completed. Table S-1 – Sample Document List is an example of the format for the Master Document List:

Table S-1
Sample Document List

Document Number	Document Description	First Review Submittal (Scheduled)	First Review Submittal (Actual)	Release for Fabrication (Scheduled)	Release for Fabrication (Actual)	Percent Complete
1	General Arrangement					
2	Calculations					
3	Weld Procedures					

1.4. Review Procedure

1.4.1. Drawings that are reviewed by the Owner will be returned to Supplier via the Web site, SharePoint site, or email transmittal. All comments and questions must be resolved before a re-submittal of the drawings will be processed. If the design has not developed enough to resolve some of the comments or questions, Supplier shall place a “hold” on those items or areas of design. The Owner reserves the right to return drawings unprocessed to Supplier if there is any evidence that Supplier has not acknowledged all comments and questions.

1.4.2. Documents or portions thereof, submitted for review will be reproduced and distributed to meet the project requirements. Proprietary statements are not allowed.

1.4.3. A minimum of 20 working days shall be allowed on all comment cycles.

1.4.4. Identification of changes on all documents from previous issue/revision must be clearly shown on each document by scoping/"clouding" all revisions from the previous issue. Submittals without revisions annotated will be rejected and returned to Supplier unprocessed.

1.4.5. The Owner will stamp each drawing with one the following status codes which instruct the Suppler how to proceed with fabrication:

1.4.5.1. Status 1: Approved / No Exception Taken – The Supplier/Manufacturer may proceed with fabrication or construction in accordance with the specifications.

1.4.5.2. Status 2: Approved As Noted – The Supplier shall make the noted changes and submit the revised/final drawings. The Supplier may proceed with fabrication/construction as noted.

1.4.5.3. Status 3: Not Approved – Revise the drawings as noted and resubmit drawings for approval; hold fabrication/construction for resubmittal and approval.

1.4.5.4. Status 4: Review Not Required – Submitted for information only.

1.4.5.5. Status 5: Final Drawings – Drawings accepted as final, and the Supplier/Manufacturer may proceed with fabrication or construction in accordance with the specification. No resubmittal required after drawing accepted as final.

1.4.6. The Owner's review of the drawings and documentation does not relieve the Supplier from responsibility for errors, correctness of details, or compliance with the Contract or Specification requirements.

1.4.7. The Supplier is responsible in obtaining the Owner's "Status 1" or "Status 4" on those documents covering an item at least two weeks before that item is to be shipped. Supplier shall be liable for the costs of any field changes resulting from failure to adhere to this requirement.

1.4.8. Documents shall not be submitted for Owner's record until they are acceptable to the Owner without comment (Status 1 or Status 4).

1.5. Design Document Submittals and Liquidated Damages

1.5.1. Drawings and other design documents shall be submitted by the date identified in this Specification and as set forth herein. A submittal shall include completed engineering drawings and design, shall be in final form, and shall include all parts of the set (i.e. all sheets of a drawing and all drawings of a set). The Owner will review the submittals for completeness. If the Supplier fails to submit the completed documents by the date identified in this Specification the Supplier shall pay Liquidated Damages subject to the provisions of the terms and conditions at the rated indicated below:

Table S-2 – Document Submittal Liquidated Damages for Delay

Number of Days Late	Document Delivery Liquidated Damages
1 – 10 Days	$500 per day
Over 10 Days	$1,000 per day

PART 2 – DOCUMENT SUBMITTAL SCHEDULE

2.1. Table S-3 summarizes the submittals required for this specification.

2.2. Due date description:

ANTP = After Notice to Proceed
ASC = After Substantial Completion
AT = After Acceptance of the Test/Examination
PF = Prior to Start of Fabrication
PS = Prior to Shipment

2.3. Document Submittal Schedule

Table S-3 – Document Submittal Schedule

Item	Discipline	Submittal Item	Requested Schedule	Liquidated Damages
1.	General	Master Document List and Submittal Schedule	4 Weeks ANTP and Monthly	No
2.	General	Monthly Progress Report	4 Weeks ANTP and Monthly	No
3.	General	Critical Path Method (CPM) Level 3 Schedule, Reference Appendix D	4 Weeks ANTP and Monthly	No
4.	General	List of Planned Subcontractors / Sub-suppliers.	4 Weeks ANTP	No

Item	Discipline	Submittal Item	Requested Schedule	Liquidated Damages
5.	General	Compressor Performance Curves • Discharge pressure vs. mas or volume flow. • Coupling power vs. mass or volume flow. • Curves for different cases. • Parameters of operating points. • API Data Sheets.	4 Weeks ANTP	No
6.	General	Process & Instrument Diagram (P&ID) • Legend, seal schematic, lube oil schematic, process schematic, instrumentation. • Tag numbers of components. • Instrumentation with alarms and shutdowns. • Setpoints and interlocks. • Limits of scope of supply.	4 Weeks ANTP	Yes
7.	General	Utility Consumption List • Description of consumers (utilities needed). • Rated power of consumers. • Quality and condition (pressure, temperature) of required utilities.	4 Weeks ANTP	Yes
8.	Quality	Shop Inspection and Test Plan	4 Weeks ANTP	No
9.	Quality	Welding Procedures and Welder Qualifications	2 Weeks PF	No
10.	Civil / Structural	Foundation Loadings	10 Weeks ANTP	Yes
11.	Civil / Structural	Foundation and Embedment Arrangement; including: • General requirements for foundations such as levelness, type of finish, and allowable construction tolerance. • Foundation stiffness requirements and relative (vertical) displacement/ settlement limits. • Anchor rod forces to be used to design embedment depth. • Scope of supply for mounting hardware (bolts, shims, sub-sole plates).	10 Weeks ANTP	Yes
12.	Mechanical	General Arrangement Drawings, including: • Overall dimensions of main equipment. • Nozzle locations / Customer connections. • Off-Skid Components. • Weight of main driver, overall unit weight, and center of gravity. • Allowable pipe forces and moments.	10 Weeks ANTP	Yes
13.	Mechanical	Pressure Vessel Design Calculations	10 Weeks ANTP	No
14.	Electrical	Motor Drawings and Motor Data Sheets • Main driver and ancillary motors.	10 Weeks ANTP	No
15.	Electrical	Wiring Diagrams • Detailed electrical arrangement drawings. • Point to point layout of the devices wired to the PLC, local or remote. • General layout of devices within electrical enclosures. • Limits of supply for connection wiring by others.	10 Weeks ANTP	No

Item	Discipline	Submittal Item	Requested Schedule	Liquidated Damages
16.	Electrical	Control Schematics • Three wire diagrams of the power distribution system. • Ladder style diagrams for instrumentation. • Complete loop of each circuit with termination points included. • Layout of the PLC. • Addressing of all I/O Points • I/O List	10 Weeks ANTP	No
17.	Electrical	Layout of Control Cabinets and Junction Boxes • Detailed drawings of all enclosures • Bill of materials	10 Weeks ANTP	No
18.	Electrical	Instrument List • Listing of all instruments with tag numbers. • Instrument descriptions. • Technical data (calibration range) • Manufacturer and model numbers. • Instrument type.	10 Weeks ANTP	No
19.	Mechanical	Material CMTR's for Pressure Vessels	2 Weeks PM	No
20.	Quality	Complete Fabrication Data Book / IOM Manual **(2 Hard copies of IOM Manual Required)**	2 Weeks ASC / Shop Fabrication Complete	No
21.	Quality	Spare Parts List • List of recommended spare parts. • Instructions on ordering parts.	2 Weeks ASC	No
22.	Quality	NDE Test Results, including welding inspection and examination records and hydrotest results.	1 Week AT	No
23.	Quality	Test Run Reports • Test setup and preparations. • Documentation of test conditions. • Document of machine type and type of run test. • Inspection data of run test. • Report of run test.	1 Week AT	
24.	Mechanical	Surface preparation and coating system specifications including paint manufacturer name and catalog numbers	10 Weeks ANTP	No
25.	General	Notice of Shipping, including packing and shipping lists with weights and instructions, and BOMs.	2 Weeks PS	No
26.	Quality	Details on the Operation, Troubleshooting, and Maintenance Training	2 Weeks PS	No

PART 3 – FINAL RECORD DRAWINGS, DOCUMENTS, AND DATA

3.1. The Supplier shall submit final as-fabricated record drawings, documents, and data within 2 weeks after substantial completion, or as directed by the Owner.

3.2 At the completion of the project the Supplier shall submit a complete set of al final Suppler and Subcontractor drawings, including any changes through testing.

END OF APPENDIX S

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